NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
100	**44.77**	American elm sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34	0.3	1.7	175.3	1.0	$22.62	12	7,851.0	47.0	$1,012.77
			36									
			>36	0.2	1.7	175.3	1.0	$22.62	9	7,851.0	47.0	$1,012.77
		American elm sawtimber Total		**0.5**	**3.3**	**350.7**	**2.1**	**$45.24**	**21**	**15,701.9**	**93.9**	**$2,025.55**
		Hardwood pulpwood	6									
			8	4.8	1.7	0.3	0.6	$4.53	214	13.9	28.5	$202.68
			10									
			12	6.4	5.0	1.1	2.4	$17.34	285	50.4	109.2	$776.52
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**11.1**	**6.7**	**1.4**	**3.1**	**$21.87**	**499**	**64.3**	**137.7**	**$979.20**
		Chip-n-saw	6									
			8									
			10									
			12	2.1	1.7	177.5	0.9	$20.77	95	7,946.8	41.3	$929.77
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**2.1**	**1.7**	**177.5**	**0.9**	**$20.77**	**95**	**7,946.8**	**41.3**	**$929.77**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- ·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- ·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- ·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- ·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
100	**44.77**	loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16	1.2	1.7	298.1	1.4	$48.29	53	13,346.6	61.6	$2,162.15
			18									
			20	2.3	5.0	894.3	4.1	$144.87	103	40,039.8	184.7	$6,486.45
			22	2.5	6.7	1,192.4	5.5	$193.16	113	53,386.4	246.3	$8,648.60
			24	1.6	5.0	894.3	4.1	$144.87	71	40,039.8	184.7	$6,486.45
			26	0.9	3.3	596.2	2.8	$96.58	40	26,693.2	123.2	$4,324.30
			28	1.6	6.7	1,192.4	5.5	$193.16	70	53,386.4	246.3	$8,648.60
			30	1.0	5.0	894.3	4.1	$144.87	46	40,039.8	184.7	$6,486.45
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**11.1**	**33.3**	**5,961.8**	**27.5**	**$965.82**	**496**	**266,932.1**	**1,231.6**	**$43,243.01**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	2.4	3.3	301.2	2.6	$57.84	107	13,487.4	117.2	$2,589.58
			18	0.9	1.7	150.6	1.3	$28.92	42	6,743.7	58.6	$1,294.79
			20	0.8	1.7	150.6	1.3	$28.92	34	6,743.7	58.6	$1,294.79
			22									
			24	0.5	1.7	150.6	1.3	$28.92	24	6,743.7	58.6	$1,294.79
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**4.6**	**8.3**	**753.1**	**6.5**	**$144.59**	**207**	**33,718.5**	**293.1**	**$6,473.96**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	4.7	5.0	430.7	2.9	$55.57	209	19,285.7	130.2	$2,487.86
			16	2.4	3.3	287.2	1.9	$37.04	107	12,857.1	86.8	$1,658.57
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**7.1**	**8.3**	**717.9**	**4.8**	**$92.61**	**316**	**32,142.9**	**216.9**	**$4,146.43**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
100	**44.77**	swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	1.2	1.7	193.4	1.4	$37.14	53	8,660.0	61.2	$1,662.71
			18	3.8	6.7	773.7	5.5	$148.54	169	34,639.9	244.8	$6,650.86
			20	0.8	1.7	193.4	1.4	$37.14	34	8,660.0	61.2	$1,662.71
			22									
			24	2.1	6.7	773.7	5.5	$148.54	95	34,639.9	244.8	$6,650.86
			26	0.5	1.7	193.4	1.4	$37.14	20	8,660.0	61.2	$1,662.71
			28	1.2	5.0	580.3	4.1	$111.41	52	25,979.9	183.6	$4,988.14
			30	0.7	3.3	386.8	2.7	$74.27	30	17,319.9	122.4	$3,325.43
			32									
			34	0.3	1.7	193.4	1.4	$37.14	12	8,660.0	61.2	$1,662.71
			36	0.2	1.7	193.4	1.4	$37.14	11	8,660.0	61.2	$1,662.71
			>36									
		swamp chestnut oak sawtimber Total		**10.7**	**30.0**	**3,481.5**	**24.6**	**$668.45**	**477**	**155,879.4**	**1,101.8**	**$29,928.85**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	4.7	5.0	502.2	3.6	$64.78	209	22,484.0	159.8	$2,900.43
			16	3.6	5.0	502.2	3.6	$64.78	160	22,484.0	159.8	$2,900.43
			18	2.8	5.0	502.2	3.6	$64.78	127	22,484.0	159.8	$2,900.43
			20	2.3	5.0	502.2	3.6	$64.78	103	22,484.0	159.8	$2,900.43
			22	1.3	3.3	334.8	2.4	$43.19	57	14,989.3	106.6	$1,933.62
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**14.6**	**23.3**	**2,343.5**	**16.7**	**$302.31**	**656**	**104,925.2**	**745.9**	**$13,535.35**
		white oak sawtimber	6									
			8									
			10									
			12									
			14	1.6	1.7	168.6	1.3	$32.37	70	7,548.9	56.2	$1,449.38
			16									
			18	2.8	5.0	505.8	3.8	$97.11	127	22,646.6	168.5	$4,348.15
			20	0.8	1.7	168.6	1.3	$32.37	34	7,548.9	56.2	$1,449.38
			22	0.6	1.7	168.6	1.3	$32.37	28	7,548.9	56.2	$1,449.38
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		white oak sawtimber Total		**5.8**	**10.0**	**1,011.6**	**7.5**	**$194.23**	**259**	**45,293.2**	**337.0**	**$8,696.29**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
101	**30.32**	Hardwood pulpwood	6									
			8	7.2	2.5	0.5	1.3	$9.38	217	15.8	40.0	$284.40
			10	27.5	15.0	2.9	5.9	$42.27	834	88.2	180.3	$1,281.66
			12	15.9	12.5	2.4	5.0	$35.48	483	74.1	151.3	$1,075.77
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**50.6**	**30.0**	**5.9**	**12.3**	**$87.13**	**1,534**	**178.1**	**371.6**	**$2,641.83**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	1.1	2.5	225.9	2.0	$43.38	35	6,850.4	59.5	$1,315.28
			22									
			24									
			26									
			28									
			30									
			32	0.4	2.5	225.9	2.0	$43.38	14	6,850.4	59.5	$1,315.28
			34									
			36									
			>36	0.2	2.5	225.9	2.0	$43.38	6	6,850.4	59.5	$1,315.28
		red oak sawtimber Total		**1.8**	**7.5**	**677.8**	**5.9**	**$130.13**	**54**	**20,551.3**	**178.6**	**$3,945.85**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	7.0	7.5	646.1	4.4	$83.35	213	19,590.9	132.2	$2,527.23
			16	3.6	5.0	430.7	2.9	$55.57	109	13,060.6	88.1	$1,684.82
			18	2.8	5.0	430.7	2.9	$55.57	86	13,060.6	88.1	$1,684.82
			20	1.1	2.5	215.4	1.5	$27.78	35	6,530.3	44.1	$842.41
			22	1.9	5.0	430.7	2.9	$55.57	57	13,060.6	88.1	$1,684.82
			24	1.6	5.0	430.7	2.9	$55.57	48	13,060.6	88.1	$1,684.82
			26									
			28	0.6	2.5	215.4	1.5	$27.78	18	6,530.3	44.1	$842.41
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**18.6**	**32.5**	**2,799.8**	**18.9**	**$361.17**	**565**	**84,894.0**	**572.9**	**$10,951.33**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
101	**30.32**	swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14	2.3	2.5	290.1	2.1	$55.70	71	8,797.0	62.2	$1,689.03
			16									
			18	2.8	5.0	580.3	4.1	$111.41	86	17,594.0	124.4	$3,378.05
			20									
			22	2.8	7.5	870.4	6.2	$167.11	86	26,391.0	186.5	$5,067.08
			24									
			26	0.7	2.5	290.1	2.1	$55.70	21	8,797.0	62.2	$1,689.03
			28	0.6	2.5	290.1	2.1	$55.70	18	8,797.0	62.2	$1,689.03
			30									
			32									
			34									
			36									
			>36									
		swamp chestnut oak sawtimber Total		**9.3**	**20.0**	**2,321.0**	**16.4**	**$445.63**	**281**	**70,376.1**	**497.4**	**$13,512.21**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	2.3	2.5	251.1	1.8	$32.39	71	7,613.3	54.1	$982.11
			16	10.7	15.0	1,506.5	10.7	$194.34	326	45,679.6	324.7	$5,892.66
			18	2.8	5.0	502.2	3.6	$64.78	86	15,226.5	108.2	$1,964.22
			20	2.3	5.0	502.2	3.6	$64.78	69	15,226.5	108.2	$1,964.22
			22	1.9	5.0	502.2	3.6	$64.78	57	15,226.5	108.2	$1,964.22
			24	0.8	2.5	251.1	1.8	$32.39	24	7,613.3	54.1	$982.11
			26	0.7	2.5	251.1	1.8	$32.39	21	7,613.3	54.1	$982.11
			28	0.6	2.5	251.1	1.8	$32.39	18	7,613.3	54.1	$982.11
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**22.2**	**40.0**	**4,017.4**	**28.6**	**$518.24**	**672**	**121,812.1**	**865.9**	**$15,713.77**
		white oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	1.1	2.5	252.9	1.9	$48.56	35	7,668.3	57.0	$1,472.32
			22									
			24									
			26									
			28									
			30									
			32	0.4	2.5	252.9	1.9	$48.56	14	7,668.3	57.0	$1,472.32
			34									
			36									
			>36									
		white oak sawtimber Total		**1.6**	**5.0**	**505.8**	**3.8**	**$97.11**	**48**	**15,336.7**	**114.1**	**$2,944.64**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
102	**4.39**	Hardwood pulpwood	6									
			8									
			10	18.3	10.0	1.9	3.8	$27.16	81	8.2	16.8	$119.32
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**18.3**	**10.0**	**1.9**	**3.8**	**$27.16**	**81**	**8.2**	**16.8**	**$119.32**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	4.6	10.0	1,788.5	8.3	$289.74	20	7,857.3	36.3	$1,272.88
			22	3.8	10.0	1,788.5	8.3	$289.74	17	7,857.3	36.3	$1,272.88
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**8.4**	**20.0**	**3,577.1**	**16.5**	**$579.49**	**37**	**15,714.6**	**72.5**	**$2,545.76**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	5.7	10.0	903.7	7.9	$173.51	25	3,970.1	34.5	$762.26
			20	4.6	10.0	903.7	7.9	$173.51	20	3,970.1	34.5	$762.26
			22									
			24									
			26									
			28									
			30									
			32	1.8	10.0	903.7	7.9	$173.51	8	3,970.1	34.5	$762.26
			34									
			36									
			>36									
		red oak sawtimber Total		**12.0**	**30.0**	**2,711.1**	**23.6**	**$520.54**	**53**	**11,910.3**	**103.5**	**$2,286.77**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
102	**4.39**	soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16	7.2	10.0	861.5	5.8	$111.13	31	3,784.6	25.5	$488.21
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**7.2**	**10.0**	**861.5**	**5.8**	**$111.13**	**31**	**3,784.6**	**25.5**	**$488.21**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,004.3	7.1	$129.56	41	4,412.2	31.4	$569.17
			16	14.3	20.0	2,008.7	14.3	$259.12	63	8,824.4	62.7	$1,138.34
			18	11.3	20.0	2,008.7	14.3	$259.12	50	8,824.4	62.7	$1,138.34
			20	9.2	20.0	2,008.7	14.3	$259.12	40	8,824.4	62.7	$1,138.34
			22									
			24									
			26	5.4	20.0	2,008.7	14.3	$259.12	24	8,824.4	62.7	$1,138.34
			28									
			30									
			32									
			34									
			36									
			>36	1.3	10.0	1,004.3	7.1	$129.56	6	4,412.2	31.4	$569.17
		sweetgum sawtimber Total		**50.9**	**100.0**	**10,043.4**	**71.4**	**$1,295.60**	**223**	**44,121.9**	**313.6**	**$5,691.72**
		white oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22	3.8	10.0	1,011.6	7.5	$194.23	17	4,444.1	33.1	$853.27
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		white oak sawtimber Total		**3.8**	**10.0**	**1,011.6**	**7.5**	**$194.23**	**17**	**4,444.1**	**33.1**	**$853.27**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
103	**3.11**	Hardwood pulpwood	6									
			8									
			10									
			12	12.7	10.0	1.9	3.8	$27.16	40	5.8	11.9	$84.55
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**12.7**	**10.0**	**1.9**	**3.8**	**$27.16**	**40**	**5.8**	**11.9**	**$84.55**
		Chip-n-saw	6									
			8									
			10	18.3	10.0	1,064.9	5.5	$124.60	57	3,315.2	17.2	$387.88
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**18.3**	**10.0**	**1,064.9**	**5.5**	**$124.60**	**57**	**3,315.2**	**17.2**	**$387.88**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,788.5	8.3	$289.74	29	5,567.8	25.7	$901.99
			16	28.6	40.0	7,154.2	33.0	$1,158.98	89	22,271.4	102.8	$3,607.96
			18	11.3	20.0	3,577.1	16.5	$579.49	35	11,135.7	51.4	$1,803.98
			20	9.2	20.0	3,577.1	16.5	$579.49	29	11,135.7	51.4	$1,803.98
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**58.5**	**90.0**	**16,096.9**	**74.3**	**$2,607.70**	**182**	**50,110.5**	**231.2**	**$8,117.91**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
103	**3.11**	soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	11.3	20.0	1,723.0	11.6	$222.26	35	5,363.7	36.2	$691.91
			20									
			22									
			24	3.2	10.0	861.5	5.8	$111.13	10	2,681.8	18.1	$345.96
			26									
			28									
			30									
			32	1.8	10.0	861.5	5.8	$111.13	6	2,681.8	18.1	$345.96
			34									
			36									
			>36									
		soft maple sawtimber Total		**16.3**	**40.0**	**3,445.9**	**23.3**	**$444.52**	**51**	**10,727.3**	**72.4**	**$1,383.82**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14									
			16	7.2	10.0	1,004.3	7.1	$129.56	22	3,126.6	22.2	$403.33
			18	17.0	30.0	3,013.0	21.4	$388.68	53	9,379.7	66.7	$1,209.98
			20									
			22									
			24									
			26									
			28	2.3	10.0	1,004.3	7.1	$129.56	7	3,126.6	22.2	$403.33
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**26.5**	**50.0**	**5,021.7**	**35.7**	**$647.80**	**82**	**15,632.8**	**111.1**	**$2,016.63**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
104	**7.81**	Hardwood pulpwood	6	34.0	6.7	1.2	2.5	$18.11	265	9.7	19.9	$141.36
			8	19.1	6.7	1.2	2.5	$18.11	149	9.7	19.9	$141.36
			10	97.8	53.3	10.9	22.1	$157.08	763	84.9	172.5	$1,226.29
			12	17.0	13.3	2.8	5.7	$40.29	133	21.9	44.2	$314.52
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**167.8**	**80.0**	**16.2**	**32.9**	**$233.58**	**1,310**	**126.2**	**256.5**	**$1,823.54**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16	4.8	6.7	1,192.4	5.5	$193.16	37	9,308.7	43.0	$1,508.01
			18	3.8	6.7	1,192.4	5.5	$193.16	29	9,308.7	43.0	$1,508.01
			20	6.1	13.3	2,384.7	11.0	$386.33	48	18,617.4	85.9	$3,016.01
			22									
			24	2.1	6.7	1,192.4	5.5	$193.16	17	9,308.7	43.0	$1,508.01
			26	1.8	6.7	1,192.4	5.5	$193.16	14	9,308.7	43.0	$1,508.01
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**18.6**	**40.0**	**7,154.2**	**33.0**	**$1,158.98**	**145**	**55,852.1**	**257.7**	**$9,048.04**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	574.3	3.9	$74.09	49	4,483.7	30.3	$578.39
			16	4.8	6.7	574.3	3.9	$74.09	37	4,483.7	30.3	$578.39
			18	7.5	13.3	1,148.6	7.8	$148.17	59	8,967.3	60.5	$1,156.78
			20									
			22	2.5	6.7	574.3	3.9	$74.09	20	4,483.7	30.3	$578.39
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**21.1**	**33.3**	**2,871.6**	**19.4**	**$370.44**	**165**	**22,418.3**	**151.3**	**$2,891.96**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
104	**7.81**	sweetgum sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	2,008.7	14.3	$259.12	146	15,681.6	111.5	$2,022.93
			16	28.6	40.0	4,017.4	28.6	$518.24	224	31,363.2	222.9	$4,045.85
			18	3.8	6.7	669.6	4.8	$86.37	29	5,227.2	37.2	$674.31
			20	3.1	6.7	669.6	4.8	$86.37	24	5,227.2	37.2	$674.31
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**54.2**	**73.3**	**7,365.2**	**52.4**	**$950.11**	**423**	**57,499.2**	**408.7**	**$7,417.39**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
105	**3.74**	Hardwood pulpwood	6									
			8									
			10	36.7	20.0	4.7	9.4	$66.54	137	17.5	35.0	$248.88
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**36.7**	**20.0**	**4.7**	**9.4**	**$66.54**	**137**	**17.5**	**35.0**	**$248.88**
		Chip-n-saw	6									
			8									
			10									
			12	25.5	20.0	2,129.9	11.1	$249.19	95	7,966.3	41.4	$932.05
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**25.5**	**20.0**	**2,129.9**	**11.1**	**$249.19**	**95**	**7,966.3**	**41.4**	**$932.05**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	112.3	120.0	21,462.6	99.0	$3,476.94	420	80,276.0	370.4	$13,004.72
			16	28.6	40.0	7,154.2	33.0	$1,158.98	107	26,758.7	123.5	$4,334.91
			18	22.6	40.0	7,154.2	33.0	$1,158.98	85	26,758.7	123.5	$4,334.91
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**163.5**	**200.0**	**35,771.0**	**165.0**	**$5,794.89**	**612**	**133,793.4**	**617.3**	**$21,674.53**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
106	**6.86**	Hardwood pulpwood	6									
			8	28.6	10.0	1.9	3.8	$27.16	196	12.8	26.2	$186.19
			10									
			12	25.5	20.0	4.2	10.6	$75.04	175	28.5	72.3	$514.38
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**54.1**	**30.0**	**6.0**	**14.4**	**$102.20**	**371**	**41.3**	**98.5**	**$700.58**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	5.7	10.0	861.5	5.8	$111.13	39	5,905.5	39.9	$761.81
			20	4.6	10.0	861.5	5.8	$111.13	31	5,905.5	39.9	$761.81
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**10.2**	**20.0**	**1,723.0**	**11.6**	**$222.26**	**70**	**11,811.0**	**79.7**	**$1,523.62**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14									
			16	14.3	20.0	2,008.7	14.3	$259.12	98	13,769.7	97.9	$1,776.29
			18	11.3	20.0	2,008.7	14.3	$259.12	78	13,769.7	97.9	$1,776.29
			20	13.8	30.0	3,013.0	21.4	$388.68	94	20,654.5	146.8	$2,664.43
			22	7.6	20.0	2,008.7	14.3	$259.12	52	13,769.7	97.9	$1,776.29
			24									
			26	2.7	10.0	1,004.3	7.1	$129.56	19	6,884.8	48.9	$888.14
			28	4.7	20.0	2,008.7	14.3	$259.12	32	13,769.7	97.9	$1,776.29
			30	2.0	10.0	1,004.3	7.1	$129.56	14	6,884.8	48.9	$888.14
			32	1.8	10.0	1,004.3	7.1	$129.56	12	6,884.8	48.9	$888.14
			34									
			36									
			>36									
		sweetgum sawtimber Total		**58.2**	**140.0**	**14,060.8**	**100.0**	**$1,813.84**	**399**	**96,387.6**	**685.2**	**$12,434.00**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
107	**14.82**	Hardwood pulpwood	6	17.0	3.3	0.6	1.3	$9.05	252	9.2	18.9	$134.20
			8	28.6	10.0	2.1	5.3	$37.52	425	30.8	78.2	$556.13
			10	12.2	6.7	1.4	3.5	$25.01	181	20.6	52.1	$370.76
			12	8.5	6.7	1.5	3.3	$23.60	126	21.8	49.2	$349.77
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**66.3**	**26.7**	**5.6**	**13.4**	**$95.18**	**983**	**82.4**	**198.4**	**$1,410.86**
		Chip-n-saw	6									
			8									
			10									
			12	12.7	10.0	1,064.9	5.5	$124.60	189	15,785.3	82.0	$1,846.88
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**12.7**	**10.0**	**1,064.9**	**5.5**	**$124.60**	**189**	**15,785.3**	**82.0**	**$1,846.88**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,788.5	8.3	$289.74	139	26,511.5	122.3	$4,294.86
			16	4.8	6.7	1,192.4	5.5	$193.16	71	17,674.3	81.5	$2,863.24
			18	5.7	10.0	1,788.5	8.3	$289.74	84	26,511.5	122.3	$4,294.86
			20	13.8	30.0	5,365.6	24.8	$869.23	204	79,534.4	367.0	$12,884.57
			22	2.5	6.7	1,192.4	5.5	$193.16	37	17,674.3	81.5	$2,863.24
			24	1.1	3.3	596.2	2.8	$96.58	16	8,837.2	40.8	$1,431.62
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**37.1**	**66.7**	**11,923.7**	**55.0**	**$1,931.63**	**550**	**176,743.0**	**815.5**	**$28,632.37**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
107	**14.82**	red oak sawtimber	6									
			8									
			10									
			12									
			14	3.1	3.3	301.2	2.6	$57.84	46	4,465.2	38.8	$857.32
			16									
			18	1.9	3.3	301.2	2.6	$57.84	28	4,465.2	38.8	$857.32
			20	1.5	3.3	301.2	2.6	$57.84	23	4,465.2	38.8	$857.32
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**6.5**	**10.0**	**903.7**	**7.9**	**$173.51**	**97**	**13,395.6**	**116.4**	**$2,571.95**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	3.1	3.3	287.2	1.9	$37.04	46	4,256.5	28.7	$549.09
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**3.1**	**3.3**	**287.2**	**1.9**	**$37.04**	**46**	**4,256.5**	**28.7**	**$549.09**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,004.3	7.1	$129.56	139	14,887.2	105.8	$1,920.45
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**9.4**	**10.0**	**1,004.3**	**7.1**	**$129.56**	**139**	**14,887.2**	**105.8**	**$1,920.45**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
107	**14.82**	white oak sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,011.6	7.5	$194.23	139	14,994.9	111.6	$2,879.03
			16	7.2	10.0	1,011.6	7.5	$194.23	106	14,994.9	111.6	$2,879.03
			18	3.8	6.7	674.4	5.0	$129.49	56	9,996.6	74.4	$1,919.35
			20	1.5	3.3	337.2	2.5	$64.74	23	4,998.3	37.2	$959.68
			22	1.3	3.3	337.2	2.5	$64.74	19	4,998.3	37.2	$959.68
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		white oak sawtimber Total		**23.1**	**33.3**	**3,372.0**	**25.1**	**$647.43**	**342**	**49,983.1**	**371.8**	**$9,596.76**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
108	**20.28**	Hardwood pulpwood	6	29.1	5.7	1.1	2.2	$15.52	590	21.6	44.3	$314.76
			8	16.4	5.7	1.3	2.8	$20.23	332	25.6	57.7	$410.17
			10	47.1	25.7	5.0	12.2	$87.02	956	100.6	248.2	$1,764.85
			12	32.7	25.7	5.1	13.2	$93.84	664	104.4	267.7	$1,903.02
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**125.4**	**62.9**	**12.4**	**30.5**	**$216.61**	**2,542**	**252.2**	**617.8**	**$4,392.81**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16	2.0	2.9	511.0	2.4	$82.78	41	10,363.5	47.8	$1,678.88
			18									
			20	3.9	8.6	1,533.0	7.1	$248.35	80	31,090.4	143.5	$5,036.64
			22	1.1	2.9	511.0	2.4	$82.78	22	10,363.5	47.8	$1,678.88
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**7.1**	**14.3**	**2,555.1**	**11.8**	**$413.92**	**143**	**51,817.3**	**239.1**	**$8,394.40**
		red oak sawtimber	6									
			8									
			10									
			12									
			14	2.7	2.9	258.2	2.2	$49.57	54	5,236.4	45.5	$1,005.39
			16	2.0	2.9	258.2	2.2	$49.57	41	5,236.4	45.5	$1,005.39
			18	3.2	5.7	516.4	4.5	$99.15	66	10,472.8	91.0	$2,010.78
			20									
			22	2.2	5.7	516.4	4.5	$99.15	44	10,472.8	91.0	$2,010.78
			24									
			26	1.5	5.7	516.4	4.5	$99.15	31	10,472.8	91.0	$2,010.78
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**11.7**	**22.9**	**2,065.6**	**18.0**	**$396.60**	**237**	**41,891.2**	**364.1**	**$8,043.10**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
108	**20.28**	white oak sawtimber	6									
			8									
			10									
			12									
			14	2.7	2.9	289.0	2.2	$55.49	54	5,861.6	43.6	$1,125.43
			16	6.1	8.6	867.1	6.5	$166.48	124	17,584.8	130.8	$3,376.28
			18	4.9	8.6	867.1	6.5	$166.48	98	17,584.8	130.8	$3,376.28
			20	1.3	2.9	289.0	2.2	$55.49	27	5,861.6	43.6	$1,125.43
			22									
			24									
			26	0.8	2.9	289.0	2.2	$55.49	16	5,861.6	43.6	$1,125.43
			28									
			30	0.6	2.9	289.0	2.2	$55.49	12	5,861.6	43.6	$1,125.43
			32	0.5	2.9	289.0	2.2	$55.49	10	5,861.6	43.6	$1,125.43
			34	0.5	2.9	289.0	2.2	$55.49	9	5,861.6	43.6	$1,125.43
			36									
			>36									
		white oak sawtimber Total		**17.3**	**34.3**	**3,468.4**	**25.8**	**$665.93**	**351**	**70,339.1**	**523.3**	**$13,505.11**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
109	**3.62**	Hardwood pulpwood	6									
			8	28.6	10.0	1.7	4.6	$32.90	104	6.3	16.8	$119.15
			10	55.0	30.0	6.5	13.2	$93.70	199	23.7	47.7	$339.36
			12	12.7	10.0	2.3	4.7	$33.27	46	8.5	16.9	$120.50
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**96.4**	**50.0**	**10.6**	**22.5**	**$159.87**	**349**	**38.4**	**81.4**	**$579.01**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,788.5	8.3	$289.74	34	6,477.6	29.9	$1,049.38
			16	7.2	10.0	1,788.5	8.3	$289.74	26	6,477.6	29.9	$1,049.38
			18	11.3	20.0	3,577.1	16.5	$579.49	41	12,955.3	59.8	$2,098.76
			20	9.2	20.0	3,577.1	16.5	$579.49	33	12,955.3	59.8	$2,098.76
			22	7.6	20.0	3,577.1	16.5	$579.49	27	12,955.3	59.8	$2,098.76
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**44.6**	**80.0**	**14,308.4**	**66.0**	**$2,317.96**	**161**	**51,821.1**	**239.1**	**$8,395.02**
		red oak sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	903.7	7.9	$173.51	34	3,273.0	28.4	$628.41
			16									
			18									
			20									
			22									
			24	3.2	10.0	903.7	7.9	$173.51	12	3,273.0	28.4	$628.41
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**12.5**	**20.0**	**1,807.4**	**15.7**	**$347.02**	**45**	**6,546.0**	**56.9**	**$1,256.83**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
109	**3.62**	soft maple sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	861.5	5.8	$111.13	34	3,120.0	21.1	$402.49
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**9.4**	**10.0**	**861.5**	**5.8**	**$111.13**	**34**	**3,120.0**	**21.1**	**$402.49**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	28.1	30.0	3,013.0	21.4	$388.68	102	10,912.4	77.6	$1,407.70
			16	14.3	20.0	2,008.7	14.3	$259.12	52	7,274.9	51.7	$938.46
			18	11.3	20.0	2,008.7	14.3	$259.12	41	7,274.9	51.7	$938.46
			20									
			22	3.8	10.0	1,004.3	7.1	$129.56	14	3,637.5	25.9	$469.23
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**57.5**	**80.0**	**8,034.7**	**57.1**	**$1,036.48**	**208**	**29,099.6**	**206.9**	**$3,753.85**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
110	**24.32**	Hardwood pulpwood	6	22.6	4.4	1.0	2.1	$14.79	551	25.3	50.6	$359.63
			8	57.3	20.0	4.3	8.7	$61.79	1,393	104.7	211.4	$1,502.76
			10	36.7	20.0	4.1	8.5	$60.35	892	98.8	206.4	$1,467.74
			12	22.6	17.8	3.7	7.6	$53.72	551	90.8	183.7	$1,306.44
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**139.2**	**62.2**	**13.1**	**26.8**	**$190.64**	**3,386**	**319.7**	**652.1**	**$4,636.57**
		Chip-n-saw	6									
			8									
			10									
			12	5.7	4.4	473.3	2.5	$55.38	138	11,511.1	59.8	$1,346.80
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**5.7**	**4.4**	**473.3**	**2.5**	**$55.38**	**138**	**11,511.1**	**59.8**	**$1,346.80**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16	9.5	13.3	2,384.7	11.0	$386.33	232	57,998.6	267.6	$9,395.77
			18	7.5	13.3	2,384.7	11.0	$386.33	184	57,998.6	267.6	$9,395.77
			20	4.1	8.9	1,589.8	7.3	$257.55	99	38,665.7	178.4	$6,263.85
			22	7.2	18.9	3,378.4	15.6	$547.30	174	82,164.7	379.1	$13,310.68
			24	2.8	8.9	1,589.8	7.3	$257.55	69	38,665.7	178.4	$6,263.85
			26	0.3	1.1	198.7	0.9	$32.19	7	4,833.2	22.3	$782.98
			28	0.8	3.3	596.2	2.8	$96.58	19	14,499.6	66.9	$2,348.94
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**32.2**	**67.8**	**12,122.4**	**55.9**	**$1,963.83**	**784**	**294,826.2**	**1,360.3**	**$47,761.84**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
110	**24.32**	red oak sawtimber	6									
			8									
			10									
			12									
			14	2.1	2.2	200.8	1.7	$38.56	51	4,884.2	42.5	$937.77
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32	0.4	2.2	200.8	1.7	$38.56	10	4,884.2	42.5	$937.77
			34									
			36									
			>36									
		red oak sawtimber Total		**2.5**	**4.4**	**401.6**	**3.5**	**$77.12**	**60**	**9,768.4**	**84.9**	**$1,875.54**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	8.3	8.9	765.8	5.2	$98.78	202	18,623.9	125.7	$2,402.48
			16	1.6	2.2	191.4	1.3	$24.70	39	4,656.0	31.4	$600.62
			18									
			20	1.0	2.2	191.4	1.3	$24.70	25	4,656.0	31.4	$600.62
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**10.9**	**13.3**	**1,148.6**	**7.8**	**$148.17**	**266**	**27,935.8**	**188.5**	**$3,603.72**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	4.2	4.4	446.4	3.2	$57.58	101	10,856.2	77.2	$1,400.45
			16	1.6	2.2	223.2	1.6	$28.79	39	5,428.1	38.6	$700.22
			18	3.8	6.7	669.6	4.8	$86.37	92	16,284.3	115.8	$2,100.67
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**9.5**	**13.3**	**1,339.1**	**9.5**	**$172.75**	**232**	**32,568.5**	**231.5**	**$4,201.34**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
111	**29.77**	Hardwood pulpwood	6	9.3	1.8	0.4	0.9	$6.05	276	12.7	25.3	$180.07
			8	18.2	6.4	1.4	2.8	$20.06	543	41.7	84.0	$597.17
			10	11.7	6.4	1.4	2.8	$20.06	347	41.7	84.0	$597.17
			12	15.0	11.8	2.5	5.1	$35.99	448	74.5	150.7	$1,071.24
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**54.2**	**26.4**	**5.7**	**11.6**	**$82.16**	**1,614**	**170.6**	**344.0**	**$2,445.65**
		Chip-n-saw	6									
			8									
			10	5.0	2.7	290.4	1.5	$33.98	149	8,645.5	44.9	$1,011.52
			12	9.3	7.3	774.5	4.0	$90.62	276	23,054.6	119.8	$2,697.38
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**14.3**	**10.0**	**1,064.9**	**5.5**	**$124.60**	**424**	**31,700.0**	**164.8**	**$3,708.90**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	16.2	17.3	3,089.3	14.3	$500.47	481	91,960.4	424.3	$14,897.58
			16	5.9	8.2	1,463.4	6.8	$237.06	174	43,560.2	201.0	$7,056.75
			18	6.2	10.9	1,951.1	9.0	$316.09	184	58,080.2	268.0	$9,409.00
			20	5.8	12.7	2,276.3	10.5	$368.77	174	67,760.3	312.6	$10,977.16
			22	3.4	9.1	1,626.0	7.5	$263.40	103	48,400.2	223.3	$7,840.83
			24	1.7	5.5	975.6	4.5	$158.04	52	29,040.1	134.0	$4,704.50
			26	0.5	1.8	325.2	1.5	$52.68	15	9,680.0	44.7	$1,568.17
			28	0.9	3.6	650.4	3.0	$105.36	25	19,360.1	89.3	$3,136.33
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**40.5**	**69.1**	**12,357.2**	**57.0**	**$2,001.87**	**1,207**	**367,841.4**	**1,697.2**	**$59,590.31**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
111	**29.77**	soft maple sawtimber	6									
			8									
			10									
			12									
			14	4.3	4.5	391.6	2.6	$50.51	127	11,656.3	78.7	$1,503.66
			16									
			18									
			20	0.8	1.8	156.6	1.1	$20.21	25	4,662.5	31.5	$601.47
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**5.1**	**6.4**	**548.2**	**3.7**	**$70.72**	**151**	**16,318.8**	**110.1**	**$2,105.13**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	4.3	4.5	456.5	3.2	$58.89	127	13,589.3	96.6	$1,753.02
			16	1.3	1.8	182.6	1.3	$23.56	39	5,435.7	38.6	$701.21
			18	3.1	5.5	547.8	3.9	$70.67	92	16,307.2	115.9	$2,103.63
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36	0.2	1.8	182.6	1.3	$23.56	6	5,435.7	38.6	$701.21
		sweetgum sawtimber Total		**8.8**	**13.6**	**1,369.6**	**9.7**	**$176.67**	**263**	**40,768.0**	**289.8**	**$5,259.07**
		unknown hardwood sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22	0.7	1.8	156.6	1.1	$20.21	21	4,662.5	31.5	$601.47
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		unknown hardwood sawtimber Total		**0.7**	**1.8**	**156.6**	**1.1**	**$20.21**	**21**	**4,662.5**	**31.5**	**$601.47**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
112	**22.34**	Hardwood pulpwood	6									
			8	19.1	6.7	1.2	2.8	$20.02	427	26.7	62.9	$447.25
			10	30.6	16.7	2.9	7.4	$52.92	683	65.4	166.3	$1,182.22
			12	12.7	10.0	1.9	4.6	$33.02	284	43.2	103.8	$737.74
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**62.4**	**33.3**	**6.1**	**14.9**	**$105.96**	**1,394**	**135.3**	**332.9**	**$2,367.22**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16	2.4	3.3	596.2	2.8	$96.58	53	13,319.0	61.5	$2,157.67
			18	1.9	3.3	596.2	2.8	$96.58	42	13,319.0	61.5	$2,157.67
			20	9.2	20.0	3,577.1	16.5	$579.49	205	79,913.7	368.7	$12,946.02
			22	3.8	10.0	1,788.5	8.3	$289.74	85	39,956.9	184.4	$6,473.01
			24	1.1	3.3	596.2	2.8	$96.58	24	13,319.0	61.5	$2,157.67
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**18.3**	**40.0**	**7,154.2**	**33.0**	**$1,158.98**	**409**	**159,827.5**	**737.5**	**$25,892.05**
		red oak sawtimber	6									
			8									
			10									
			12									
			14	3.1	3.3	301.2	2.6	$57.84	70	6,729.7	58.5	$1,292.11
			16	4.8	6.7	602.5	5.2	$115.67	107	13,459.5	117.0	$2,584.22
			18	1.9	3.3	301.2	2.6	$57.84	42	6,729.7	58.5	$1,292.11
			20	3.1	6.7	602.5	5.2	$115.67	68	13,459.5	117.0	$2,584.22
			22									
			24	1.1	3.3	301.2	2.6	$57.84	24	6,729.7	58.5	$1,292.11
			26									
			28									
			30									
			32									
			34									
			36									
			>36	0.8	6.7	602.5	5.2	$115.67	19	13,459.5	117.0	$2,584.22
		red oak sawtimber Total		**14.7**	**30.0**	**2,711.1**	**23.6**	**$520.54**	**329**	**60,567.6**	**526.4**	**$11,628.98**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
112	**22.34**	soft maple sawtimber	6									
			8									
			10									
			12									
			14	3.1	3.3	287.2	1.9	$37.04	70	6,415.3	43.3	$827.57
			16									
			18	3.8	6.7	574.3	3.9	$74.09	84	12,830.5	86.6	$1,655.14
			20									
			22	1.3	3.3	287.2	1.9	$37.04	28	6,415.3	43.3	$827.57
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**8.2**	**13.3**	**1,148.6**	**7.8**	**$148.17**	**182**	**25,661.0**	**173.2**	**$3,310.27**
		swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	2.4	3.3	386.8	2.7	$74.27	53	8,642.0	61.1	$1,659.27
			18	3.8	6.7	773.7	5.5	$148.54	84	17,284.1	122.2	$3,318.54
			20									
			22									
			24									
			26	0.9	3.3	386.8	2.7	$74.27	20	8,642.0	61.1	$1,659.27
			28									
			30									
			32									
			34									
			36									
			>36									
		swamp chestnut oak sawtimber Total		**7.1**	**13.3**	**1,547.3**	**10.9**	**$297.09**	**158**	**34,568.1**	**244.3**	**$6,637.08**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	3.1	3.3	334.8	2.4	$43.19	70	7,479.1	53.2	$964.81
			16									
			18	3.8	6.7	669.6	4.8	$86.37	84	14,958.3	106.3	$1,929.61
			20	1.5	3.3	334.8	2.4	$43.19	34	7,479.1	53.2	$964.81
			22									
			24	1.1	3.3	334.8	2.4	$43.19	24	7,479.1	53.2	$964.81
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**9.5**	**16.7**	**1,673.9**	**11.9**	**$215.93**	**212**	**37,395.6**	**265.8**	**$4,824.04**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
114	**26.28**	American elm sawtimber	6									
			8									
			10									
			12									
			14									
			16	1.6	2.2	233.8	1.4	$30.16	42	6,144.9	36.8	$792.69
			18									
			20	1.0	2.2	233.8	1.4	$30.16	27	6,144.9	36.8	$792.69
			22									
			24	0.7	2.2	233.8	1.4	$30.16	19	6,144.9	36.8	$792.69
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		American elm sawtimber Total		**3.3**	**6.7**	**701.4**	**4.2**	**$90.48**	**87**	**18,434.6**	**110.3**	**$2,378.07**
		Hardwood pulpwood	6	11.3	2.2	0.5	1.2	$8.34	297	12.2	30.8	$219.13
			8	25.5	8.9	1.7	4.2	$30.02	669	45.3	111.0	$789.05
			10	20.4	11.1	2.2	5.7	$40.66	535	58.7	150.3	$1,068.68
			12	17.0	13.3	2.9	6.8	$48.14	446	75.9	177.9	$1,265.17
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**74.1**	**35.6**	**7.3**	**17.9**	**$127.16**	**1,948**	**192.1**	**470.0**	**$3,342.04**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	5.0	8.9	1,589.8	7.3	$257.55	132	41,785.1	192.8	$6,769.19
			20	6.1	13.3	2,384.7	11.0	$386.33	161	62,677.7	289.2	$10,153.79
			22	4.2	11.1	1,987.3	9.2	$321.94	111	52,231.4	241.0	$8,461.49
			24	2.8	8.9	1,589.8	7.3	$257.55	74	41,785.1	192.8	$6,769.19
			26	3.0	11.1	1,987.3	9.2	$321.94	79	52,231.4	241.0	$8,461.49
			28	0.5	2.2	397.5	1.8	$64.39	14	10,446.3	48.2	$1,692.30
			30	0.9	4.4	794.9	3.7	$128.78	24	20,892.6	96.4	$3,384.60
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**22.6**	**60.0**	**10,731.3**	**49.5**	**$1,738.47**	**594**	**282,049.6**	**1,301.4**	**$45,692.04**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
114	**26.28**	red oak sawtimber	6									
			8									
			10									
			12									
			14	4.2	4.4	401.6	3.5	$77.12	109	10,556.5	91.8	$2,026.85
			16	1.6	2.2	200.8	1.7	$38.56	42	5,278.2	45.9	$1,013.42
			18									
			20	2.0	4.4	401.6	3.5	$77.12	54	10,556.5	91.8	$2,026.85
			22	4.2	11.1	1,004.1	8.7	$192.79	111	26,391.2	229.4	$5,067.12
			24									
			26									
			28									
			30	0.5	2.2	200.8	1.7	$38.56	12	5,278.2	45.9	$1,013.42
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**12.4**	**24.4**	**2,209.1**	**19.2**	**$424.14**	**327**	**58,060.7**	**504.6**	**$11,147.66**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	4.2	4.4	446.4	3.2	$57.58	109	11,732.0	83.4	$1,513.43
			16									
			18	1.3	2.2	223.2	1.6	$28.79	33	5,866.0	41.7	$756.71
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**5.4**	**6.7**	**669.6**	**4.8**	**$86.37**	**142**	**17,598.0**	**125.1**	**$2,270.14**
		white oak sawtimber	6									
			8									
			10									
			12									
			14	4.2	4.4	449.6	3.3	$86.32	109	11,816.9	87.9	$2,268.84
			16	3.2	4.4	449.6	3.3	$86.32	84	11,816.9	87.9	$2,268.84
			18	3.8	6.7	674.4	5.0	$129.49	99	17,725.3	131.9	$3,403.26
			20									
			22	0.8	2.2	224.8	1.7	$43.16	22	5,908.4	44.0	$1,134.42
			24	1.4	4.4	449.6	3.3	$86.32	37	11,816.9	87.9	$2,268.84
			26	0.6	2.2	224.8	1.7	$43.16	16	5,908.4	44.0	$1,134.42
			28	0.5	2.2	224.8	1.7	$43.16	14	5,908.4	44.0	$1,134.42
			30									
			32									
			34									
			36									
			>36									
		white oak sawtimber Total		**14.5**	**26.7**	**2,697.6**	**20.1**	**$517.94**	**381**	**70,901.3**	**527.5**	**$13,613.04**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
115	**30.78**	Hardwood pulpwood	6	10.2	2.0	0.4	0.8	$5.43	314	11.5	23.5	$167.22
			8	40.1	14.0	2.7	5.8	$41.32	1,235	84.5	178.9	$1,271.93
			10	3.7	2.0	0.4	1.1	$7.50	113	12.8	32.5	$230.99
			12	10.2	8.0	1.6	3.5	$25.02	314	50.1	108.3	$770.27
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**64.1**	**26.0**	**5.2**	**11.2**	**$79.28**	**1,975**	**158.8**	**343.2**	**$2,440.41**
		Chip-n-saw	6									
			8									
			10	11.0	6.0	639.0	3.3	$74.76	339	19,669.1	102.2	$2,301.29
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**11.0**	**6.0**	**639.0**	**3.3**	**$74.76**	**339**	**19,669.1**	**102.2**	**$2,301.29**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	1.9	2.0	357.7	1.7	$57.95	58	11,011.4	50.8	$1,783.85
			16	4.3	6.0	1,073.1	5.0	$173.85	132	33,034.3	152.4	$5,351.56
			18	6.8	12.0	2,146.3	9.9	$347.69	209	66,068.7	304.8	$10,703.13
			20	0.9	2.0	357.7	1.7	$57.95	28	11,011.4	50.8	$1,783.85
			22	4.5	12.0	2,146.3	9.9	$347.69	140	66,068.7	304.8	$10,703.13
			24	5.1	16.0	2,861.7	13.2	$463.59	157	88,091.6	406.5	$14,270.84
			26	3.3	12.0	2,146.3	9.9	$347.69	100	66,068.7	304.8	$10,703.13
			28	0.9	4.0	715.4	3.3	$115.90	29	22,022.9	101.6	$3,567.71
			30	0.4	2.0	357.7	1.7	$57.95	13	11,011.4	50.8	$1,783.85
			32	1.4	8.0	1,430.8	6.6	$231.80	44	44,045.8	203.2	$7,135.42
			34	0.3	2.0	357.7	1.7	$57.95	10	11,011.4	50.8	$1,783.85
			36									
			>36									
		loblolly pine sawtimber Total		**29.9**	**78.0**	**13,950.7**	**64.4**	**$2,260.01**	**919**	**429,446.5**	**1,981.5**	**$69,570.34**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
115	**30.78**	red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	1.1	2.0	180.7	1.6	$34.70	35	5,563.8	48.4	$1,068.25
			20									
			22									
			24									
			26	0.5	2.0	180.7	1.6	$34.70	17	5,563.8	48.4	$1,068.25
			28									
			30									
			32	0.4	2.0	180.7	1.6	$34.70	11	5,563.8	48.4	$1,068.25
			34									
			36									
			>36	0.3	2.0	180.7	1.6	$34.70	8	5,563.8	48.4	$1,068.25
		red oak sawtimber Total		**2.3**	**8.0**	**723.0**	**6.3**	**$138.81**	**70**	**22,255.2**	**193.4**	**$4,273.01**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	1.9	2.0	172.3	1.2	$22.23	58	5,303.8	35.8	$684.19
			16									
			18									
			20									
			22									
			24									
			26	0.5	2.0	172.3	1.2	$22.23	17	5,303.8	35.8	$684.19
			28	0.5	2.0	172.3	1.2	$22.23	14	5,303.8	35.8	$684.19
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**2.9**	**6.0**	**516.9**	**3.5**	**$66.68**	**89**	**15,911.4**	**107.4**	**$2,052.58**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	1.9	2.0	200.9	1.4	$25.91	58	6,183.4	44.0	$797.65
			16									
			18	4.5	8.0	803.5	5.7	$103.65	139	24,733.5	175.8	$3,190.62
			20	3.7	8.0	803.5	5.7	$103.65	113	24,733.5	175.8	$3,190.62
			22	1.5	4.0	401.7	2.9	$51.82	47	12,366.7	87.9	$1,595.31
			24	1.3	4.0	401.7	2.9	$51.82	39	12,366.7	87.9	$1,595.31
			26	1.1	4.0	401.7	2.9	$51.82	33	12,366.7	87.9	$1,595.31
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**13.9**	**30.0**	**3,013.0**	**21.4**	**$388.68**	**429**	**92,750.6**	**659.3**	**$11,964.82**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
115	**30.78**	white oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	1.4	2.0	202.3	1.5	$38.85	44	6,228.1	46.3	$1,195.79
			18									
			20									
			22	0.8	2.0	202.3	1.5	$38.85	23	6,228.1	46.3	$1,195.79
			24	0.6	2.0	202.3	1.5	$38.85	20	6,228.1	46.3	$1,195.79
			26	0.5	2.0	202.3	1.5	$38.85	17	6,228.1	46.3	$1,195.79
			28	0.5	2.0	202.3	1.5	$38.85	14	6,228.1	46.3	$1,195.79
			30	0.4	2.0	202.3	1.5	$38.85	13	6,228.1	46.3	$1,195.79
			32									
			34									
			36									
			>36	0.2	2.0	202.3	1.5	$38.85	5	6,228.1	46.3	$1,195.79
		white oak sawtimber Total		**4.4**	**14.0**	**1,416.2**	**10.5**	**$271.92**	**136**	**43,596.7**	**324.3**	**$8,370.56**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
116	**6.91**	Hardwood pulpwood	6									
			8									
			10	18.3	10.0	2.3	4.7	$33.27	127	16.2	32.3	$229.82
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**18.3**	**10.0**	**2.3**	**4.7**	**$33.27**	**127**	**16.2**	**32.3**	**$229.82**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	4.6	10.0	1,788.5	8.3	$289.74	32	12,354.9	57.0	$2,001.50
			22									
			24	3.2	10.0	1,788.5	8.3	$289.74	22	12,354.9	57.0	$2,001.50
			26	2.7	10.0	1,788.5	8.3	$289.74	19	12,354.9	57.0	$2,001.50
			28									
			30									
			32	1.8	10.0	1,788.5	8.3	$289.74	12	12,354.9	57.0	$2,001.50
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**12.3**	**40.0**	**7,154.2**	**33.0**	**$1,158.98**	**85**	**49,419.7**	**228.0**	**$8,005.99**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28	2.3	10.0	903.7	7.9	$173.51	16	6,242.6	54.3	$1,198.59
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**2.3**	**10.0**	**903.7**	**7.9**	**$173.51**	**16**	**6,242.6**	**54.3**	**$1,198.59**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
116	**6.91**	soft maple sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	1,723.0	11.6	$222.26	129	11,901.8	80.3	$1,535.34
			16									
			18									
			20									
			22									
			24									
			26	2.7	10.0	861.5	5.8	$111.13	19	5,950.9	40.2	$767.67
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**21.4**	**30.0**	**2,584.4**	**17.4**	**$333.39**	**148**	**17,852.7**	**120.5**	**$2,303.00**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	2,008.7	14.3	$259.12	129	13,875.6	98.6	$1,789.95
			16	7.2	10.0	1,004.3	7.1	$129.56	49	6,937.8	49.3	$894.97
			18	5.7	10.0	1,004.3	7.1	$129.56	39	6,937.8	49.3	$894.97
			20									
			22									
			24									
			26									
			28	4.7	20.0	2,008.7	14.3	$259.12	32	13,875.6	98.6	$1,789.95
			30									
			32									
			34									
			36									
			>36	1.1	10.0	1,004.3	7.1	$129.56	8	6,937.8	49.3	$894.97
		sweetgum sawtimber Total		**37.4**	**70.0**	**7,030.4**	**50.0**	**$906.92**	**258**	**48,564.5**	**345.2**	**$6,264.82**
		white oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	14.3	20.0	2,023.2	15.1	$388.46	99	13,975.9	104.0	$2,683.38
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		white oak sawtimber Total		**14.3**	**20.0**	**2,023.2**	**15.1**	**$388.46**	**99**	**13,975.9**	**104.0**	**$2,683.38**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
117	**3.50**	Hardwood pulpwood	6									
			8	19.1	6.7	1.4	3.5	$25.01	67	4.9	12.3	$87.63
			10	12.2	6.7	1.2	3.1	$21.93	43	4.0	10.8	$76.84
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**31.3**	**13.3**	**2.5**	**6.6**	**$46.94**	**110**	**8.9**	**23.1**	**$164.46**
		Chip-n-saw	6									
			8									
			10									
			12	8.5	6.7	710.0	3.7	$83.06	30	2,487.2	12.9	$291.00
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**8.5**	**6.7**	**710.0**	**3.7**	**$83.06**	**30**	**2,487.2**	**12.9**	**$291.00**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	12.5	13.3	2,384.7	11.0	$386.33	44	8,354.5	38.5	$1,353.43
			16	9.5	13.3	2,384.7	11.0	$386.33	33	8,354.5	38.5	$1,353.43
			18	15.1	26.7	4,769.5	22.0	$772.65	53	16,709.0	77.1	$2,706.86
			20	9.2	20.0	3,577.1	16.5	$579.49	32	12,531.8	57.8	$2,030.14
			22	2.5	6.7	1,192.4	5.5	$193.16	9	4,177.3	19.3	$676.71
			24	2.1	6.7	1,192.4	5.5	$193.16	7	4,177.3	19.3	$676.71
			26									
			28	1.6	6.7	1,192.4	5.5	$193.16	5	4,177.3	19.3	$676.71
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**52.5**	**93.3**	**16,693.1**	**77.0**	**$2,704.28**	**184**	**58,481.5**	**269.8**	**$9,474.00**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
117	**3.50**	red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	14.3	20.0	1,807.4	15.7	$347.02	50	6,332.0	55.0	$1,215.74
			18									
			20									
			22									
			24	2.1	6.7	602.5	5.2	$115.67	7	2,110.7	18.3	$405.25
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**16.4**	**26.7**	**2,409.9**	**20.9**	**$462.70**	**58**	**8,442.6**	**73.4**	**$1,620.99**
		swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	773.7	5.5	$148.54	22	2,710.4	19.2	$520.40
			16									
			18	3.8	6.7	773.7	5.5	$148.54	13	2,710.4	19.2	$520.40
			20	3.1	6.7	773.7	5.5	$148.54	11	2,710.4	19.2	$520.40
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		swamp chestnut oak sawtimber Total		**13.1**	**20.0**	**2,321.0**	**16.4**	**$445.63**	**46**	**8,131.2**	**57.5**	**$1,561.20**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14									
			16	4.8	6.7	669.6	4.8	$86.37	17	2,345.7	16.7	$302.59
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**4.8**	**6.7**	**669.6**	**4.8**	**$86.37**	**17**	**2,345.7**	**16.7**	**$302.59**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
117	**3.50**	white oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36	0.9	6.7	674.4	5.0	$129.49	3	2,362.7	17.6	$453.63
			>36									
		white oak sawtimber Total		**0.9**	**6.7**	**674.4**	**5.0**	**$129.49**	**3**	**2,362.7**	**17.6**	**$453.63**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
118	**45.17**	American elm sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	0.8	1.3	140.3	0.8	$18.10	34	6,336.2	37.9	$817.37
			20	0.6	1.3	140.3	0.8	$18.10	28	6,336.2	37.9	$817.37
			22	0.5	1.3	140.3	0.8	$18.10	23	6,336.2	37.9	$817.37
			24	0.4	1.3	140.3	0.8	$18.10	19	6,336.2	37.9	$817.37
			26									
			28	0.3	1.3	140.3	0.8	$18.10	14	6,336.2	37.9	$817.37
			30									
			32									
			34									
			36									
			>36									
		American elm sawtimber Total		**2.6**	**6.7**	**701.4**	**4.2**	**$90.48**	**118**	**31,681.1**	**189.5**	**$4,086.86**
		Hardwood pulpwood	6	13.6	2.7	0.5	1.2	$8.62	613	23.7	54.8	$389.53
			8	15.3	5.3	1.0	2.5	$18.01	690	46.7	114.4	$813.62
			10	9.8	5.3	1.1	2.5	$18.06	442	50.4	114.7	$815.86
			12	5.1	4.0	0.8	2.0	$14.39	230	35.5	91.4	$650.05
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**43.7**	**17.3**	**3.5**	**8.3**	**$59.09**	**1,975**	**156.2**	**375.4**	**$2,669.07**
		Chip-n-saw	6									
			8									
			10	2.4	1.3	142.0	0.7	$16.61	110	6,413.6	33.3	$750.39
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**2.4**	**1.3**	**142.0**	**0.7**	**$16.61**	**110**	**6,413.6**	**33.3**	**$750.39**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
118	**45.17**	loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	2.5	2.7	476.9	2.2	$77.27	113	21,543.1	99.4	$3,489.99
			16	2.9	4.0	715.4	3.3	$115.90	129	32,314.7	149.1	$5,234.98
			18	3.8	6.7	1,192.4	5.5	$193.16	170	53,857.8	248.5	$8,724.97
			20	3.7	8.0	1,430.8	6.6	$231.80	166	64,629.4	298.2	$10,469.96
			22	1.5	4.0	715.4	3.3	$115.90	68	32,314.7	149.1	$5,234.98
			24	3.0	9.3	1,669.3	7.7	$270.43	134	75,400.9	347.9	$12,214.95
			26	0.7	2.7	476.9	2.2	$77.27	33	21,543.1	99.4	$3,489.99
			28	1.2	5.3	953.9	4.4	$154.53	56	43,086.3	198.8	$6,979.97
			30	1.4	6.7	1,192.4	5.5	$193.16	61	53,857.8	248.5	$8,724.97
			32									
			34	0.2	1.3	238.5	1.1	$38.63	10	10,771.6	49.7	$1,744.99
			36									
			>36									
		loblolly pine sawtimber Total		**20.8**	**50.7**	**9,062.0**	**41.8**	**$1,468.04**	**941**	**409,319.4**	**1,888.6**	**$66,309.75**
		red oak sawtimber	6									
			8									
			10									
			12									
			14	2.5	2.7	241.0	2.1	$46.27	113	10,885.2	94.6	$2,089.96
			16	2.9	4.0	361.5	3.1	$69.40	129	16,327.8	141.9	$3,134.94
			18	2.3	4.0	361.5	3.1	$69.40	102	16,327.8	141.9	$3,134.94
			20	1.8	4.0	361.5	3.1	$69.40	83	16,327.8	141.9	$3,134.94
			22									
			24									
			26									
			28	0.6	2.7	241.0	2.1	$46.27	28	10,885.2	94.6	$2,089.96
			30	0.5	2.7	241.0	2.1	$46.27	25	10,885.2	94.6	$2,089.96
			32									
			34	0.2	1.3	120.5	1.0	$23.13	10	5,442.6	47.3	$1,044.98
			36									
			>36									
		red oak sawtimber Total		**10.8**	**21.3**	**1,927.9**	**16.8**	**$370.16**	**489**	**87,081.6**	**756.9**	**$16,719.68**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16	1.0	1.3	114.9	0.8	$14.82	43	5,188.3	35.0	$669.29
			18									
			20	1.8	4.0	344.6	2.3	$44.45	83	15,564.8	105.0	$2,007.86
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**2.8**	**5.3**	**459.5**	**3.1**	**$59.27**	**126**	**20,753.1**	**140.1**	**$2,677.15**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
118	**45.17**	swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28	0.3	1.3	154.7	1.1	$29.71	14	6,989.1	49.4	$1,341.92
			30									
			32									
			34									
			36									
			>36									
		swamp chestnut oak sawtimber Total		**0.3**	**1.3**	**154.7**	**1.1**	**$29.71**	**14**	**6,989.1**	**49.4**	**$1,341.92**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	1.2	1.3	133.9	1.0	$17.27	56	6,048.7	43.0	$780.28
			16									
			18									
			20	1.2	2.7	267.8	1.9	$34.55	55	12,097.3	86.0	$1,560.56
			22	2.0	5.3	535.6	3.8	$69.10	91	24,194.7	172.0	$3,121.11
			24	0.4	1.3	133.9	1.0	$17.27	19	6,048.7	43.0	$780.28
			26									
			28	0.3	1.3	133.9	1.0	$17.27	14	6,048.7	43.0	$780.28
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**5.2**	**12.0**	**1,205.2**	**8.6**	**$155.47**	**236**	**54,438.0**	**387.0**	**$7,022.50**
		white oak sawtimber	6									
			8									
			10									
			12									
			14	2.5	2.7	269.8	2.0	$51.79	113	12,184.8	90.6	$2,339.49
			16	4.8	6.7	674.4	5.0	$129.49	216	30,462.1	226.6	$5,848.72
			18	0.8	1.3	134.9	1.0	$25.90	34	6,092.4	45.3	$1,169.74
			20	0.6	1.3	134.9	1.0	$25.90	28	6,092.4	45.3	$1,169.74
			22	1.0	2.7	269.8	2.0	$51.79	46	12,184.8	90.6	$2,339.49
			24									
			26	0.4	1.3	134.9	1.0	$25.90	16	6,092.4	45.3	$1,169.74
			28	0.3	1.3	134.9	1.0	$25.90	14	6,092.4	45.3	$1,169.74
			30	0.5	2.7	269.8	2.0	$51.79	25	12,184.8	90.6	$2,339.49
			32									
			34									
			36									
			>36									
		white oak sawtimber Total		**10.9**	**20.0**	**2,023.2**	**15.1**	**$388.46**	**491**	**91,386.3**	**679.9**	**$17,546.16**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
119	**11.40**	Hardwood pulpwood	6									
			8	22.9	8.0	1.4	3.7	$26.32	261	15.8	42.2	$300.13
			10	14.7	8.0	1.5	4.0	$28.17	167	17.4	45.2	$321.20
			12	25.5	20.0	4.1	10.1	$71.49	290	47.0	114.7	$815.24
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**63.1**	**36.0**	**7.0**	**17.7**	**$125.98**	**719**	**80.2**	**202.0**	**$1,436.57**
		Chip-n-saw	6									
			8									
			10									
			12	5.1	4.0	426.0	2.2	$49.84	58	4,857.6	25.2	$568.34
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**5.1**	**4.0**	**426.0**	**2.2**	**$49.84**	**58**	**4,857.6**	**25.2**	**$568.34**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	3.7	4.0	715.4	3.3	$115.90	43	8,158.3	37.6	$1,321.65
			16									
			18	4.5	8.0	1,430.8	6.6	$231.80	52	16,316.6	75.3	$2,643.29
			20									
			22	3.0	8.0	1,430.8	6.6	$231.80	35	16,316.6	75.3	$2,643.29
			24	3.8	12.0	2,146.3	9.9	$347.69	44	24,474.9	112.9	$3,964.94
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**15.1**	**32.0**	**5,723.4**	**26.4**	**$927.18**	**172**	**65,266.5**	**301.1**	**$10,573.17**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
119	**11.40**	red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	2.9	4.0	361.5	3.1	$69.40	33	4,122.2	35.8	$791.46
			18	2.3	4.0	361.5	3.1	$69.40	26	4,122.2	35.8	$791.46
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**5.1**	**8.0**	**723.0**	**6.3**	**$138.81**	**58**	**8,244.4**	**71.7**	**$1,582.92**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	3.7	4.0	344.6	2.3	$44.45	43	3,929.6	26.5	$506.91
			16	8.6	12.0	1,033.8	7.0	$133.36	98	11,788.7	79.6	$1,520.74
			18									
			20									
			22	1.5	4.0	344.6	2.3	$44.45	17	3,929.6	26.5	$506.91
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**13.9**	**20.0**	**1,723.0**	**11.6**	**$222.26**	**158**	**19,647.8**	**132.6**	**$2,534.57**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	3.7	4.0	401.7	2.9	$51.82	43	4,581.2	32.6	$590.98
			16									
			18	6.8	12.0	1,205.2	8.6	$155.47	77	13,743.7	97.7	$1,772.93
			20	1.8	4.0	401.7	2.9	$51.82	21	4,581.2	32.6	$590.98
			22									
			24	1.3	4.0	401.7	2.9	$51.82	15	4,581.2	32.6	$590.98
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**13.6**	**24.0**	**2,410.4**	**17.1**	**$310.94**	**156**	**27,487.3**	**195.4**	**$3,545.86**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
119	**11.40**	white oak sawtimber	6									
			8									
			10									
			12									
			14	7.5	8.0	809.3	6.0	$155.38	85	9,228.7	68.7	$1,771.91
			16	2.9	4.0	404.6	3.0	$77.69	33	4,614.4	34.3	$885.96
			18	4.5	8.0	809.3	6.0	$155.38	52	9,228.7	68.7	$1,771.91
			20	7.3	16.0	1,618.6	12.0	$310.77	84	18,457.4	137.3	$3,543.83
			22	1.5	4.0	404.6	3.0	$77.69	17	4,614.4	34.3	$885.96
			24									
			26	1.1	4.0	404.6	3.0	$77.69	12	4,614.4	34.3	$885.96
			28									
			30	0.8	4.0	404.6	3.0	$77.69	9	4,614.4	34.3	$885.96
			32									
			34									
			36									
			>36	0.2	4.0	404.6	3.0	$77.69	3	4,614.4	34.3	$885.96
		white oak sawtimber Total		**25.9**	**52.0**	**5,260.4**	**39.1**	**$1,009.99**	**295**	**59,986.7**	**446.3**	**$11,517.44**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
120	**10.75**	Hardwood pulpwood	6									
			8	85.9	30.0	5.8	12.9	$91.84	924	62.4	138.9	$987.48
			10	18.3	10.0	2.0	4.5	$32.34	197	21.2	48.9	$347.72
			12	19.1	15.0	3.1	7.9	$56.28	205	33.6	85.1	$605.10
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**123.4**	**55.0**	**10.9**	**25.4**	**$180.46**	**1,327**	**117.1**	**272.9**	**$1,940.30**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	8.5	15.0	2,682.8	12.4	$434.62	91	28,845.8	133.1	$4,673.03
			20	6.9	15.0	2,682.8	12.4	$434.62	74	28,845.8	133.1	$4,673.03
			22	13.3	35.0	6,259.9	28.9	$1,014.11	143	67,307.0	310.6	$10,903.73
			24	11.1	35.0	6,259.9	28.9	$1,014.11	120	67,307.0	310.6	$10,903.73
			26	2.7	10.0	1,788.5	8.3	$289.74	29	19,230.6	88.7	$3,115.35
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**42.5**	**110.0**	**19,674.0**	**90.8**	**$3,187.19**	**457**	**211,536.1**	**976.0**	**$34,268.86**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22	1.9	5.0	451.9	3.9	$86.76	20	4,858.4	42.2	$932.81
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**1.9**	**5.0**	**451.9**	**3.9**	**$86.76**	**20**	**4,858.4**	**42.2**	**$932.81**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
120	**10.75**	soft maple sawtimber	6									
			8									
			10									
			12									
			14	4.7	5.0	430.7	2.9	$55.57	50	4,631.3	31.3	$597.44
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**4.7**	**5.0**	**430.7**	**2.9**	**$55.57**	**50**	**4,631.3**	**31.3**	**$597.44**
		white oak sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,011.6	7.5	$194.23	101	10,876.8	80.9	$2,088.35
			16									
			18	2.8	5.0	505.8	3.8	$97.11	30	5,438.4	40.5	$1,044.18
			20	2.3	5.0	505.8	3.8	$97.11	25	5,438.4	40.5	$1,044.18
			22	1.9	5.0	505.8	3.8	$97.11	20	5,438.4	40.5	$1,044.18
			24	1.6	5.0	505.8	3.8	$97.11	17	5,438.4	40.5	$1,044.18
			26									
			28									
			30	2.0	10.0	1,011.6	7.5	$194.23	22	10,876.8	80.9	$2,088.35
			32									
			34									
			36									
			>36									
		white oak sawtimber Total		**20.0**	**40.0**	**4,046.4**	**30.1**	**$776.91**	**215**	**43,507.4**	**323.7**	**$8,353.41**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
121	**2.85**	Hardwood pulpwood	6	50.9	10.0	2.3	4.7	$33.27	145	6.7	13.4	$94.99
			8	85.9	30.0	7.0	14.0	$99.81	245	20.0	40.1	$284.96
			10	36.7	20.0	4.7	9.4	$66.54	105	13.4	26.7	$189.97
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**173.5**	**60.0**	**14.0**	**28.1**	**$199.62**	**495**	**40.1**	**80.2**	**$569.92**
		Chip-n-saw	6									
			8									
			10									
			12	12.7	10.0	1,064.9	5.5	$124.60	36	3,040.3	15.8	$355.72
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**12.7**	**10.0**	**1,064.9**	**5.5**	**$124.60**	**36**	**3,040.3**	**15.8**	**$355.72**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	28.1	30.0	5,365.6	24.8	$869.23	80	15,318.7	70.7	$2,481.64
			16									
			18									
			20									
			22	3.8	10.0	1,788.5	8.3	$289.74	11	5,106.2	23.6	$827.21
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**31.9**	**40.0**	**7,154.2**	**33.0**	**$1,158.98**	**91**	**20,425.0**	**94.2**	**$3,308.85**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
121	**2.85**	water tupelo sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	5.7	10.0	861.5	5.8	$111.13	16	2,459.5	16.6	$317.27
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		water tupelo sawtimber Total		**5.7**	**10.0**	**861.5**	**5.8**	**$111.13**	**16**	**2,459.5**	**16.6**	**$317.27**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
122	**3.54**	Hardwood pulpwood	6	50.9	10.0	2.1	5.3	$37.52	180	7.4	18.7	$132.70
			8	57.3	20.0	4.2	10.6	$75.04	203	14.7	37.3	$265.40
			10	18.3	10.0	1.7	4.6	$32.90	65	6.1	16.4	$116.36
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**126.6**	**40.0**	**8.0**	**20.5**	**$145.45**	**448**	**28.2**	**72.4**	**$514.46**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,788.5	8.3	$289.74	33	6,325.9	29.2	$1,024.80
			16	28.6	40.0	7,154.2	33.0	$1,158.98	101	25,303.7	116.8	$4,099.20
			18	11.3	20.0	3,577.1	16.5	$579.49	40	12,651.8	58.4	$2,049.60
			20	36.7	80.0	14,308.4	66.0	$2,317.96	130	50,607.4	233.5	$8,198.39
			22									
			24	6.4	20.0	3,577.1	16.5	$579.49	23	12,651.8	58.4	$2,049.60
			26	5.4	20.0	3,577.1	16.5	$579.49	19	12,651.8	58.4	$2,049.60
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**97.8**	**190.0**	**33,982.4**	**156.8**	**$5,505.15**	**346**	**120,192.5**	**554.6**	**$19,471.18**
		white oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	7.2	10.0	1,011.6	7.5	$194.23	25	3,578.0	26.6	$686.97
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		white oak sawtimber Total		**7.2**	**10.0**	**1,011.6**	**7.5**	**$194.23**	**25**	**3,578.0**	**26.6**	**$686.97**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
130	**17.08**	Hardwood pulpwood	6									
			8	11.5	4.0	0.7	1.5	$10.86	196	12.7	26.1	$185.57
			10	22.0	12.0	2.8	5.6	$39.92	376	48.0	95.9	$681.92
			12	25.5	20.0	3.9	8.0	$56.77	435	66.8	136.4	$969.58
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**58.9**	**36.0**	**7.5**	**15.1**	**$107.55**	**1,006**	**127.5**	**258.4**	**$1,837.07**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28	0.9	4.0	715.4	3.3	$115.90	16	12,219.6	56.4	$1,979.58
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**0.9**	**4.0**	**715.4**	**3.3**	**$115.90**	**16**	**12,219.6**	**56.4**	**$1,979.58**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22	1.5	4.0	361.5	3.1	$69.40	26	6,174.3	53.7	$1,185.46
			24									
			26	2.2	8.0	723.0	6.3	$138.81	37	12,348.5	107.3	$2,370.92
			28	0.9	4.0	361.5	3.1	$69.40	16	6,174.3	53.7	$1,185.46
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**4.6**	**16.0**	**1,445.9**	**12.6**	**$277.62**	**79**	**24,697.0**	**214.7**	**$4,741.83**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
130	**17.08**	soft maple sawtimber	6									
			8									
			10									
			12									
			14	3.7	4.0	344.6	2.3	$44.45	64	5,885.7	39.7	$759.26
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**3.7**	**4.0**	**344.6**	**2.3**	**$44.45**	**64**	**5,885.7**	**39.7**	**$759.26**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	7.5	8.0	803.5	5.7	$103.65	128	13,723.6	97.6	$1,770.34
			16	5.7	8.0	803.5	5.7	$103.65	98	13,723.6	97.6	$1,770.34
			18	6.8	12.0	1,205.2	8.6	$155.47	116	20,585.4	146.3	$2,655.52
			20	1.8	4.0	401.7	2.9	$51.82	31	6,861.8	48.8	$885.17
			22									
			24	5.1	16.0	1,606.9	11.4	$207.30	87	27,447.2	195.1	$3,540.69
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**26.9**	**48.0**	**4,820.8**	**34.3**	**$621.89**	**460**	**82,341.6**	**585.3**	**$10,622.06**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
133	**2.33**	American elm sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	11.3	20.0	2,104.2	12.6	$271.44	26	4,903.9	29.3	$632.60
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		American elm sawtimber Total		**11.3**	**20.0**	**2,104.2**	**12.6**	**$271.44**	**26**	**4,903.9**	**29.3**	**$632.60**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	3,577.1	16.5	$579.49	44	8,336.5	38.5	$1,350.52
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**18.7**	**20.0**	**3,577.1**	**16.5**	**$579.49**	**44**	**8,336.5**	**38.5**	**$1,350.52**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	9.2	20.0	1,807.4	15.7	$347.02	21	4,212.2	36.6	$808.75
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**9.2**	**20.0**	**1,807.4**	**15.7**	**$347.02**	**21**	**4,212.2**	**36.6**	**$808.75**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
133	**2.33**	swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	9.2	20.0	2,321.0	16.4	$445.63	21	5,409.2	38.2	$1,038.56
			22									
			24	6.4	20.0	2,321.0	16.4	$445.63	15	5,409.2	38.2	$1,038.56
			26									
			28									
			30	4.1	20.0	2,321.0	16.4	$445.63	9	5,409.2	38.2	$1,038.56
			32									
			34									
			36									
			>36									
		swamp chestnut oak sawtimber Total		**19.6**	**60.0**	**6,963.0**	**49.2**	**$1,336.90**	**46**	**16,227.5**	**114.7**	**$3,115.69**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	18.3	40.0	4,017.4	28.6	$518.24	43	9,362.6	66.6	$1,207.78
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**18.3**	**40.0**	**4,017.4**	**28.6**	**$518.24**	**43**	**9,362.6**	**66.6**	**$1,207.78**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
201	**3.69**	Hardwood pulpwood	6									
			8									
			10	12.2	6.7	1.6	3.1	$22.18	45	5.8	11.5	$81.84
			12	17.0	13.3	3.1	6.2	$44.36	63	11.5	23.0	$163.68
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**29.2**	**20.0**	**4.7**	**9.4**	**$66.54**	**108**	**17.3**	**34.5**	**$245.52**
		Softwood pulpwood	6									
			8	38.2	13.3	1.7	3.7	$49.16	141	6.3	13.8	$181.41
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Softwood pulpwood Total		**38.2**	**13.3**	**1.7**	**3.7**	**$49.16**	**141**	**6.3**	**13.8**	**$181.41**
		Chip-n-saw	6									
			8									
			10	12.2	6.7	710.0	3.7	$83.06	45	2,619.6	13.6	$306.49
			12	17.0	13.3	1,419.9	7.4	$166.13	63	5,239.2	27.2	$612.98
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**29.2**	**20.0**	**2,129.9**	**11.1**	**$249.19**	**108**	**7,858.8**	**40.8**	**$919.48**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
201	**3.69**	loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	3,577.1	16.5	$579.49	69	13,198.8	60.9	$2,138.21
			16	4.8	6.7	1,192.4	5.5	$193.16	18	4,399.6	20.3	$712.74
			18	3.8	6.7	1,192.4	5.5	$193.16	14	4,399.6	20.3	$712.74
			20	3.1	6.7	1,192.4	5.5	$193.16	11	4,399.6	20.3	$712.74
			22	2.5	6.7	1,192.4	5.5	$193.16	9	4,399.6	20.3	$712.74
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**32.8**	**46.7**	**8,346.6**	**38.5**	**$1,352.14**	**121**	**30,797.2**	**142.1**	**$4,989.15**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	4.8	6.7	602.5	5.2	$115.67	18	2,223.0	19.3	$426.82
			18									
			20									
			22	2.5	6.7	602.5	5.2	$115.67	9	2,223.0	19.3	$426.82
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		red oak sawtimber Total		**7.3**	**13.3**	**1,204.9**	**10.5**	**$231.35**	**27**	**4,446.0**	**38.6**	**$853.64**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16	9.5	13.3	1,148.6	7.8	$148.17	35	4,238.3	28.6	$546.73
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**9.5**	**13.3**	**1,148.6**	**7.8**	**$148.17**	**35**	**4,238.3**	**28.6**	**$546.73**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
201	**3.69**	sweetgum sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	3.8	6.7	669.6	4.8	$86.37	14	2,470.6	17.6	$318.70
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**3.8**	**6.7**	**669.6**	**4.8**	**$86.37**	**14**	**2,470.6**	**17.6**	**$318.70**
		unknown hardwood sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	574.3	3.9	$74.09	23	2,119.1	14.3	$273.37
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		unknown hardwood sawtimber Total		**6.2**	**6.7**	**574.3**	**3.9**	**$74.09**	**23**	**2,119.1**	**14.3**	**$273.37**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
202	**3.48**	Hardwood pulpwood	6									
			8	57.3	20.0	3.7	7.6	$54.32	200	13.0	26.6	$189.28
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**57.3**	**20.0**	**3.7**	**7.6**	**$54.32**	**200**	**13.0**	**26.6**	**$189.28**
		Chip-n-saw	6									
			8									
			10	18.3	10.0	1,064.9	5.5	$124.60	64	3,710.5	19.3	$434.13
			12	76.4	60.0	6,389.6	33.2	$747.58	266	22,263.2	115.7	$2,604.79
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**94.7**	**70.0**	**7,454.5**	**38.7**	**$872.18**	**330**	**25,973.7**	**135.0**	**$3,038.92**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	46.8	50.0	8,942.7	41.3	$1,448.72	163	31,159.2	143.8	$5,047.79
			16	14.3	20.0	3,577.1	16.5	$579.49	50	12,463.7	57.5	$2,019.11
			18	11.3	20.0	3,577.1	16.5	$579.49	39	12,463.7	57.5	$2,019.11
			20									
			22	3.8	10.0	1,788.5	8.3	$289.74	13	6,231.8	28.8	$1,009.56
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**76.2**	**100.0**	**17,885.5**	**82.5**	**$2,897.45**	**266**	**62,318.4**	**287.5**	**$10,095.57**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
202	**3.48**	soft maple sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	861.5	5.8	$111.13	33	3,001.6	20.3	$387.21
			16									
			18									
			20	4.6	10.0	861.5	5.8	$111.13	16	3,001.6	20.3	$387.21
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		soft maple sawtimber Total		**13.9**	**20.0**	**1,723.0**	**11.6**	**$222.26**	**49**	**6,003.3**	**40.5**	**$774.43**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
203	**3.45**	Hardwood pulpwood	6									
			8									
			10									
			12	6.4	5.0	1.2	2.3	$16.64	22	4.0	8.1	$57.41
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Hardwood pulpwood Total		**6.4**	**5.0**	**1.2**	**2.3**	**$16.64**	**22**	**4.0**	**8.1**	**$57.41**
		Chip-n-saw	6									
			8									
			10	55.0	30.0	3,194.8	16.6	$373.79	190	11,025.1	57.3	$1,289.94
			12	50.9	40.0	4,259.7	22.1	$498.39	176	14,700.1	76.4	$1,719.91
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		Chip-n-saw Total		**105.9**	**70.0**	**7,454.5**	**38.7**	**$872.18**	**366**	**25,725.2**	**133.7**	**$3,009.85**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,788.5	8.3	$289.74	32	6,172.2	28.5	$999.90
			16	10.7	15.0	2,682.8	12.4	$434.62	37	9,258.3	42.7	$1,499.85
			18	8.5	15.0	2,682.8	12.4	$434.62	29	9,258.3	42.7	$1,499.85
			20	4.6	10.0	1,788.5	8.3	$289.74	16	6,172.2	28.5	$999.90
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		loblolly pine sawtimber Total		**33.2**	**50.0**	**8,942.7**	**41.3**	**$1,448.72**	**114**	**30,861.1**	**142.4**	**$4,999.49**

NASO Forest Stand Stock Tables

Based on field reconnaisance 3/14 - 5/14

Volume units are:
- Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
- Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
- Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
- Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
203	**3.45**	sweetgum sawtimber	6									
			8									
			10									
			12									
			14	4.7	5.0	502.2	3.6	$64.78	16	1,733.0	12.3	$223.55
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			36									
			>36									
		sweetgum sawtimber Total		**4.7**	**5.0**	**502.2**	**3.6**	**$64.78**	**16**	**1,733.0**	**12.3**	**$223.55**

Appendix K
NALFF Forest Stand Summary

Appendix K: NALFF Forest Stand Summary Table These tables summarize, at the stand level, basal area, and number of trees, volume, and weight by hardwood/softwood and product category (sawtimber, chip-n-saw, and pulpwood), and value, both per acre and for the entire installation. Additional variables describing the inherent productivity, character, and condition of the stand such as site index species, site index, growth, forest type, age, and size class are reported.

NALFF Forest Stand Summary Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, International ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord
Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons.

QMD is quadratic mean diameter, the diameter of the tree of average basal area
Average height is Lorey's mean height (BA-weighted height), the arithmetic average of the trees selected by variable radius point sampling.
Site index values are all reported with base age of 50, and growth is calculated from ΔMean Stand Diameter, a method more robust than counting rings on individual trees.
Type-inventory is assigned on the basis of the majority of basal area; Pine: >=75% softwood BA; Pine-Hardwood: >=50 - <75% softwood BA;
Hardwood-Pine: >=25 - <50% softwood BA; Hardwood: <25% softwood BA.
Size class is assigned on the basis of majority basal area, and can take the values sawtimber, chip-n-saw, or pulpwood.

Stand number	1	2	3	4	7	8	9	10	11	12	14	15	16	17	18	19
Acres	70.63	48.26	15.90	118.92	29.85	18.76	21.95	17.57	11.16	7.80	58.13	5.58	13.58	21.57	3.80	2.12
Site index spp.	pine	pine	pine	yellow-poplar	pine	pine	pine	pine	pine	pine	pine	pine	pine	pine	pine	pine
Site index (50)	100	100	110	76	95	95	93	105	92	90	100	82	87	100	90	95
Growth (%)	2.0%	2.2%	1.7%	1.9%	1.4%	2.7%	1.3%	3.1%	1.9%	1.8%	3.3%	1.9%	1.7%	2.8%	2.4%	2.0%
Type - inventory	H	HP	PH	H	PH	HP	PH	PH	H	PH	PH	P	PH	HP	P	H
Age	56	56	51	76	61	58	56	51	50	46	51	40	58	39	46	37
Size class	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	pulpwood
Basal area (BA, sq. ft.)/acre	144.6	155.4	160.0	140.0	156.0	154.3	191.1	165.7	140.0	160.0	155.8	220.0	216.0	153.3	240.0	180.0
Hardwood BA/acre	121.5	93.8	80.0	134.5	74.0	82.9	62.2	80.0	106.7	80.0	67.4	40.0	60.0	91.1	30.0	140.0
Softwood BA/acre	23.1	61.5	80.0	5.5	82.0	71.4	128.9	85.7	33.3	80.0	88.4	180.0	156.0	62.2	210.0	40.0
Trees/acre	184	186	139	125	159	148	190	122	145	117	119	184	167	145	205	279
QMD (inches)	12.0	12.4	14.5	14.4	13.4	13.8	13.6	15.8	13.3	15.9	15.5	14.8	15.4	13.9	14.6	10.9
Average height (feet)	77	80	83	84	82	81	81	86	83	86	85	84	86	82	85	73
Sawtimber BA/acre	78.5	98.5	126.7	104.5	114.0	105.7	142.2	145.7	106.7	140.0	126.3	190.0	184.0	115.6	200.0	60.0
Hardwood sawtimber BA/acre	55.4	38.5	50.0	100.0	38.0	42.9	40.0	60.0	73.3	60.0	42.1	20.0	40.0	57.8	0.0	20.0
Softwood sawtimber BA/acre	23.1	60.0	76.7	4.5	76.0	62.9	102.2	85.7	33.3	80.0	84.2	170.0	144.0	57.8	200.0	40.0
Sawtimber volume (board-feet)/acre	8,872	13,555	17,529	10,434	16,320	14,642	20,963	20,246	12,060	18,705	17,938	30,231	27,768	14,671	33,643	8,363
Hardwood sawtimber volume (board-feet)/acre	4,990	3,462	4,632	9,669	3,536	4,068	3,767	5,827	6,453	5,248	3,772	1,634	3,545	4,952	0	1,634
Softwood sawtimber volume (board-feet)/acre	3,882	10,093	12,896	765	12,784	10,573	17,195	14,418	5,607	13,457	14,165	28,596	24,223	9,719	33,643	6,729
Sawtimber tons/acre	55.1	72.4	94.3	72.3	87.0	80.7	106.4	108.0	74.4	102.4	94.1	147.0	139.6	83.6	157.3	44.8
Hardwood sawtimber tons/acre	36.9	25.2	33.9	68.7	27.2	31.3	26.0	40.5	48.2	39.5	27.8	13.3	26.3	38.2	0.0	13.3
Softwood sawtimber tons/acre	18.2	47.2	60.3	3.6	59.8	49.4	80.4	67.4	26.2	62.9	66.2	133.7	113.3	45.5	157.3	31.5
Sawtimber $/acre	$1,292.64	$2,081.60	$2,730.12	$1,501.25	$2,605.24	$2,349.19	$3,271.62	$3,143.24	$1,740.79	$2,857.09	$2,788.27	$4,843.46	$4,381.40	$2,213.25	$5,450.15	$1,300.86
Chip-n-saw BA/acre	0.0	1.5	3.3	0.9	6.0	8.6	26.7	0.0	0.0	0.0	4.2	10.0	8.0	4.4	10.0	0.0
Chip-n-saw volume (board-feet)/acre	0	150	324	88	584	834	2,595	0	0	0	410	973	778	432	973	0
Chip-n-saw tons/acre	0.0	0.9	1.9	0.5	3.4	4.8	15.0	0.0	0.0	0.0	2.4	5.6	4.5	2.5	5.6	0.0
Chip-n-saw $/acre	$0.00	$17.51	$37.94	$10.35	$68.30	$97.57	$303.56	$0.00	$0.00	$0.00	$47.93	$113.83	$91.07	$50.59	$113.83	$0.00
Pulp BA/acre	66.2	55.4	30.0	34.5	36.0	40.0	22.2	20.0	33.3	20.0	25.3	20.0	24.0	33.3	30.0	120.0
Hardwood pulp BA/acre	66.2	55.4	30.0	34.5	36.0	40.0	22.2	20.0	33.3	20.0	25.3	20.0	20.0	33.3	30.0	120.0
Softwood pulp BA/acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0
Pulp volume (cords) per acre	15.2	12.9	7.0	8.4	8.6	10.6	5.2	4.5	7.5	4.6	5.7	4.5	5.4	7.5	6.7	27.0
Hardwood pulp volume (cords)/acre	15.2	12.9	7.0	8.4	8.6	10.6	5.2	4.5	7.5	4.6	5.7	4.5	4.5	7.5	6.7	27.0
Softwood pulp volume (cords)/acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0
Pulp tons/acre	31.2	26.9	14.6	18.3	18.2	24.7	10.8	9.3	15.1	9.4	11.6	9.2	11.0	15.2	13.4	54.2
Hardwood pulp tons/acre	31.2	26.9	14.6	18.3	18.2	24.7	10.8	9.3	15.1	9.4	11.6	9.2	9.1	15.2	13.4	54.2
Softwood pulp tons/acre	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0
Pulp $/acre	$222.13	$191.27	$103.94	$130.13	$129.18	$175.64	$77.04	$65.84	$107.13	$66.71	$82.18	$65.19	$89.54	$107.81	$95.51	$385.07
Total $/acre	$1,514.77	$2,290.38	$2,872.00	$1,641.73	$2,802.73	$2,622.40	$3,652.23	$3,209.07	$1,847.92	$2,923.80	$2,918.39	$5,022.48	$4,562.01	$2,371.65	$5,659.49	$1,685.93
Total number of trees	12,999	8,957	2,209	14,810	4,734	2,781	4,171	2,141	1,616	909	6,901	1,029	2,274	3,123	781	592
Total sawtimber volume (board-feet)	626,693	654,121	278,776	1,240,752	487,129	274,700	460,144	355,761	134,614	145,810	1,042,653	168,669	377,073	316,432	127,885	17,719
Total hardwood sawtimber volume (board-feet)	352,499	167,055	73,669	1,149,827	105,543	76,326	82,697	102,398	72,028	40,911	219,270	9,119	48,138	106,802	0	3,463
Total softwood sawtimber volume (board-feet)	274,194	487,066	205,107	90,926	381,586	198,374	377,448	253,363	62,587	104,899	823,384	159,550	328,935	209,630	127,885	14,256
Total sawtimber tons	3888.7	3494.0	1499.0	8599.4	2595.5	1514.4	2336.2	1897.0	831.0	798.4	5467.8	820.4	1895.1	1803.3	598.1	94.9
Total hardwood sawtimber tons	2,606.3	1,216.1	539.8	8,174.2	810.9	586.6	570.9	712.1	538.3	307.8	1,617.0	74.2	356.8	822.9	0.0	28.2
Total softwood sawtimber tons	1,282.3	2,277.9	959.2	425.2	1,784.6	927.8	1,765.2	1,184.9	292.7	490.6	3,850.8	746.2	1,538.4	980.4	598.1	66.7
Total sawtimber $	$91,305.17	$100,454.81	$43,420.17	$178,524.91	$77,761.34	$44,074.29	$71,814.40	$55,233.65	$19,430.62	$22,271.11	$162,071.86	$27,023.49	$59,497.31	$47,737.53	$20,717.42	$2,756.24
Total chip-n-saw volume (board-feet)	0	7,224	5,158	10,518	17,424	15,646	56,952	0	0	0	23,812	5,428	10,570	9,327	3,698	0
Total chip-n-saw tons	0.0	41.9	29.9	61.0	101.1	90.7	330.3	0.0	0.0	0.0	138.1	31.5	61.3	54.1	21.5	0.0
Total chip-n-saw $	$0.00	$845.15	$603.48	$1,230.63	$2,038.65	$1,830.61	$6,663.35	$0.00	$0.00	$0.00	$2,786.02	$635.13	$1,236.66	$1,091.25	$432.72	$0.00
Total pulp volume (cords)	1,072.7	622.2	111.4	1,001.3	255.4	199.5	113.8	79.8	83.6	35.6	331.8	25.2	73.7	162.0	25.5	57.1
Total hardwood pulp volume (cords)	1,072.7	622.2	111.4	1,001.3	255.4	199.5	113.8	79.8	83.6	35.6	331.8	25.2	61.3	162.0	25.5	57.1
Total softwood pulp volume (cords)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.4	0.0	0.0	0.0
Total pulp tons	2,206.7	1,298.2	232.5	2,176.4	542.3	463.5	237.9	162.7	168.2	73.1	671.9	51.2	149.4	327.0	51.1	114.8
Total hardwood pulp tons	2,206.7	1,298.2	232.5	2,176.4	542.3	463.5	237.9	162.7	168.2	73.1	671.9	51.2	123.9	327.0	51.1	114.8
Total softwood pulp tons	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.5	0.0	0.0	0.0
Total pulp $	$15,689.84	$9,230.27	$1,653.11	$15,474.54	$3,855.88	$3,295.27	$1,691.16	$1,156.94	$1,195.80	$519.97	$4,777.09	$363.72	$1,215.93	$2,325.27	$363.05	$815.88
Total stand $	$106,995.01	$110,530.23	$45,676.76	$195,230.08	$83,655.87	$49,200.16	$80,168.91	$56,390.59	$20,626.42	$22,791.08	$169,634.97	$28,022.34	$61,949.91	$51,154.04	$21,513.19	$3,572.12

NALFF Forest Stand Summary Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, International ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord
Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons.

QMD is quadratic mean diameter, the diameter of the tree of average basal area
Average height is Lorey's mean height (BA-weighted height), the arithmetic average of the trees selected by variable radius point sampling.
Site index values are all reported with base age of 50, and growth is calculated from ΔMean Stand Diameter, a method more robust than counting rings on individual trees.
Type-inventory is assigned on the basis of the majority of basal area; Pine: >=75% softwood BA; Pine-Hardwood: >=50 - <75% softwood BA;
Hardwood-Pine: >=25 - <50% softwood BA; Hardwood: <25% softwood BA.
Size class is assigned on the basis of majority basal area, and can take the values sawtimber, chip-n-saw, or pulpwood.

Stand number	26	31	32	33	34	37	38	39	41	42	100	101	102	103
Acres	11.28	5.35	12.95	8.07	13.79	12.46	10.75	46.14	45.68	72.26	52.86	281.49	7.74	7.03
Site index spp.	poplar	red maple	loblolly pine	red maple	pine	red maple	pine	pine	red maple	red maple	red maple	red maple	red maple	red maple
Site index (50)	82	77	94	77	80	71	65	65	73	66	75	73	78	73
Growth (%)	2.2%	17.1%	11.7%	14.0%	10.7%	0.7%	5.6%	6.2%	2.2%	1.0%	1.8%	1.3%	1.2%	1.3%
Type - inventory	H	HP	HP	HP	PH	PH	P	P	H	H	HP	H	H	HP
Age	56	54	38	54	28	50	36	36	51	47	53	52	55	52
Size class	pulpwood	sawtimber	pulpwood	sawtimber	sawtimber	sawtimber	sawtimber	sawtimber	pulpwood	pulpwood	pulpwood	pulpwood	sawtimber	pulpwood
Basal area (BA, sq. ft.)/acre	128.0	110.0	145.0	100.0	160.0	175.0	113.3	115.6	95.0	132.5	65.5	143.6	126.7	133.3
Hardwood BA/acre	128.0	70.0	85.0	70.0	48.0	75.0	0.0	0.0	95.0	132.5	47.3	143.6	126.7	93.3
Softwood BA/acre	0.0	40.0	60.0	30.0	112.0	100.0	113.3	115.6	0.0	0.0	18.2	0.0	0.0	40.0
Trees/acre	169	90	216	109	261	261	108	100	201	382	109	239	149	168
QMD (inches)	11.8	14.9	11.1	13.0	10.6	11.1	13.9	14.6	9.3	8.0	10.5	10.5	12.5	12.1
Average height (feet)	75	84	74	79	72	76	81	82	68	61	71	72	78	76
Sawtimber BA/acre	48.0	80.0	61.7	70.0	58.0	90.0	100.0	100.0	25.0	15.0	25.5	41.8	66.7	46.7
Hardwood sawtimber BA/acre	48.0	40.0	25.0	50.0	8.0	0.0	0.0	0.0	25.0	15.0	15.5	41.8	66.7	20.0
Softwood sawtimber BA/acre	0.0	40.0	36.7	20.0	50.0	90.0	100.0	100.0	0.0	0.0	10.0	0.0	0.0	26.7
Sawtimber volume (board-feet)/acre	4,682	10,515	8,340	7,795	9,134	15,139	16,821	16,821	2,302	1,312	3,196	3,982	6,712	6,465
Hardwood sawtimber volume (board-feet)/acre	4,682	3,787	2,172	4,431	723	0	0	0	2,302	1,312	1,514	3,982	6,712	1,980
Softwood sawtimber volume (board-feet)/acre	0	6,729	6,168	3,364	8,411	15,139	16,821	16,821	0	0	1,682	0	0	4,486
Sawtimber tons/acre	31.0	57.5	46.0	48.6	44.6	70.8	78.7	78.7	16.3	9.9	17.8	27.1	48.2	33.9
Hardwood sawtimber tons/acre	31.0	26.0	17.1	32.8	5.2	0.0	0.0	0.0	16.3	9.9	10.0	27.1	48.2	12.9
Softwood sawtimber tons/acre	0.0	31.5	28.8	15.7	39.3	70.8	78.7	78.7	0.0	0.0	7.9	0.0	0.0	21.0
Sawtimber $/acre	$603.98	$1,578.50	$1,301.08	$1,116.63	$1,455.78	$2,452.57	$2,725.07	$2,725.07	$296.94	$169.26	$467.81	$513.71	$1,039.26	$982.05
Chip-n-saw BA/acre	0.0	0.0	20.0	10.0	50.0	10.0	6.7	13.3	0.0	0.0	0.0	0.0	0.0	13.3
Chip-n-saw volume (board-feet)/acre	0	0	1,946	973	4,865	973	649	1,297	0	0	0	0	0	1,297
Chip-n-saw tons/acre	0.0	0.0	11.3	5.6	28.2	5.6	3.8	7.5	0.0	0.0	0.0	0.0	0.0	7.5
Chip-n-saw $/acre	$0.00	$0.00	$227.67	$113.83	$569.17	$113.83	$75.89	$151.78	$0.00	$0.00	$0.00	$0.00	$0.00	$151.78
Pulp BA/acre	80.0	30.0	63.3	20.0	52.0	75.0	6.7	2.2	70.0	117.5	40.0	101.8	60.0	73.3
Hardwood pulp BA/acre	80.0	30.0	60.0	20.0	40.0	75.0	0.0	0.0	70.0	117.5	31.8	101.8	60.0	73.3
Softwood pulp BA/acre	0.0	0.0	3.3	0.0	12.0	0.0	6.7	2.2	0.0	0.0	8.2	0.0	0.0	0.0
Pulp volume (cords) per acre	18.3	6.8	14.5	4.6	11.7	17.1	1.5	0.5	16.0	26.8	9.1	23.3	13.6	17.6
Hardwood pulp volume (cords)/acre	18.3	6.8	13.7	4.6	9.0	17.1	0.0	0.0	16.0	26.8	7.3	23.3	13.6	17.6
Softwood pulp volume (cords)/acre	0.0	0.0	0.8	0.0	2.7	0.0	1.5	0.5	0.0	0.0	1.9	0.0	0.0	0.0
Pulp tons/acre	37.5	13.6	29.7	9.4	23.5	34.9	3.1	1.0	32.8	55.1	18.7	47.8	27.7	37.7
Hardwood pulp tons/acre	37.5	13.6	28.1	9.4	17.9	34.9	0.0	0.0	32.8	55.1	14.8	47.8	27.7	37.7
Softwood pulp tons/acre	0.0	0.0	1.6	0.0	5.6	0.0	3.1	1.0	0.0	0.0	3.8	0.0	0.0	0.0
Pulp $/acre	$266.82	$97.03	$220.50	$66.71	$201.31	$247.87	$41.09	$13.70	$233.47	$391.52	$155.96	$339.59	$197.08	$268.21
Total $/acre	$870.80	$1,675.52	$1,749.26	$1,297.17	$2,226.26	$2,814.27	$2,842.06	$2,890.55	$530.41	$560.78	$623.77	$853.30	$1,236.35	$1,402.04
Total number of trees	1,904	485	2,793	878	3,592	3,248	1,161	4,616	9,173	27,602	5,746	67,416	1,153	1,181
Total sawtimber volume (board-feet)	52,829	56,308	108,005	62,941	125,906	188,635	180,795	776,123	105,156	94,809	168,955	1,120,979	51,923	45,470
Total hardwood sawtimber volume (board-feet)	52,829	20,277	28,130	35,777	9,964	0	0	0	105,156	94,809	80,033	1,120,979	51,923	13,922
Total softwood sawtimber volume (board-feet)	0	36,031	79,875	27,164	115,942	188,635	180,795	776,123	0	0	88,922	0	0	31,548
Total sawtimber tons	350.0	307.7	595.5	392.2	614.4	882.2	845.5	3629.8	745.5	713.4	943.4	7639.8	372.7	238.2
Total hardwood sawtimber tons	350.0	139.2	222.0	265.2	72.2	0.0	0.0	0.0	745.5	713.4	527.6	7,639.8	372.7	90.7
Total softwood sawtimber tons	0.0	168.5	373.6	127.0	542.2	882.2	845.5	3,629.8	0.0	0.0	415.9	0.0	0.0	147.5
Total sawtimber $	$6,814.98	$8,452.77	$16,849.26	$9,015.78	$20,067.98	$30,558.88	$29,288.72	$125,732.00	$13,565.13	$12,230.33	$24,729.68	$144,606.23	$8,039.63	$6,906.75
Total chip-n-saw volume (board-feet)	0	0	25,200	7,856	67,061	12,123	6,971	59,854	0	0	0	0	0	9,124
Total chip-n-saw tons	0.0	0.0	146.2	45.6	388.9	70.3	40.4	347.1	0.0	0.0	0.0	0.0	0.0	52.9
Total chip-n-saw $	$0.00	$0.00	$2,948.36	$919.11	$7,846.11	$1,418.38	$815.66	$7,002.97	$0.00	$0.00	$0.00	$0.00	$0.00	$1,067.46
Total pulp volume (cords)	206.2	36.2	187.7	36.9	161.2	212.6	16.4	23.4	730.4	1,938.4	482.5	6,546.2	105.3	123.7
Total hardwood pulp volume (cords)	206.2	36.2	177.9	36.9	123.5	212.6	0.0	0.0	730.4	1,938.4	383.7	6,546.2	105.3	123.7
Total softwood pulp volume (cords)	0.0	0.0	9.9	0.0	37.8	0.0	16.4	23.4	0.0	0.0	98.8	0.0	0.0	0.0
Total pulp tons	423.4	73.1	384.5	75.8	324.5	434.4	33.6	48.1	1,500.1	3,979.0	987.5	13,445.0	214.4	265.3
Total hardwood pulp tons	423.4	73.1	364.2	75.8	246.9	434.4	0.0	0.0	1,500.1	3,979.0	784.6	13,445.0	214.4	265.3
Total softwood pulp tons	0.0	0.0	20.2	0.0	77.6	0.0	33.6	48.1	0.0	0.0	202.9	0.0	0.0	0.0
Total pulp $	$3,010.71	$519.57	$2,855.55	$538.59	$2,775.11	$3,088.48	$441.66	$632.00	$10,665.57	$28,290.46	$8,244.41	$95,593.90	$1,524.62	$1,886.31
Total stand $	$9,825.69	$8,972.34	$22,653.17	$10,473.49	$30,689.20	$35,065.73	$30,546.03	$133,366.97	$24,230.70	$40,520.79	$32,974.09	$240,200.14	$9,564.25	$9,860.53

Appendix L
NALFF Statistical Summary Table

Appendix L: NALFF Timber Inventory Statistical Summary Table: This table provides sampling error for overall quadratic mean diameter, and basal area, volume, and weight for hardwoods, softwoods, and product categories (sawtimber, chip-n-saw, and pulpwood). Sampling error is reported as the 90% confidence limit half-width expressed as a percent of the mean, for each compartment, forest type, and installation. Installation sampling error is stratified based on forest type.

90% confidence limit half-width as percent of the mean for major timber category totals for 2014 forest inventory at NALFF. A value of zero indicates no trees of the category were sampled in the stratum.

		Basal area (ft^2/ac)	Hardwood BA/acre	Softwood BA/acre	Trees/ acre	Tree height (ft)	QMD	Hardwood sawtimber board-feet	Softwood sawtimber board-feet	Sawtimber board-feet	Hardwood sawtimber tons	Softwood sawtimber tons	Sawtimber tons	Chip-n-saw board-feet	Chip-n-saw tons	Hardwood pulpwood cords	Softwood pulpwood cords	Pulpwood cords	Hardwood pulpwood tons	Softwood pulpwood tons	Pulpwood tons
Compartment	1	3.4%	6.5%	11.5%	6.2%	0.6%	3.3%	11.8%	11.7%	10.0%	7.9%	11.9%	6.8%	24.4%	18.2%	13.2%	0.0%	13.2%	13.6%	0.0%	13.6%
Forest type	H	4.9%	5.7%	49.2%	11.6%	1.2%	5.2%	13.7%	125.9%	19.8%	10.7%	125.2%	16.1%	641.4%	630.3%	15.4%	0.0%	15.4%	15.7%	0.0%	15.7%
	HP	8.5%	11.5%	20.1%	11.4%	1.3%	7.8%	18.5%	25.8%	16.2%	16.4%	25.7%	13.0%	39.5%	36.2%	17.3%	0.0%	17.3%	17.5%	0.0%	17.5%
	PH	4.3%	10.5%	9.6%	9.0%	0.9%	6.1%	15.4%	12.0%	10.7%	12.8%	12.1%	7.7%	23.0%	17.4%	20.4%	0.0%	20.4%	20.7%	0.0%	20.7%
	P	16.1%	81.5%	12.7%	18.7%	1.5%	18.1%	421.2%	17.3%	17.5%	409.3%	17.2%	14.7%	35.8%	34.4%	170.9%	0.0%	170.9%	170.3%	0.0%	170.3%
	Total[1]	3.3%	4.6%	8.6%	7.8%	0.8%	3.6%	10.0%	17.5%	9.3%	8.0%	17.4%	7.5%	31.4%	29.6%	11.1%	0.0%	11.1%	11.3%	0.0%	11.3%

[1]Installation-level total uncertainty based upon stratification by *forest type* .

Appendix M
NALFF Stock Tables

Appendix M-1: NALFF Forest Installation Stock Tables: These tables summarize at the installation level, for each stock class (hardwood pulpwood, softwood pulpwood, chip-n-saw, and sawtimber by species) and 2" dbh class, the mean number of trees per acre, mean basal area per acre (ft^2/ac), mean volume per acre (cords for pulp, board-feet Doyle log rule for hardwood sawlog volume, or board-feet Int'l ¼-inch log rule for softwood sawlog and chip-n-saw volume), and mean weight per acre (short tons, green volume basis, wood & bark in merchandised portion of tree); as well as the total number of trees and total weight using the above units, and total value. Installation means and totals are based on stratification by forest type and so vary from totals aggregated from compartment sub-totals. Total installation area is 1,053.44 acres. Null (blank) entries in the table indicate no trees were sampled of that particular combination of dbh and stock class.

NALFF Forest Installation Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
Hardwood pulpwood	6	22.8	4.5	1.0	2.1	$14.94	24,003	1,077.8	2,213.9	$15,740.49
	8	42.4	14.8	3.4	7.1	$50.65	44,668	3,610.6	7,503.9	$53,352.85
	10	28.4	15.5	3.6	7.4	$52.50	29,962	3,763.9	7,778.7	$55,306.84
	12	23.6	18.5	4.3	8.9	$63.49	24,828	4,523.5	9,406.6	$66,881.06
	14									
	16									
	18									
	20									
	22									
	24									
	26									
	28									
	30									
	32									
	34									
	≥36									
Hardwood pulpwood Total		**117.2**	**53.3**	**12.3**	**25.5**	**$181.58**	**123,462**	**12,975.9**	**26,903.1**	**$191,281.25**
Softwood pulpwood	6	0.6	0.1	0.0	0.1	$0.72	631	28.3	58.1	$763.54
	8	1.7	0.6	0.1	0.3	$3.72	1,823	145.3	298.5	$3,921.89
	10									
	12									
	14									
	16									
	18									
	20									
	22									
	24									
	26									
	28									
	30									
	32									
	34									
	≥36									
Softwood pulpwood Total		**2.3**	**0.7**	**0.2**	**0.3**	**$4.45**	**2,454**	**173.6**	**356.6**	**$4,685.43**
Chip-n-saw	6									
	8									
	10	2.3	1.3	122.6	0.7	$14.34	2,433	129,105.1	748.8	$15,105.30
	12	3.3	2.6	248.4	1.4	$29.06	3,424	261,633.4	1,517.4	$30,611.11
	14									
	16									
	18									
	20									
	22									
	24									
	26									
	28									
	30									
	32									
	34									
	≥36									
Chip-n-saw Total		**5.6**	**3.8**	**370.9**	**2.2**	**$43.40**	**5,857**	**390,738.5**	**2,266.2**	**$45,716.41**

NALFF Forest Installation Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
baldcypress sawtimber	6									
	8									
	10									
	12									
	14	0.3	0.3	26.1	0.2	$3.36	314	27,443.5	223.3	$3,540.21
	16	0.7	1.0	78.2	0.6	$10.08	722	82,330.5	670.0	$10,620.64
	18	0.1	0.2	13.0	0.1	$1.68	95	13,721.8	111.7	$1,770.11
	20	0.1	0.3	26.1	0.2	$3.36	154	27,443.5	223.3	$3,540.21
	22	0.1	0.3	26.1	0.2	$3.36	127	27,443.5	223.3	$3,540.21
	24									
	26									
	28									
	30									
	32									
	34									
	≥36									
baldcypress sawtimber Total		**1.3**	**2.1**	**169.3**	**1.4**	**$21.84**	**1,412**	**178,382.8**	**1,451.7**	**$23,011.38**
blackgum sawtimber	6									
	8									
	10									
	12									
	14	0.1	0.1	6.2	0.0	$0.80	62	6,531.3	42.5	$842.54
	16	0.0	0.1	6.2	0.0	$0.80	47	6,531.3	42.5	$842.54
	18									
	20									
	22									
	24									
	26									
	28									
	30									
	32									
	34									
	≥36									
blackgum sawtimber Total		**0.1**	**0.1**	**12.4**	**0.1**	**$1.60**	**109**	**13,062.6**	**85.1**	**$1,685.08**
Carolina ash sawtimber	6									
	8									
	10									
	12									
	14	0.6	0.6	63.1	0.4	$8.14	628	66,481.1	432.9	$8,576.06
	16	0.1	0.2	15.8	0.1	$2.04	120	16,620.3	108.2	$2,144.02
	18									
	20									
	22									
	24									
	26									
	28									
	30									
	32									
	34									
	≥36									
Carolina ash sawtimber Total		**0.7**	**0.8**	**78.9**	**0.5**	**$10.18**	**749**	**83,101.4**	**541.1**	**$10,720.08**

NALFF Forest Installation Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
loblolly pine sawtimber	6									
	8									
	10									
	12									
	14	5.5	5.8	983.1	4.6	$159.26	5,759	1,035,619.6	4,843.4	$167,770.38
	16	5.0	7.0	1,175.3	5.5	$190.39	5,271	1,238,083.8	5,790.2	$200,569.57
	18	4.6	8.0	1,352.9	6.3	$219.16	4,794	1,425,160.6	6,665.2	$230,876.02
	20	2.9	6.3	1,059.5	5.0	$171.63	3,041	1,116,068.7	5,219.6	$180,803.13
	22	1.6	4.1	695.9	3.3	$112.73	1,651	733,075.5	3,428.4	$118,758.22
	24	0.7	2.2	367.3	1.7	$59.49	732	386,878.4	1,809.3	$62,674.30
	26	0.1	0.5	90.1	0.4	$14.60	153	94,953.5	444.1	$15,382.46
	28	0.1	0.6	94.1	0.4	$15.24	138	99,131.1	463.6	$16,059.23
	30	0.1	0.3	42.3	0.2	$6.84	54	44,508.0	208.2	$7,210.29
	32									
	34									
	≥36									
loblolly pine sawtimber Total		**20.5**	**34.8**	**5,860.3**	**27.4**	**$949.37**	**21,594**	**6,173,479.2**	**28,872.0**	**$1,000,103.62**
red oak sawtimber	6									
	8									
	10									
	12									
	14	0.3	0.4	38.6	0.3	$7.41	368	40,642.7	330.8	$7,803.39
	16	0.4	0.6	57.2	0.5	$10.98	418	60,241.3	490.3	$11,566.33
	18	0.2	0.4	44.3	0.4	$8.50	256	46,618.1	379.4	$8,950.67
	20	0.1	0.1	12.1	0.1	$2.33	57	12,787.0	104.1	$2,455.11
	22	0.2	0.6	62.9	0.5	$12.07	243	66,216.7	538.9	$12,713.61
	24	0.1	0.2	22.1	0.2	$4.25	72	23,309.0	189.7	$4,475.33
	26									
	28									
	30									
	32									
	34									
	≥36									
red oak sawtimber Total		**1.3**	**2.3**	**237.1**	**1.9**	**$45.53**	**1,413**	**249,814.8**	**2,033.0**	**$47,964.44**
soft maple sawtimber	6									
	8									
	10									
	12									
	14	4.8	5.1	507.4	3.3	$65.46	5,052	534,557.0	3,481.0	$68,957.85
	16	3.0	4.2	418.0	2.7	$53.92	3,186	440,347.0	2,867.5	$56,804.76
	18	2.3	4.0	397.3	2.6	$51.26	2,393	418,565.4	2,725.7	$53,994.93
	20	1.5	3.3	326.5	2.1	$42.12	1,593	343,949.2	2,239.8	$44,369.45
	22	0.6	1.7	165.8	1.1	$21.39	669	174,672.2	1,137.5	$22,532.71
	24	0.6	2.0	198.1	1.3	$25.56	671	208,714.6	1,359.1	$26,924.18
	26	0.3	0.9	91.3	0.6	$11.78	264	96,164.0	626.2	$12,405.16
	28	0.1	0.3	32.9	0.2	$4.24	82	34,610.5	225.4	$4,464.76
	30	0.1	0.3	31.6	0.2	$4.07	68	33,240.6	216.5	$4,288.03
	32	0.0	0.2	15.8	0.1	$2.04	30	16,620.3	108.2	$2,144.02
	34	0.0	0.2	15.8	0.1	$2.04	27	16,620.3	108.2	$2,144.02
	≥36									
soft maple sawtimber Total		**13.3**	**22.2**	**2,200.5**	**14.3**	**$283.86**	**14,034**	**2,318,061.0**	**15,095.0**	**$299,029.87**

NALFF Forest Installation Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
swamp chestnut oak sawtimber	6									
	8									
	10									
	12									
	14	0.8	0.9	88.7	0.7	$17.04	847	93,479.9	760.8	$17,948.13
	16	0.3	0.5	49.4	0.4	$9.48	361	52,000.9	423.2	$9,984.18
	18	0.1	0.2	16.5	0.1	$3.16	95	17,333.6	141.1	$3,328.06
	20	0.1	0.2	16.5	0.1	$3.16	77	17,333.6	141.1	$3,328.06
	22	0.1	0.2	16.5	0.1	$3.16	64	17,333.6	141.1	$3,328.06
	24									
	26	0.0	0.2	16.5	0.1	$3.16	46	17,333.6	141.1	$3,328.06
	28	0.0	0.2	16.5	0.1	$3.16	39	17,333.6	141.1	$3,328.06
	30									
	32									
	34									
	≥36									
swamp chestnut oak sawtimber Total		**1.5**	**2.1**	**220.4**	**1.8**	**$42.31**	**1,528**	**232,149.0**	**1,889.3**	**$44,572.62**
sweetgum sawtimber	6									
	8									
	10									
	12									
	14	5.2	5.5	452.3	3.7	$58.34	5,454	476,456.1	3,877.5	$61,462.84
	16	2.6	3.7	301.1	2.5	$38.84	2,780	317,160.9	2,581.1	$40,913.75
	18	1.1	1.9	158.4	1.3	$20.44	1,156	166,909.9	1,358.3	$21,531.38
	20	0.9	1.9	152.9	1.2	$19.73	904	161,101.4	1,311.1	$20,782.08
	22	0.1	0.3	22.0	0.2	$2.84	107	23,182.3	188.7	$2,990.51
	24	0.1	0.2	13.0	0.1	$1.68	53	13,721.8	111.7	$1,770.11
	26	0.1	0.2	17.5	0.1	$2.26	61	18,452.0	150.2	$2,380.31
	28									
	30									
	32									
	34									
	≥36	0.0	0.1	4.5	0.0	$0.58	7	4,730.3	38.5	$610.20
sweetgum sawtimber Total		**10.0**	**13.7**	**1,121.8**	**9.1**	**$144.71**	**10,523**	**1,181,714.6**	**9,617.0**	**$152,441.18**
unknown hardwood sawtimber	6									
	8									
	10									
	12									
	14	0.1	0.1	6.2	0.0	$0.80	62	6,531.3	42.5	$842.54
	16									
	18	0.0	0.0	3.1	0.0	$0.40	19	3,265.7	21.3	$421.27
	20									
	22	0.0	0.0	3.1	0.0	$0.40	12	3,265.7	21.3	$421.27
	24									
	26									
	28									
	30									
	32									
	34									
	≥36									
unknown hardwood sawtimber Total		**0.1**	**0.1**	**12.4**	**0.1**	**$1.60**	**93**	**13,062.6**	**85.1**	**$1,685.08**

NALFF Forest Installation Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords: 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
water oak sawtimber	6									
	8									
	10									
	12									
	14	0.6	0.6	65.8	0.5	$12.64	628	69,334.6	564.3	$13,312.24
	16	0.1	0.2	16.5	0.1	$3.16	120	17,333.6	141.1	$3,328.06
	18	0.1	0.1	12.1	0.1	$2.33	70	12,787.0	104.1	$2,455.11
	20	0.0	0.1	5.7	0.0	$1.09	27	5,975.4	48.6	$1,147.27
	22									
	24									
	26	0.0	0.2	16.5	0.1	$3.16	46	17,333.6	141.1	$3,328.06
	28									
	30									
	32									
	34									
	≥36									
water oak sawtimber Total		**0.8**	**1.1**	**116.5**	**0.9**	**$22.38**	**891**	**122,764.3**	**999.1**	**$23,570.74**
water tupelo sawtimber	6									
	8									
	10									
	12									
	14	1.5	1.6	157.8	1.0	$20.35	1,571	166,202.8	1,082.3	$21,440.16
	16	0.7	1.0	94.7	0.6	$12.21	722	99,721.7	649.4	$12,864.10
	18	0.4	0.6	63.1	0.4	$8.14	380	66,481.1	432.9	$8,576.06
	20									
	22	0.1	0.2	15.8	0.1	$2.04	64	16,620.3	108.2	$2,144.02
	24									
	26									
	28									
	30									
	32									
	34									
	≥36									
water tupelo sawtimber Total		**2.6**	**3.3**	**331.3**	**2.2**	**$42.74**	**2,736**	**349,025.9**	**2,272.8**	**$45,024.34**

Appendix M-2: NALFF Forest Compartment Stock Tables: These tables summarize at the compartment level, for each stock class (hardwood pulpwood, softwood pulpwood, chip-n-saw, and sawtimber by species) and 2" dbh class, the mean number of trees per acre, mean basal area per acre (ft^2/ac), mean volume per acre (cords for pulp, mean board-feet Doyle log rule for hardwood sawlog volume, or board-feet Int'l ¼-inch log rule for softwood sawlog and chip-n-saw volume), and mean weight per acre (short tons, green volume basis, wood & bark in merchandised portion of tree); as well as the total number of trees and total weight using the above units, and total value. The total area of the compartment is also provided. No stratification is performed to arrive at means and totals at this hierarchical level. Null (blank) entries in the table indicate no trees were sampled of that particular combination of dbh and stock class. Compartment designations were retained from the prior inventory, if present (which it was for NALFF), and compartment designations were not updated as part of the 2014 inventory. As such, there is a single compartment at NALFF.

NALFF Forest Compartment Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Cmp.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
1	1,053.44	Hardwood pulpwood	6	17.8	3.5	0.8	1.6	$11.70	18,739	842.9	1,732.9	$12,320.79
			8	35.1	12.2	2.8	5.9	$42.10	36,965	2,995.6	6,237.1	$44,345.80
			10	25.4	13.8	3.2	6.6	$46.95	26,708	3,361.4	6,955.7	$49,454.97
			12	19.9	15.6	3.6	7.5	$53.66	20,986	3,823.9	7,950.0	$56,524.58
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**98.2**	**45.2**	**10.5**	**21.7**	**$154.40**	**103,398**	**11,023.8**	**22,875.7**	**$162,646.14**
		Softwood pulpwood	6	1.0	0.2	0.0	0.1	$1.18	1,027	46.0	94.6	$1,242.75
			8	2.6	0.9	0.2	0.4	$5.60	2,744	218.7	449.2	$5,903.06
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**3.6**	**1.1**	**0.3**	**0.5**	**$6.78**	**3,770**	**264.8**	**543.8**	**$7,145.81**
		Chip-n-saw	6									
			8									
			10	3.6	2.0	190.9	1.1	$22.33	3,789	201,065.4	1,166.1	$23,524.65
			12	5.0	3.9	381.7	2.2	$44.66	5,262	402,130.7	2,332.3	$47,049.30
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**8.6**	**5.9**	**572.6**	**3.3**	**$66.99**	**9,051**	**603,196.1**	**3,498.4**	**$70,573.94**

NALFF Forest Compartment Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Cmp.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		baldcypress sawtimber	6									
			8									
			10									
			12									
			14	0.2	0.2	15.6	0.1	$2.02	189	16,475.6	134.1	$2,125.35
			16	0.4	0.6	46.9	0.4	$6.05	433	49,426.8	402.2	$6,376.06
			18	0.1	0.1	7.8	0.1	$1.01	57	8,237.8	67.0	$1,062.68
			20	0.1	0.2	15.6	0.1	$2.02	92	16,475.6	134.1	$2,125.35
			22	0.1	0.2	15.6	0.1	$2.02	76	16,475.6	134.1	$2,125.35
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		baldcypress sawtimber Total		**0.8**	**1.2**	**101.7**	**0.8**	**$13.11**	**848**	**107,091.5**	**871.5**	**$13,814.80**
		blackgum sawtimber	6									
			8									
			10									
			12									
			14	0.1	0.1	9.5	0.1	$1.22	94	9,977.9	65.0	$1,287.15
			16	0.1	0.1	9.5	0.1	$1.22	72	9,977.9	65.0	$1,287.15
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		blackgum sawtimber Total		**0.2**	**0.2**	**18.9**	**0.1**	**$2.44**	**166**	**19,955.9**	**130.0**	**$2,574.31**
		Carolina ash sawtimber	6									
			8									
			10									
			12									
			14	0.4	0.4	37.9	0.2	$4.89	377	39,911.7	259.9	$5,148.61
			16	0.1	0.1	9.5	0.1	$1.22	72	9,977.9	65.0	$1,287.15
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Carolina ash sawtimber Total		**0.4**	**0.5**	**47.4**	**0.3**	**$6.11**	**449**	**49,889.6**	**324.9**	**$6,435.76**

NALFF Forest Compartment Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Cmp.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	7.8	8.3	1,400.4	6.5	$226.87	8,204	1,475,285.3	6,899.6	$238,996.22
			16	7.3	10.2	1,714.3	8.0	$277.72	7,689	1,805,952.7	8,446.0	$292,564.34
			18	6.6	11.7	1,963.8	9.2	$318.14	6,960	2,068,790.9	9,675.3	$335,144.13
			20	4.0	8.7	1,464.8	6.9	$237.30	4,205	1,543,114.5	7,216.8	$249,984.55
			22	2.3	6.1	1,030.2	4.8	$166.89	2,444	1,085,267.4	5,075.6	$175,813.31
			24	1.1	3.4	571.4	2.7	$92.57	1,139	601,984.2	2,815.3	$97,521.45
			26	0.2	0.7	112.7	0.5	$18.25	191	118,701.1	555.1	$19,229.58
			28	0.2	0.8	128.8	0.6	$20.86	189	135,658.4	634.4	$21,976.66
			30	0.1	0.4	64.4	0.3	$10.43	82	67,829.2	317.2	$10,988.33
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**29.5**	**50.2**	**8,451.0**	**39.5**	**$1,369.06**	**31,103**	**8,902,583.8**	**41,635.4**	**$1,442,218.58**
		red oak sawtimber	6									
			8									
			10									
			12									
			14	0.3	0.3	29.6	0.2	$5.69	283	31,218.6	254.1	$5,993.97
			16	0.4	0.6	59.3	0.5	$11.38	433	62,437.2	508.1	$11,987.94
			18	0.2	0.4	39.5	0.3	$7.59	228	41,624.8	338.8	$7,991.96
			20	0.1	0.2	19.8	0.2	$3.79	92	20,812.4	169.4	$3,995.98
			22	0.3	0.7	69.1	0.6	$13.28	267	72,843.4	592.8	$13,985.93
			24	0.1	0.2	19.8	0.2	$3.79	64	20,812.4	169.4	$3,995.98
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**1.3**	**2.3**	**237.1**	**1.9**	**$45.52**	**1,368**	**249,748.7**	**2,032.5**	**$47,951.75**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	4.1	4.4	435.7	2.8	$56.21	4,338	458,984.8	2,988.9	$59,209.03
			16	2.6	3.6	359.9	2.3	$46.43	2,744	379,161.3	2,469.1	$48,911.81
			18	2.1	3.6	359.9	2.3	$46.43	2,168	379,161.3	2,469.1	$48,911.81
			20	1.4	3.2	312.6	2.0	$40.32	1,525	329,271.7	2,144.2	$42,476.05
			22	0.5	1.4	142.1	0.9	$18.33	573	149,668.9	974.6	$19,307.29
			24	0.5	1.6	161.0	1.0	$20.77	545	169,624.8	1,104.6	$21,881.60
			26	0.2	0.7	66.3	0.4	$8.55	191	69,845.5	454.8	$9,010.07
			28	0.1	0.4	37.9	0.2	$4.89	94	39,911.7	259.9	$5,148.61
			30	0.0	0.2	18.9	0.1	$2.44	41	19,955.9	130.0	$2,574.31
			32	0.0	0.1	9.5	0.1	$1.22	18	9,977.9	65.0	$1,287.15
			34	0.0	0.1	9.5	0.1	$1.22	16	9,977.9	65.0	$1,287.15
			≥36									
		soft maple sawtimber Total		**11.6**	**19.3**	**1,913.3**	**12.5**	**$246.82**	**12,253**	**2,015,541.8**	**13,125.0**	**$260,004.89**

NALFF Forest Compartment Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Cmp.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14	0.5	0.6	59.3	0.5	$11.38	566	62,437.2	508.1	$11,987.94
			16	0.2	0.3	29.6	0.2	$5.69	217	31,218.6	254.1	$5,993.97
			18	0.1	0.1	9.9	0.1	$1.90	57	10,406.2	84.7	$1,997.99
			20	0.0	0.1	9.9	0.1	$1.90	46	10,406.2	84.7	$1,997.99
			22	0.0	0.1	9.9	0.1	$1.90	38	10,406.2	84.7	$1,997.99
			24									
			26	0.0	0.1	9.9	0.1	$1.90	27	10,406.2	84.7	$1,997.99
			28	0.0	0.1	9.9	0.1	$1.90	24	10,406.2	84.7	$1,997.99
			30									
			32									
			34									
			≥36									
		swamp chestnut oak sawtimber Total		**0.9**	**1.3**	**138.3**	**1.1**	**$26.55**	**975**	**145,686.7**	**1,185.6**	**$27,971.86**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	5.6	6.0	492.7	4.0	$63.55	5,941	518,981.8	4,223.6	$66,948.66
			16	2.9	4.0	328.4	2.7	$42.37	3,032	345,987.9	2,815.7	$44,632.44
			18	1.1	2.0	164.2	1.3	$21.18	1,198	172,993.9	1,407.9	$22,316.22
			20	0.8	1.7	140.8	1.1	$18.16	832	148,280.5	1,206.7	$19,128.19
			22	0.1	0.3	23.5	0.2	$3.03	115	24,713.4	201.1	$3,188.03
			24	0.0	0.1	7.8	0.1	$1.01	32	8,237.8	67.0	$1,062.68
			26	0.1	0.2	15.6	0.1	$2.02	55	16,475.6	134.1	$2,125.35
			28									
			30									
			32									
			34									
			≥36	0.0	0.1	7.8	0.1	$1.01	13	8,237.8	67.0	$1,062.68
		sweetgum sawtimber Total		**10.6**	**14.4**	**1,180.8**	**9.6**	**$152.32**	**11,217**	**1,243,908.8**	**10,123.1**	**$160,464.24**
		unknown hardwood sawtimber	6									
			8									
			10									
			12									
			14	0.1	0.1	9.5	0.1	$1.22	94	9,977.9	65.0	$1,287.15
			16									
			18	0.0	0.0	4.7	0.0	$0.61	29	4,989.0	32.5	$643.58
			20									
			22	0.0	0.0	4.7	0.0	$0.61	19	4,989.0	32.5	$643.58
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		unknown hardwood sawtimber Total		**0.1**	**0.2**	**18.9**	**0.1**	**$2.44**	**142**	**19,955.9**	**130.0**	**$2,574.31**

NALFF Forest Compartment Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Cmp.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		water oak sawtimber	6									
			8									
			10									
			12									
			14	0.4	0.4	39.5	0.3	$7.59	377	41,624.8	338.8	$7,991.96
			16	0.1	0.1	9.9	0.1	$1.90	72	10,406.2	84.7	$1,997.99
			18	0.1	0.2	19.8	0.2	$3.79	114	20,812.4	169.4	$3,995.98
			20	0.0	0.1	9.9	0.1	$1.90	46	10,406.2	84.7	$1,997.99
			22									
			24									
			26	0.0	0.1	9.9	0.1	$1.90	27	10,406.2	84.7	$1,997.99
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**0.6**	**0.9**	**88.9**	**0.7**	**$17.07**	**637**	**93,655.8**	**762.2**	**$17,981.91**
		water tupelo sawtimber	6									
			8									
			10									
			12									
			14	0.9	1.0	94.7	0.6	$12.22	943	99,779.3	649.8	$12,871.53
			16	0.4	0.6	56.8	0.4	$7.33	433	59,867.6	389.9	$7,722.92
			18	0.2	0.4	37.9	0.2	$4.89	228	39,911.7	259.9	$5,148.61
			20									
			22	0.0	0.1	9.5	0.1	$1.22	38	9,977.9	65.0	$1,287.15
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water tupelo sawtimber Total		**1.6**	**2.0**	**198.9**	**1.3**	**$25.66**	**1,643**	**209,536.5**	**1,364.5**	**$27,030.21**

Appendix M-3: NALFF Forest Type Stock Tables: These tables summarize at the forest type level, for each stock class (hardwood pulpwood, softwood pulpwood, chip-n-saw, and sawtimber by species) and 2" dbh class, the mean number of trees per acre, mean basal area per acre (ft^2/ac), mean volume per acre (cords for pulp, board-feet Doyle log rule for hardwood sawlog volume, or board-feet Int'l ¼-inch log rule for softwood sawlog and chip-n-saw volume), and mean weight per acre (short tons, green volume basis, wood & bark in merchandised portion of tree); as well as the total number of trees and total weight using the above units, and total value. The total area of the type contained in the installation is also provided. Null (blank) entries in the table indicate no trees were sampled of that particular combination of dbh and stock class.

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
H	**621.29**	Hardwood pulpwood	6	31.7	6.2	1.4	2.9	$20.69	19,669	881.3	1,808.1	$12,855.65
			8	55.7	19.5	4.5	9.3	$66.26	34,635	2,791.7	5,789.7	$41,165.02
			10	34.2	18.6	4.3	8.8	$62.83	21,243	2,661.4	5,490.1	$39,034.59
			12	30.3	23.8	5.5	11.5	$81.54	18,814	3,426.5	7,125.4	$50,661.72
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**151.9**	**68.1**	**15.7**	**32.5**	**$231.32**	**94,361**	**9,761.0**	**20,213.4**	**$143,716.98**
		Chip-n-saw	6									
			8									
			10									
			12	0.3	0.3	26.3	0.2	$3.08	214	16,337.3	94.8	$1,911.47
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**0.3**	**0.3**	**26.3**	**0.2**	**$3.08**	**214**	**16,337.3**	**94.8**	**$1,911.47**
		baldcypress sawtimber	6									
			8									
			10									
			12									
			14	0.5	0.5	44.2	0.4	$5.70	314	27,443.5	223.3	$3,540.21
			16	1.2	1.6	132.5	1.1	$17.09	722	82,330.5	670.0	$10,620.64
			18	0.2	0.3	22.1	0.2	$2.85	95	13,721.8	111.7	$1,770.11
			20	0.2	0.5	44.2	0.4	$5.70	154	27,443.5	223.3	$3,540.21
			22	0.2	0.5	44.2	0.4	$5.70	127	27,443.5	223.3	$3,540.21
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		baldcypress sawtimber Total		**2.3**	**3.5**	**287.1**	**2.3**	**$37.04**	**1,412**	**178,382.8**	**1,451.7**	**$23,011.38**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		Carolina ash sawtimber	6									
			8									
			10									
			12									
			14	1.0	1.1	107.0	0.7	$13.80	628	66,481.1	432.9	$8,576.06
			16	0.2	0.3	26.8	0.2	$3.45	120	16,620.3	108.2	$2,144.02
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Carolina ash sawtimber Total		**1.2**	**1.4**	**133.8**	**0.9**	**$17.25**	**749**	**83,101.4**	**541.1**	**$10,720.08**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	0.8	0.8	136.4	0.6	$22.10	471	84,737.6	396.3	$13,727.48
			16	0.6	0.8	136.4	0.6	$22.10	361	84,737.6	396.3	$13,727.48
			18	0.9	1.6	272.8	1.3	$44.19	570	169,475.1	792.6	$27,454.97
			20	1.0	2.2	363.7	1.7	$58.92	616	225,966.8	1,056.8	$36,606.63
			22	0.4	1.1	181.9	0.9	$29.46	254	112,983.4	528.4	$18,303.31
			24	0.1	0.3	45.5	0.2	$7.37	53	28,245.9	132.1	$4,575.83
			26	0.1	0.3	45.5	0.2	$7.37	46	28,245.9	132.1	$4,575.83
			28	0.1	0.3	45.5	0.2	$7.37	39	28,245.9	132.1	$4,575.83
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**3.9**	**7.3**	**1,227.5**	**5.7**	**$198.86**	**2,411**	**762,638.0**	**3,566.7**	**$123,547.36**
		red oak sawtimber	6									
			8									
			10									
			12									
			14	0.5	0.5	55.8	0.5	$10.71	314	34,667.3	282.1	$6,656.12
			16	0.4	0.5	55.8	0.5	$10.71	241	34,667.3	282.1	$6,656.12
			18	0.3	0.5	55.8	0.5	$10.71	190	34,667.3	282.1	$6,656.12
			20									
			22	0.2	0.5	55.8	0.5	$10.71	127	34,667.3	282.1	$6,656.12
			24	0.1	0.3	27.9	0.2	$5.36	53	17,333.6	141.1	$3,328.06
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**1.5**	**2.4**	**251.1**	**2.0**	**$48.21**	**925**	**156,002.8**	**1,269.6**	**$29,952.54**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	6.1	6.5	642.0	4.2	$82.82	3,770	398,886.7	2,597.5	$51,456.39
			16	3.9	5.4	535.0	3.5	$69.02	2,405	332,405.6	2,164.6	$42,880.32
			18	2.8	4.9	481.5	3.1	$62.12	1,710	299,165.1	1,948.1	$38,592.29
			20	1.7	3.8	374.5	2.4	$48.31	1,078	232,683.9	1,515.2	$30,016.23
			22	0.8	2.2	214.0	1.4	$27.61	509	132,962.2	865.8	$17,152.13
			24	0.9	2.7	267.5	1.7	$34.51	534	166,202.8	1,082.3	$21,440.16
			26	0.4	1.4	133.8	0.9	$17.25	228	83,101.4	541.1	$10,720.08
			28	0.1	0.3	26.8	0.2	$3.45	39	16,620.3	108.2	$2,144.02
			30	0.1	0.5	53.5	0.3	$6.90	68	33,240.6	216.5	$4,288.03
			32	0.0	0.3	26.8	0.2	$3.45	30	16,620.3	108.2	$2,144.02
			34	0.0	0.3	26.8	0.2	$3.45	27	16,620.3	108.2	$2,144.02
			≥36									
		soft maple sawtimber Total		**16.7**	**28.1**	**2,782.1**	**18.1**	**$358.90**	**10,398**	**1,728,509.2**	**11,255.9**	**$222,977.69**
		swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14	1.3	1.4	139.5	1.1	$26.78	785	86,668.2	705.3	$16,640.30
			16	0.6	0.8	83.7	0.7	$16.07	361	52,000.9	423.2	$9,984.18
			18	0.2	0.3	27.9	0.2	$5.36	95	17,333.6	141.1	$3,328.06
			20	0.1	0.3	27.9	0.2	$5.36	77	17,333.6	141.1	$3,328.06
			22	0.1	0.3	27.9	0.2	$5.36	64	17,333.6	141.1	$3,328.06
			24									
			26	0.1	0.3	27.9	0.2	$5.36	46	17,333.6	141.1	$3,328.06
			28	0.1	0.3	27.9	0.2	$5.36	39	17,333.6	141.1	$3,328.06
			30									
			32									
			34									
			≥36									
		swamp chestnut oak sawtimber Total		**2.4**	**3.5**	**362.7**	**3.0**	**$69.64**	**1,467**	**225,337.4**	**1,833.8**	**$43,264.78**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	4.6	4.9	397.5	3.2	$51.28	2,827	246,991.5	2,010.1	$31,861.91
			16	2.3	3.2	265.0	2.2	$34.19	1,443	164,661.0	1,340.0	$21,241.27
			18	1.1	1.9	154.6	1.3	$19.94	665	96,052.3	781.7	$12,390.74
			20	1.0	2.2	176.7	1.4	$22.79	616	109,774.0	893.4	$14,160.85
			22	0.1	0.3	22.1	0.2	$2.85	64	13,721.8	111.7	$1,770.11
			24	0.1	0.3	22.1	0.2	$2.85	53	13,721.8	111.7	$1,770.11
			26	0.1	0.3	22.1	0.2	$2.85	46	13,721.8	111.7	$1,770.11
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**9.2**	**13.0**	**1,060.1**	**8.6**	**$136.76**	**5,714**	**658,644.0**	**5,360.1**	**$84,965.08**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		water oak sawtimber	6									
			8									
			10									
			12									
			14	1.0	1.1	111.6	0.9	$21.43	628	69,334.6	564.3	$13,312.24
			16	0.2	0.3	27.9	0.2	$5.36	120	17,333.6	141.1	$3,328.06
			18									
			20									
			22									
			24									
			26	0.1	0.3	27.9	0.2	$5.36	46	17,333.6	141.1	$3,328.06
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**1.3**	**1.6**	**167.4**	**1.4**	**$32.14**	**794**	**104,001.9**	**846.4**	**$19,968.36**
		water tupelo sawtimber	6									
			8									
			10									
			12									
			14	2.5	2.7	267.5	1.7	$34.51	1,571	166,202.8	1,082.3	$21,440.16
			16	1.2	1.6	160.5	1.0	$20.71	722	99,721.7	649.4	$12,864.10
			18	0.6	1.1	107.0	0.7	$13.80	380	66,481.1	432.9	$8,576.06
			20									
			22	0.1	0.3	26.8	0.2	$3.45	64	16,620.3	108.2	$2,144.02
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water tupelo sawtimber Total		**4.4**	**5.7**	**561.8**	**3.7**	**$72.47**	**2,736**	**349,025.9**	**2,272.8**	**$45,024.34**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
HP	**174.86**	Hardwood pulpwood	6	10.6	2.1	0.5	1.1	$7.56	1,848	86.9	186.0	$1,322.36
			8	28.1	9.8	2.3	4.9	$35.03	4,915	406.6	861.4	$6,124.73
			10	30.8	16.8	3.9	8.2	$58.29	5,384	686.0	1,433.6	$10,193.09
			12	19.5	15.3	3.6	7.5	$53.44	3,403	626.3	1,314.3	$9,344.37
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**88.9**	**44.0**	**10.3**	**21.7**	**$154.32**	**15,550**	**1,805.9**	**3,795.3**	**$26,984.55**
		Softwood pulpwood	6	1.9	0.4	0.1	0.2	$2.33	336	15.1	31.0	$406.74
			8	4.9	1.7	0.4	0.8	$10.47	851	67.8	139.3	$1,830.31
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**6.8**	**2.1**	**0.5**	**1.0**	**$12.79**	**1,187**	**82.9**	**170.2**	**$2,237.05**
		Chip-n-saw	6									
			8									
			10	3.5	1.9	183.6	1.1	$21.48	605	32,100.6	186.2	$3,755.77
			12	4.8	3.8	367.2	2.1	$42.96	840	64,201.2	372.4	$7,511.54
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**8.3**	**5.7**	**550.7**	**3.2**	**$64.43**	**1,445**	**96,301.7**	**558.5**	**$11,267.30**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		blackgum sawtimber	6									
			8									
			10									
			12									
			14	0.4	0.4	37.4	0.2	$4.82	62	6,531.3	42.5	$842.54
			16	0.3	0.4	37.4	0.2	$4.82	47	6,531.3	42.5	$842.54
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		blackgum sawtimber Total		**0.6**	**0.8**	**74.7**	**0.5**	**$9.64**	**109**	**13,062.6**	**85.1**	**$1,685.08**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.6	1,110.8	5.2	$179.96	1,080	194,247.0	908.5	$31,468.01
			16	4.7	6.6	1,110.8	5.2	$179.96	827	194,247.0	908.5	$31,468.01
			18	6.6	11.7	1,967.8	9.2	$318.78	1,158	344,094.6	1,609.3	$55,743.33
			20	2.9	6.4	1,079.1	5.0	$174.82	514	188,697.1	882.5	$30,568.92
			22	2.0	5.3	888.7	4.2	$143.97	350	155,397.6	726.8	$25,174.41
			24	1.3	4.0	666.5	3.1	$107.97	221	116,548.2	545.1	$18,880.81
			26	0.3	1.1	190.4	0.9	$30.85	54	33,299.5	155.7	$5,394.52
			28	0.2	0.8	127.0	0.6	$20.57	31	22,199.7	103.8	$3,596.34
			30	0.1	0.4	63.5	0.3	$10.28	13	11,099.8	51.9	$1,798.17
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**24.3**	**42.8**	**7,204.7**	**33.7**	**$1,167.15**	**4,247**	**1,259,830.4**	**5,892.0**	**$204,092.52**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	0.5	0.8	77.9	0.6	$14.96	95	13,623.3	110.9	$2,615.67
			18									
			20	0.2	0.4	39.0	0.3	$7.48	30	6,811.6	55.4	$1,307.83
			22	0.3	0.8	77.9	0.6	$14.96	50	13,623.3	110.9	$2,615.67
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**1.0**	**1.9**	**194.8**	**1.6**	**$37.40**	**175**	**34,058.2**	**277.2**	**$6,539.17**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	4.2	4.5	448.2	2.9	$57.82	741	78,375.6	510.4	$10,110.46
			16	1.6	2.3	224.1	1.5	$28.91	284	39,187.8	255.2	$5,055.23
			18	1.3	2.3	224.1	1.5	$28.91	224	39,187.8	255.2	$5,055.23
			20	0.5	1.1	112.1	0.7	$14.45	91	19,593.9	127.6	$2,527.61
			22	0.3	0.8	74.7	0.5	$9.64	50	13,062.6	85.1	$1,685.08
			24	0.4	1.1	112.1	0.7	$14.45	63	19,593.9	127.6	$2,527.61
			26	0.2	0.8	74.7	0.5	$9.64	36	13,062.6	85.1	$1,685.08
			28	0.1	0.4	37.4	0.2	$4.82	15	6,531.3	42.5	$842.54
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**8.6**	**13.2**	**1,307.3**	**8.5**	**$168.64**	**1,503**	**228,595.6**	**1,488.6**	**$29,488.84**
		swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14	0.4	0.4	39.0	0.3	$7.48	62	6,811.6	55.4	$1,307.83
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		swamp chestnut oak sawtimber Total		**0.4**	**0.4**	**39.0**	**0.3**	**$7.48**	**62**	**6,811.6**	**55.4**	**$1,307.83**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	7.8	8.3	678.4	5.5	$87.52	1,358	118,629.8	965.4	$15,303.24
			16	4.3	6.0	493.4	4.0	$63.65	756	86,276.2	702.1	$11,129.63
			18	1.5	2.6	215.9	1.8	$27.85	261	37,745.8	307.2	$4,869.21
			20	0.5	1.1	92.5	0.8	$11.93	91	16,176.8	131.6	$2,086.81
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**14.1**	**18.1**	**1,480.2**	**12.0**	**$190.94**	**2,466**	**258,828.6**	**2,106.4**	**$33,388.89**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		unknown hardwood sawtimber	6									
			8									
			10									
			12									
			14	0.4	0.4	37.4	0.2	$4.82	62	6,531.3	42.5	$842.54
			16									
			18	0.1	0.2	18.7	0.1	$2.41	19	3,265.7	21.3	$421.27
			20									
			22	0.1	0.2	18.7	0.1	$2.41	12	3,265.7	21.3	$421.27
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		unknown hardwood sawtimber Total		**0.5**	**0.8**	**74.7**	**0.5**	**$9.64**	**93**	**13,062.6**	**85.1**	**$1,685.08**
		water oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	0.2	0.4	39.0	0.3	$7.48	37	6,811.6	55.4	$1,307.83
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**0.2**	**0.4**	**39.0**	**0.3**	**$7.48**	**37**	**6,811.6**	**55.4**	**$1,307.83**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
PH	**191.02**	Hardwood pulpwood	6	10.8	2.1	0.5	1.0	$6.80	2,064	91.0	182.7	$1,298.77
			8	24.3	8.5	2.0	4.1	$28.91	4,643	374.9	776.8	$5,523.10
			10	16.7	9.1	2.1	4.3	$30.44	3,184	397.9	817.9	$5,815.46
			12	13.1	10.3	2.4	4.9	$34.61	2,506	452.1	929.9	$6,611.25
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**64.9**	**30.0**	**6.9**	**14.2**	**$100.77**	**12,397**	**1,315.9**	**2,707.3**	**$19,248.59**
		Softwood pulpwood	6	1.5	0.3	0.1	0.1	$1.87	295	13.2	27.2	$356.80
			8	2.6	0.9	0.2	0.4	$5.60	497	39.7	81.5	$1,070.41
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**4.1**	**1.2**	**0.3**	**0.6**	**$7.47**	**792**	**52.9**	**108.6**	**$1,427.21**
		Chip-n-saw	6									
			8									
			10	6.4	3.5	339.1	2.0	$39.67	1,220	64,767.1	375.6	$7,577.76
			12	9.6	7.6	737.1	4.3	$86.24	1,843	140,798.1	816.6	$16,473.38
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**16.0**	**11.1**	**1,076.1**	**6.2**	**$125.91**	**3,063**	**205,565.3**	**1,192.2**	**$24,051.14**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	11.5	12.3	2,064.4	9.7	$334.44	2,193	394,353.1	1,844.3	$63,885.20
			16	12.4	17.3	2,905.5	13.6	$470.69	2,363	555,015.5	2,595.7	$89,912.51
			18	11.1	19.7	3,313.3	15.5	$536.76	2,129	632,912.4	2,960.0	$102,531.80
			20	7.2	15.8	2,650.7	12.4	$429.41	1,380	506,329.9	2,368.0	$82,025.44
			22	4.8	12.7	2,140.9	10.0	$346.83	921	408,958.8	1,912.6	$66,251.32
			24	2.1	6.7	1,121.4	5.2	$181.67	405	214,216.5	1,001.8	$34,703.07
			26	0.2	0.6	101.9	0.5	$16.52	31	19,474.2	91.1	$3,154.82
			28	0.4	1.5	254.9	1.2	$41.29	68	48,685.6	227.7	$7,887.06
			30	0.1	0.6	101.9	0.5	$16.52	24	19,474.2	91.1	$3,154.82
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**49.8**	**87.1**	**14,655.0**	**68.5**	**$2,374.12**	**9,514**	**2,799,420.1**	**13,092.3**	**$453,506.06**
		red oak sawtimber	6									
			8									
			10									
			12									
			14	0.3	0.3	31.3	0.3	$6.01	54	5,975.4	48.6	$1,147.27
			16	0.4	0.6	62.6	0.5	$12.01	83	11,950.8	97.3	$2,294.55
			18	0.3	0.6	62.6	0.5	$12.01	66	11,950.8	97.3	$2,294.55
			20	0.1	0.3	31.3	0.3	$6.01	27	5,975.4	48.6	$1,147.27
			22	0.3	0.9	93.8	0.8	$18.02	66	17,926.1	145.9	$3,441.82
			24	0.1	0.3	31.3	0.3	$6.01	18	5,975.4	48.6	$1,147.27
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**1.6**	**3.0**	**312.8**	**2.5**	**$60.06**	**313**	**59,753.8**	**486.3**	**$11,472.73**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	2.8	3.0	299.9	2.0	$38.69	541	57,294.6	373.1	$7,391.01
			16	2.6	3.6	359.9	2.3	$46.43	497	68,753.6	447.7	$8,869.21
			18	2.4	4.2	419.9	2.7	$54.17	459	80,212.5	522.3	$10,347.41
			20	2.2	4.8	479.9	3.1	$61.91	425	91,671.4	597.0	$11,825.61
			22	0.6	1.5	150.0	1.0	$19.35	110	28,647.3	186.5	$3,695.50
			24	0.4	1.2	120.0	0.8	$15.48	74	22,917.9	149.2	$2,956.40
			26									
			28	0.1	0.6	60.0	0.4	$7.74	27	11,458.9	74.6	$1,478.20
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**11.2**	**19.1**	**1,889.6**	**12.3**	**$243.76**	**2,132**	**360,956.2**	**2,350.5**	**$46,563.34**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	544.8	4.4	$70.28	1,191	104,065.7	846.9	$13,424.48
			16	3.0	4.2	346.7	2.8	$44.72	580	66,223.6	538.9	$8,542.85
			18	1.2	2.1	173.3	1.4	$22.36	229	33,111.8	269.5	$4,271.43
			20	0.8	1.8	148.6	1.2	$19.17	159	28,381.6	231.0	$3,661.22
			22	0.2	0.6	49.5	0.4	$6.39	44	9,460.5	77.0	$1,220.41
			24									
			26	0.1	0.3	24.8	0.2	$3.19	16	4,730.3	38.5	$610.20
			28									
			30									
			32									
			34									
			≥36	0.0	0.3	24.8	0.2	$3.19	7	4,730.3	38.5	$610.20
		sweetgum sawtimber Total		**11.7**	**16.1**	**1,312.4**	**10.7**	**$169.30**	**2,227**	**250,703.8**	**2,040.3**	**$32,340.79**
		water oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	0.2	0.3	31.3	0.3	$6.01	33	5,975.4	48.6	$1,147.27
			20	0.1	0.3	31.3	0.3	$6.01	27	5,975.4	48.6	$1,147.27
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**0.3**	**0.6**	**62.6**	**0.5**	**$12.01**	**59**	**11,950.8**	**97.3**	**$2,294.55**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
P	**66.27**	Hardwood pulpwood	6	6.4	1.3	0.3	0.6	$3.98	422	18.5	37.1	$263.71
			8	7.2	2.5	0.6	1.1	$8.15	475	37.5	75.9	$539.99
			10	2.3	1.3	0.3	0.6	$3.98	152	18.5	37.1	$263.71
			12	1.6	1.3	0.3	0.6	$3.98	105	18.5	37.1	$263.71
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**17.4**	**6.3**	**1.4**	**2.8**	**$20.09**	**1,154**	**93.1**	**187.2**	**$1,331.13**
		Softwood pulpwood	6									
			8	7.2	2.5	0.6	1.2	$15.41	475	37.8	77.7	$1,021.17
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**7.2**	**2.5**	**0.6**	**1.2**	**$15.41**	**475**	**37.8**	**77.7**	**$1,021.17**
		Chip-n-saw	6									
			8									
			10	9.2	5.0	486.5	2.8	$56.92	607	32,237.4	187.0	$3,771.78
			12	8.0	6.3	608.1	3.5	$71.15	527	40,296.8	233.7	$4,714.72
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**17.1**	**11.3**	**1,094.6**	**6.3**	**$128.06**	**1,135**	**72,534.2**	**420.7**	**$8,486.50**

NALFF Forest Type Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Forest type	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/ acre	Total trees	Total volume	Total weight (t)	Total $
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	30.4	32.5	5,467.0	25.6	$885.65	2,015	362,282.0	1,694.3	$58,689.69
			16	26.0	36.3	6,097.8	28.5	$987.84	1,720	404,083.8	1,889.8	$65,461.57
			18	14.1	25.0	4,205.4	19.7	$681.27	937	278,678.5	1,303.3	$45,145.91
			20	8.0	17.5	2,943.8	13.8	$476.89	532	195,074.9	912.3	$31,602.14
			22	1.9	5.0	841.1	3.9	$136.25	126	55,735.7	260.7	$9,029.18
			24	0.8	2.5	420.5	2.0	$68.13	53	27,867.8	130.3	$4,514.59
			26	0.3	1.3	210.3	1.0	$34.06	22	13,933.9	65.2	$2,257.30
			28									
			30	0.3	1.3	210.3	1.0	$34.06	17	13,933.9	65.2	$2,257.30
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**81.8**	**121.3**	**20,396.0**	**95.4**	**$3,304.15**	**5,422**	**1,351,590.6**	**6,321.1**	**$218,957.68**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	1.2	1.3	102.1	0.8	$13.18	77	6,769.1	55.1	$873.21
			16									
			18									
			20	0.6	1.3	102.1	0.8	$13.18	38	6,769.1	55.1	$873.21
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**1.7**	**2.5**	**204.3**	**1.7**	**$26.35**	**115**	**13,538.1**	**110.2**	**$1,746.42**

Appendix M-4: NALFF Forest Stand Stock Tables: These tables summarize at the forest stand level, for each stock class (hardwood pulpwood, softwood pulpwood, chip-n-saw, and sawtimber by species) and 2" dbh class, the mean number of trees per acre, basal area per acre (ft^2/ac), mean volume per acre (cords for pulp, board-feet Doyle log rule for hardwood sawlog volume, or board-feet Int'l ¼-inch log rule for softwood sawlog and chip-n-saw volume), and mean weight per acre (short tons, green volume basis, wood & bark in merchandised portion of tree); as well as the total number of trees and total weight using the above units, and total value. The total area of the stand is also provided. Null (blank) entries in the table indicate no trees were sampled of that particular combination of dbh and stock class.

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
1	**70.63**	Hardwood pulpwood	6	23.5	4.6	1.0	2.1	$15.16	1,660	74.0	150.6	$1,070.84
			8	35.3	12.3	2.8	5.7	$40.35	2,490	197.1	400.9	$2,850.09
			10	36.7	20.0	4.6	9.6	$68.26	2,590	327.1	678.2	$4,821.85
			12	37.2	29.2	6.7	13.8	$98.35	2,629	474.5	977.1	$6,947.06
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**132.7**	**66.2**	**15.2**	**31.2**	**$222.13**	**9,370**	**1,072.7**	**2,206.7**	**$15,689.84**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	1.4	1.5	258.8	1.2	$41.92	102	18,279.6	85.5	$2,961.30
			16	2.2	3.1	517.6	2.4	$83.85	156	36,559.2	171.0	$5,922.59
			18	4.4	7.7	1,294.0	6.1	$209.62	307	91,398.0	427.4	$14,806.48
			20	2.8	6.2	1,035.2	4.8	$167.70	199	73,118.4	342.0	$11,845.18
			22	1.7	4.6	776.4	3.6	$125.77	123	54,838.8	256.5	$8,883.89
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**12.6**	**23.1**	**3,881.9**	**18.2**	**$628.86**	**888**	**274,194.1**	**1,282.3**	**$44,419.44**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	0.9	1.5	158.8	1.3	$30.49	61	11,217.7	91.3	$2,153.79
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**0.9**	**1.5**	**158.8**	**1.3**	**$30.49**	**61**	**11,217.7**	**91.3**	**$2,153.79**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	1.4	1.5	152.3	1.0	$19.64	102	10,756.0	70.0	$1,387.52
			16	6.6	9.2	913.7	5.9	$117.86	467	64,535.9	420.3	$8,325.14
			18	3.5	6.2	609.1	4.0	$78.57	246	43,024.0	280.2	$5,550.09
			20	0.7	1.5	152.3	1.0	$19.64	50	10,756.0	70.0	$1,387.52
			22	1.2	3.1	304.6	2.0	$39.29	82	21,512.0	140.1	$2,775.05
			24	0.5	1.5	152.3	1.0	$19.64	35	10,756.0	70.0	$1,387.52
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**13.9**	**23.1**	**2,284.2**	**14.9**	**$294.66**	**981**	**161,339.9**	**1,050.6**	**$20,812.84**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	11.5	12.3	1,005.8	8.2	$129.74	813	71,041.4	578.1	$9,164.34
			16	8.8	12.3	1,005.8	8.2	$129.74	623	71,041.4	578.1	$9,164.34
			18	0.9	1.5	125.7	1.0	$16.22	61	8,880.2	72.3	$1,145.54
			20	1.4	3.1	251.4	2.0	$32.44	100	17,760.4	144.5	$2,291.09
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**22.6**	**29.2**	**2,388.7**	**19.4**	**$308.14**	**1,597**	**168,723.4**	**1,373.1**	**$21,765.31**
		water oak sawtimber	6									
			8									
			10									
			12									
			14	1.4	1.5	158.8	1.3	$30.49	102	11,217.7	91.3	$2,153.79
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**1.4**	**1.5**	**158.8**	**1.3**	**$30.49**	**102**	**11,217.7**	**91.3**	**$2,153.79**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
2	**48.26**	Hardwood pulpwood	6	23.5	4.6	1.2	2.5	$18.12	1,134	55.6	123.0	$874.41
			8	44.1	15.4	3.6	7.6	$54.27	2,127	174.6	368.4	$2,619.04
			10	39.5	21.5	5.0	10.3	$72.93	1,906	239.7	495.0	$3,519.46
			12	17.6	13.8	3.2	6.5	$45.95	851	152.3	311.9	$2,217.36
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**124.7**	**55.4**	**12.9**	**26.9**	**$191.27**	**6,018**	**622.2**	**1,298.2**	**$9,230.27**
		Chip-n-saw	6									
			8									
			10									
			12	2.0	1.5	149.7	0.9	$17.51	95	7,223.5	41.9	$845.15
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**2.0**	**1.5**	**149.7**	**0.9**	**$17.51**	**95**	**7,223.5**	**41.9**	**$845.15**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	5.8	6.2	1,035.2	4.8	$167.70	278	49,955.5	233.6	$8,092.79
			16	2.2	3.1	517.6	2.4	$83.85	106	24,977.7	116.8	$4,046.39
			18	13.1	23.1	3,881.9	18.2	$628.86	630	187,333.0	876.1	$30,347.95
			20	5.6	12.3	2,070.3	9.7	$335.39	272	99,910.9	467.3	$16,185.57
			22	2.3	6.2	1,035.2	4.8	$167.70	112	49,955.5	233.6	$8,092.79
			24	2.0	6.2	1,035.2	4.8	$167.70	95	49,955.5	233.6	$8,092.79
			26	0.4	1.5	258.8	1.2	$41.92	20	12,488.9	58.4	$2,023.20
			28	0.4	1.5	258.8	1.2	$41.92	17	12,488.9	58.4	$2,023.20
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**31.7**	**60.0**	**10,092.9**	**47.2**	**$1,635.04**	**1,531**	**487,065.9**	**2,277.9**	**$78,904.67**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	5.8	6.2	609.1	4.0	$78.57	278	29,394.5	191.4	$3,791.90
			16	1.1	1.5	152.3	1.0	$19.64	53	7,348.6	47.9	$947.97
			18									
			20	1.4	3.1	304.6	2.0	$39.29	68	14,697.3	95.7	$1,895.95
			22	1.2	3.1	304.6	2.0	$39.29	56	14,697.3	95.7	$1,895.95
			24	0.5	1.5	152.3	1.0	$19.64	24	7,348.6	47.9	$947.97
			26	0.8	3.1	304.6	2.0	$39.29	40	14,697.3	95.7	$1,895.95
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**10.8**	**18.5**	**1,827.3**	**11.9**	**$235.72**	**519**	**88,183.6**	**574.2**	**$11,375.69**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	10.1	10.8	880.0	7.2	$113.53	486	42,469.4	345.6	$5,478.55
			16	5.5	7.7	628.6	5.1	$81.09	266	30,335.3	246.9	$3,913.25
			18	0.9	1.5	125.7	1.0	$16.22	42	6,067.1	49.4	$782.65
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**16.5**	**20.0**	**1,634.4**	**13.3**	**$210.83**	**794**	**78,871.7**	**641.9**	**$10,174.45**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
3	**15.90**	Hardwood pulpwood	6									
			8	9.5	3.3	0.8	1.6	$11.12	152	12.1	24.9	$176.82
			10	12.2	6.7	1.5	3.1	$21.73	194	24.0	48.6	$345.59
			12	25.5	20.0	4.7	10.0	$71.09	405	75.3	159.0	$1,130.70
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**47.2**	**30.0**	**7.0**	**14.6**	**$103.94**	**751**	**111.4**	**232.5**	**$1,653.11**
		Chip-n-saw	6									
			8									
			10	6.1	3.3	324.3	1.9	$37.94	97	5,158.0	29.9	$603.48
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**6.1**	**3.3**	**324.3**	**1.9**	**$37.94**	**97**	**5,158.0**	**29.9**	**$603.48**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	3,364.3	15.7	$545.01	298	53,506.1	250.2	$8,667.99
			16	9.5	13.3	2,242.9	10.5	$363.34	152	35,670.7	166.8	$5,778.66
			18	13.2	23.3	3,925.0	18.4	$635.85	210	62,423.8	291.9	$10,112.66
			20	6.1	13.3	2,242.9	10.5	$363.34	97	35,670.7	166.8	$5,778.66
			22	1.3	3.3	560.7	2.6	$90.84	20	8,917.7	41.7	$1,444.67
			24	1.1	3.3	560.7	2.6	$90.84	17	8,917.7	41.7	$1,444.67
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**49.9**	**76.7**	**12,896.4**	**60.3**	**$2,089.22**	**794**	**205,106.8**	**959.2**	**$33,227.30**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	1.5	3.3	344.1	2.8	$66.07	24	5,472.5	44.5	$1,050.72
			22									
			24	1.1	3.3	344.1	2.8	$66.07	17	5,472.5	44.5	$1,050.72
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**2.6**	**6.7**	**688.2**	**5.6**	**$132.13**	**41**	**10,945.0**	**89.1**	**$2,101.45**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	659.9	4.3	$85.12	99	10,494.6	68.3	$1,353.80
			16									
			18	3.8	6.7	659.9	4.3	$85.12	60	10,494.6	68.3	$1,353.80
			20	3.1	6.7	659.9	4.3	$85.12	49	10,494.6	68.3	$1,353.80
			22	1.3	3.3	329.9	2.1	$42.56	20	5,247.3	34.2	$676.90
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**14.3**	**23.3**	**2,309.5**	**15.0**	**$297.93**	**228**	**36,731.1**	**239.2**	**$4,738.31**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	1,634.4	13.3	$210.83	298	25,993.1	211.5	$3,353.11
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**18.7**	**20.0**	**1,634.4**	**13.3**	**$210.83**	**298**	**25,993.1**	**211.5**	**$3,353.11**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
4	**118.92**	Hardwood pulpwood	6	4.6	0.9	0.2	0.4	$3.03	551	24.7	50.7	$360.57
			8	18.2	6.4	1.6	3.7	$26.47	2,168	194.8	442.7	$3,147.75
			10	18.3	10.0	2.3	4.9	$35.10	2,180	278.9	587.1	$4,174.18
			12	22.0	17.3	4.2	9.2	$65.52	2,615	502.8	1,095.9	$7,792.04
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**63.2**	**34.5**	**8.4**	**18.3**	**$130.13**	**7,514**	**1,001.3**	**2,176.4**	**$15,474.54**
		Chip-n-saw	6									
			8									
			10									
			12	1.2	0.9	88.4	0.5	$10.35	138	10,518.2	61.0	$1,230.63
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**1.2**	**0.9**	**88.4**	**0.5**	**$10.35**	**138**	**10,518.2**	**61.0**	**$1,230.63**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	0.9	0.9	152.9	0.7	$24.77	101	18,185.1	85.0	$2,945.99
			16									
			18	0.5	0.9	152.9	0.7	$24.77	61	18,185.1	85.0	$2,945.99
			20	1.3	2.7	458.8	2.1	$74.32	149	54,555.4	255.1	$8,837.98
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**2.6**	**4.5**	**764.6**	**3.6**	**$123.87**	**311**	**90,925.7**	**425.2**	**$14,729.96**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		red oak sawtimber	6									
			8									
			10									
			12									
			14	1.7	1.8	187.7	1.5	$36.04	202	22,319.4	181.6	$4,285.32
			16	1.3	1.8	187.7	1.5	$36.04	155	22,319.4	181.6	$4,285.32
			18									
			20									
			22	0.7	1.8	187.7	1.5	$36.04	82	22,319.4	181.6	$4,285.32
			24	0.3	0.9	93.8	0.8	$18.02	34	11,159.7	90.8	$2,142.66
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**4.0**	**6.4**	**656.9**	**5.3**	**$126.13**	**473**	**78,117.8**	**635.7**	**$14,998.62**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	7.7	8.2	809.8	5.3	$104.47	910	96,303.7	627.1	$12,423.17
			16	6.5	9.1	899.8	5.9	$116.08	774	107,004.1	696.8	$13,803.53
			18	6.2	10.9	1,079.8	7.0	$139.29	734	128,404.9	836.2	$16,564.23
			20	5.0	10.9	1,079.8	7.0	$139.29	595	128,404.9	836.2	$16,564.23
			22	2.1	5.5	539.9	3.5	$69.65	246	64,202.4	418.1	$8,282.12
			24	2.6	8.2	809.8	5.3	$104.47	310	96,303.7	627.1	$12,423.17
			26	1.2	4.5	449.9	2.9	$58.04	147	53,502.0	348.4	$6,901.76
			28	0.2	0.9	90.0	0.6	$11.61	25	10,700.4	69.7	$1,380.35
			30	0.4	1.8	180.0	1.2	$23.22	44	21,400.8	139.4	$2,760.71
			32	0.2	0.9	90.0	0.6	$11.61	19	10,700.4	69.7	$1,380.35
			34	0.1	0.9	90.0	0.6	$11.61	17	10,700.4	69.7	$1,380.35
			≥36									
		soft maple sawtimber Total		**32.1**	**61.8**	**6,118.8**	**39.8**	**$789.32**	**3,821**	**727,627.7**	**4,738.3**	**$93,863.98**
		swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14	3.4	3.6	375.4	3.1	$72.07	405	44,638.7	363.3	$8,570.64
			16	1.3	1.8	187.7	1.5	$36.04	155	22,319.4	181.6	$4,285.32
			18	0.5	0.9	93.8	0.8	$18.02	61	11,159.7	90.8	$2,142.66
			20									
			22	0.3	0.9	93.8	0.8	$18.02	41	11,159.7	90.8	$2,142.66
			24									
			26	0.2	0.9	93.8	0.8	$18.02	29	11,159.7	90.8	$2,142.66
			28	0.2	0.9	93.8	0.8	$18.02	25	11,159.7	90.8	$2,142.66
			30									
			32									
			34									
			≥36									
		swamp chestnut oak sawtimber Total		**6.0**	**9.1**	**938.4**	**7.6**	**$180.18**	**716**	**111,596.8**	**908.2**	**$21,426.59**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	6.0	6.4	520.0	4.2	$67.08	708	61,840.0	503.3	$7,977.36
			16	2.0	2.7	222.9	1.8	$28.75	232	26,502.9	215.7	$3,418.87
			18	1.5	2.7	222.9	1.8	$28.75	184	26,502.9	215.7	$3,418.87
			20	1.7	3.6	297.2	2.4	$38.33	198	35,337.1	287.6	$4,558.49
			22	0.3	0.9	74.3	0.6	$9.58	41	8,834.3	71.9	$1,139.62
			24	0.3	0.9	74.3	0.6	$9.58	34	8,834.3	71.9	$1,139.62
			26	0.2	0.9	74.3	0.6	$9.58	29	8,834.3	71.9	$1,139.62
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**12.0**	**18.2**	**1,485.8**	**12.1**	**$191.67**	**1,427**	**176,685.7**	**1,437.9**	**$22,792.46**
		water oak sawtimber	6									
			8									
			10									
			12									
			14	2.6	2.7	281.5	2.3	$54.05	303	33,479.1	272.5	$6,427.98
			16	0.7	0.9	93.8	0.8	$18.02	77	11,159.7	90.8	$2,142.66
			18									
			20									
			22									
			24									
			26	0.2	0.9	93.8	0.8	$18.02	29	11,159.7	90.8	$2,142.66
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**3.4**	**4.5**	**469.2**	**3.8**	**$90.09**	**410**	**55,798.4**	**454.1**	**$10,713.30**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
7	29.85	Hardwood pulpwood	6	10.2	2.0	0.4	0.9	$6.37	304	13.4	26.7	$190.05
			8	40.1	14.0	3.3	7.0	$49.63	1,197	98.7	208.4	$1,481.38
			10	25.7	14.0	3.3	7.0	$49.63	766	98.7	208.4	$1,481.38
			12	7.6	6.0	1.5	3.3	$23.56	228	44.7	98.9	$703.07
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**83.6**	**36.0**	**8.6**	**18.2**	**$129.18**	**2,495**	**255.4**	**542.3**	**$3,855.88**
		Chip-n-saw	6									
			8									
			10									
			12	7.6	6.0	583.8	3.4	$68.30	228	17,424.3	101.1	$2,038.65
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**7.6**	**6.0**	**583.8**	**3.4**	**$68.30**	**228**	**17,424.3**	**101.1**	**$2,038.65**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	11.2	12.0	2,018.6	9.4	$327.01	335	60,250.4	281.8	$9,760.56
			16	5.7	8.0	1,345.7	6.3	$218.01	171	40,166.9	187.9	$6,507.04
			18	13.6	24.0	4,037.1	18.9	$654.02	405	120,500.8	563.6	$19,521.12
			20	6.4	14.0	2,355.0	11.0	$381.51	192	70,292.1	328.7	$11,387.32
			22	6.1	16.0	2,691.4	12.6	$436.01	181	80,333.8	375.7	$13,014.08
			24	0.6	2.0	336.4	1.6	$54.50	19	10,041.7	47.0	$1,626.76
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**43.7**	**76.0**	**12,784.3**	**59.8**	**$2,071.06**	**1,303**	**381,585.8**	**1,784.6**	**$61,816.90**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		red oak sawtimber	6									
			8									
			10									
			12									
			14	1.9	2.0	206.5	1.7	$39.64	56	6,162.3	50.2	$1,183.16
			16	1.4	2.0	206.5	1.7	$39.64	43	6,162.3	50.2	$1,183.16
			18	1.1	2.0	206.5	1.7	$39.64	34	6,162.3	50.2	$1,183.16
			20									
			22	1.5	4.0	412.9	3.4	$79.28	45	12,324.6	100.3	$2,366.33
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**6.0**	**10.0**	**1,032.3**	**8.4**	**$198.20**	**178**	**30,811.6**	**250.8**	**$5,915.82**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16	1.4	2.0	198.0	1.3	$25.54	43	5,908.7	38.5	$762.22
			18	1.1	2.0	198.0	1.3	$25.54	34	5,908.7	38.5	$762.22
			20	1.8	4.0	395.9	2.6	$51.07	55	11,817.4	77.0	$1,524.45
			22									
			24	0.6	2.0	198.0	1.3	$25.54	19	5,908.7	38.5	$762.22
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**5.0**	**10.0**	**989.8**	**6.4**	**$127.68**	**150**	**29,543.5**	**192.4**	**$3,811.11**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	7.5	8.0	653.7	5.3	$84.33	223	19,513.0	158.8	$2,517.17
			16	2.9	4.0	326.9	2.7	$42.17	86	9,756.5	79.4	$1,258.59
			18									
			20	0.9	2.0	163.4	1.3	$21.08	27	4,878.2	39.7	$629.29
			22									
			24									
			26	0.5	2.0	163.4	1.3	$21.08	16	4,878.2	39.7	$629.29
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**11.8**	**16.0**	**1,307.5**	**10.6**	**$168.67**	**352**	**39,025.9**	**317.6**	**$5,034.35**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		water oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	0.9	2.0	206.5	1.7	$39.64	27	6,162.3	50.2	$1,183.16
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**0.9**	**2.0**	**206.5**	**1.7**	**$39.64**	**27**	**6,162.3**	**50.2**	**$1,183.16**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
8	**18.76**	Hardwood pulpwood	6									
			8	16.4	5.7	1.7	4.2	$30.05	307	31.7	79.3	$563.77
			10	31.4	17.1	4.5	10.2	$72.80	590	83.9	192.1	$1,365.75
			12	21.8	17.1	4.5	10.2	$72.80	410	83.9	192.1	$1,365.75
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**69.6**	**40.0**	**10.6**	**24.7**	**$175.64**	**1,306**	**199.5**	**463.5**	**$3,295.27**
		Chip-n-saw	6									
			8									
			10									
			12	10.9	8.6	834.0	4.8	$97.57	205	15,646.2	90.7	$1,830.61
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**10.9**	**8.6**	**834.0**	**4.8**	**$97.57**	**205**	**15,646.2**	**90.7**	**$1,830.61**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	13.4	14.3	2,403.1	11.2	$389.30	251	45,085.0	210.9	$7,303.77
			16	12.3	17.1	2,883.7	13.5	$467.16	230	54,102.0	253.0	$8,764.53
			18	8.1	14.3	2,403.1	11.2	$389.30	152	45,085.0	210.9	$7,303.77
			20	3.9	8.6	1,441.8	6.7	$233.58	74	27,051.0	126.5	$4,382.26
			22	2.2	5.7	961.2	4.5	$155.72	41	18,034.0	84.3	$2,921.51
			24									
			26	0.8	2.9	480.6	2.2	$77.86	15	9,017.0	42.2	$1,460.75
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**40.6**	**62.9**	**10,573.5**	**49.4**	**$1,712.90**	**762**	**198,374.0**	**927.8**	**$32,136.59**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	4.1	5.7	589.9	4.8	$113.26	77	11,066.9	90.1	$2,124.85
			18									
			20	1.3	2.9	294.9	2.4	$56.63	25	5,533.5	45.0	$1,062.43
			22	1.1	2.9	294.9	2.4	$56.63	20	5,533.5	45.0	$1,062.43
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**6.5**	**11.4**	**1,179.8**	**9.6**	**$226.51**	**122**	**22,133.9**	**180.1**	**$4,249.70**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16	2.0	2.9	282.8	1.8	$36.48	38	5,305.7	34.6	$684.44
			18	1.6	2.9	282.8	1.8	$36.48	30	5,305.7	34.6	$684.44
			20									
			22									
			24	0.9	2.9	282.8	1.8	$36.48	17	5,305.7	34.6	$684.44
			26									
			28	0.7	2.9	282.8	1.8	$36.48	13	5,305.7	34.6	$684.44
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**5.2**	**11.4**	**1,131.2**	**7.4**	**$145.92**	**98**	**21,223.0**	**138.2**	**$2,737.76**
		swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14	2.7	2.9	294.9	2.4	$56.63	50	5,533.5	45.0	$1,062.43
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		swamp chestnut oak sawtimber Total		**2.7**	**2.9**	**294.9**	**2.4**	**$56.63**	**50**	**5,533.5**	**45.0**	**$1,062.43**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	5.3	5.7	467.0	3.8	$60.24	100	8,760.9	71.3	$1,130.15
			16	4.1	5.7	467.0	3.8	$60.24	77	8,760.9	71.3	$1,130.15
			18	1.6	2.9	233.5	1.9	$30.12	30	4,380.4	35.6	$565.08
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**11.1**	**14.3**	**1,167.4**	**9.5**	**$150.59**	**207**	**21,902.2**	**178.2**	**$2,825.38**
		water oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	1.6	2.9	294.9	2.4	$56.63	30	5,533.5	45.0	$1,062.43
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**1.6**	**2.9**	**294.9**	**2.4**	**$56.63**	**30**	**5,533.5**	**45.0**	**$1,062.43**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
9	**21.95**	Hardwood pulpwood	6	22.6	4.4	1.0	2.0	$14.49	497	22.1	44.7	$317.99
			8	12.7	4.4	1.2	2.7	$19.10	279	25.6	59.0	$419.20
			10	12.2	6.7	1.5	3.1	$22.24	268	33.4	68.6	$488.08
			12	8.5	6.7	1.5	3.0	$21.22	186	32.8	65.5	$465.89
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**56.1**	**22.2**	**5.2**	**10.8**	**$77.04**	**1,231**	**113.8**	**237.9**	**$1,691.16**
		Chip-n-saw	6									
			8									
			10	16.3	8.9	864.8	5.0	$101.19	358	18,983.9	110.1	$2,221.12
			12	22.6	17.8	1,729.7	10.0	$202.37	497	37,967.8	220.2	$4,442.23
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**38.9**	**26.7**	**2,594.5**	**15.0**	**$303.56**	**855**	**56,951.7**	**330.3**	**$6,663.35**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	24.9	26.7	4,485.7	21.0	$726.69	548	98,464.6	460.5	$15,951.26
			16	31.8	44.4	7,476.2	35.0	$1,211.14	699	164,107.6	767.5	$26,585.43
			18	8.8	15.6	2,616.7	12.2	$423.90	193	57,437.7	268.6	$9,304.90
			20	4.1	8.9	1,495.2	7.0	$242.23	89	32,821.5	153.5	$5,317.09
			22	1.7	4.4	747.6	3.5	$121.11	37	16,410.8	76.7	$2,658.54
			24	0.7	2.2	373.8	1.7	$60.56	16	8,205.4	38.4	$1,329.27
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**72.0**	**102.2**	**17,195.3**	**80.4**	**$2,785.63**	**1,581**	**377,447.5**	**1,765.2**	**$61,146.50**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	2.1	2.2	220.0	1.4	$28.37	46	4,828.2	31.4	$622.83
			16									
			18	3.8	6.7	659.9	4.3	$85.12	83	14,484.5	94.3	$1,868.50
			20	6.1	13.3	1,319.7	8.6	$170.25	134	28,969.0	188.6	$3,737.00
			22	0.8	2.2	220.0	1.4	$28.37	18	4,828.2	31.4	$622.83
			24	0.7	2.2	220.0	1.4	$28.37	16	4,828.2	31.4	$622.83
			26									
			28	0.5	2.2	220.0	1.4	$28.37	11	4,828.2	31.4	$622.83
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**14.0**	**28.9**	**2,859.4**	**18.6**	**$368.86**	**308**	**62,766.2**	**408.7**	**$8,096.84**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	4.2	4.4	363.2	3.0	$46.85	91	7,972.3	64.9	$1,028.43
			16	4.8	6.7	544.8	4.4	$70.28	105	11,958.4	97.3	$1,542.64
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**8.9**	**11.1**	**908.0**	**7.4**	**$117.13**	**196**	**19,930.7**	**162.2**	**$2,571.07**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
10	**17.57**	Hardwood pulpwood	6									
			8	24.6	8.6	1.9	4.0	$28.15	431	34.2	69.6	$494.74
			10	5.2	2.9	0.7	1.3	$9.53	92	11.5	23.6	$167.45
			12	10.9	8.6	1.9	4.0	$28.15	192	34.2	69.6	$494.74
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**40.7**	**20.0**	**4.5**	**9.3**	**$65.84**	**715**	**79.8**	**162.7**	**$1,156.94**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	5.3	5.7	961.2	4.5	$155.72	94	16,890.9	79.0	$2,736.32
			16	12.3	17.1	2,883.7	13.5	$467.16	216	50,672.6	237.0	$8,208.96
			18	14.6	25.7	4,325.5	20.2	$700.73	256	76,008.9	355.5	$12,313.44
			20	7.9	17.1	2,883.7	13.5	$467.16	138	50,672.6	237.0	$8,208.96
			22	6.5	17.1	2,883.7	13.5	$467.16	114	50,672.6	237.0	$8,208.96
			24	0.9	2.9	480.6	2.2	$77.86	16	8,445.4	39.5	$1,368.16
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**47.4**	**85.7**	**14,418.4**	**67.4**	**$2,335.78**	**834**	**253,363.0**	**1,184.9**	**$41,044.81**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	1.6	2.9	294.9	2.4	$56.63	28	5,182.7	42.2	$995.08
			20									
			22	1.1	2.9	294.9	2.4	$56.63	19	5,182.7	42.2	$995.08
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**2.7**	**5.7**	**589.9**	**4.8**	**$113.26**	**47**	**10,365.4**	**84.4**	**$1,990.16**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	5.3	5.7	565.6	3.7	$72.96	94	9,938.8	64.7	$1,282.11
			16	4.1	5.7	565.6	3.7	$72.96	72	9,938.8	64.7	$1,282.11
			18	3.2	5.7	565.6	3.7	$72.96	57	9,938.8	64.7	$1,282.11
			20	5.2	11.4	1,131.2	7.4	$145.92	92	19,877.7	129.4	$2,564.22
			22	3.2	8.6	848.4	5.5	$109.44	57	14,908.3	97.1	$1,923.17
			24	0.9	2.9	282.8	1.8	$36.48	16	4,969.4	32.4	$641.06
			26									
			28	0.7	2.9	282.8	1.8	$36.48	12	4,969.4	32.4	$641.06
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**22.7**	**42.9**	**4,242.0**	**27.6**	**$547.22**	**399**	**74,541.3**	**485.4**	**$9,615.83**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	5.3	5.7	467.0	3.8	$60.24	94	8,205.5	66.8	$1,058.51
			16									
			18									
			20	1.3	2.9	233.5	1.9	$30.12	23	4,102.8	33.4	$529.26
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**6.7**	**8.6**	**700.4**	**5.7**	**$90.36**	**117**	**12,308.3**	**100.2**	**$1,587.77**
		water oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	1.6	2.9	294.9	2.4	$56.63	28	5,182.7	42.2	$995.08
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water oak sawtimber Total		**1.6**	**2.9**	**294.9**	**2.4**	**$56.63**	**28**	**5,182.7**	**42.2**	**$995.08**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
11	**11.16**	Hardwood pulpwood	6	34.0	6.7	1.5	3.1	$22.24	379	17.0	34.9	$248.19
			8	19.1	6.7	1.5	3.0	$21.22	213	16.7	33.3	$236.90
			10	24.4	13.3	3.0	6.0	$42.45	273	33.3	66.6	$473.81
			12	8.5	6.7	1.5	3.0	$21.22	95	16.7	33.3	$236.90
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**86.0**	**33.3**	**7.5**	**15.1**	**$107.13**	**960**	**83.6**	**168.2**	**$1,195.80**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	3.1	6.7	1,121.4	5.2	$181.67	34	12,517.3	58.5	$2,027.81
			22	2.5	6.7	1,121.4	5.2	$181.67	28	12,517.3	58.5	$2,027.81
			24	2.1	6.7	1,121.4	5.2	$181.67	24	12,517.3	58.5	$2,027.81
			26	1.8	6.7	1,121.4	5.2	$181.67	20	12,517.3	58.5	$2,027.81
			28	1.6	6.7	1,121.4	5.2	$181.67	17	12,517.3	58.5	$2,027.81
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**11.1**	**33.3**	**5,607.1**	**26.2**	**$908.36**	**124**	**62,586.7**	**292.7**	**$10,139.04**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	12.5	13.3	1,319.7	8.6	$170.25	139	14,730.8	95.9	$1,900.27
			16									
			18	3.8	6.7	659.9	4.3	$85.12	42	7,365.4	48.0	$950.13
			20	3.1	6.7	659.9	4.3	$85.12	34	7,365.4	48.0	$950.13
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**19.3**	**26.7**	**2,639.5**	**17.2**	**$340.49**	**215**	**29,461.5**	**191.9**	**$3,800.54**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	544.8	4.4	$70.28	70	6,080.9	49.5	$784.43
			16	4.8	6.7	544.8	4.4	$70.28	53	6,080.9	49.5	$784.43
			18	11.3	20.0	1,634.4	13.3	$210.83	126	18,242.7	148.5	$2,353.30
			20	6.1	13.3	1,089.6	8.9	$140.56	68	12,161.8	99.0	$1,568.87
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**28.4**	**46.7**	**3,813.5**	**31.0**	**$491.94**	**317**	**42,566.2**	**346.4**	**$5,491.04**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
12	**7.80**	Hardwood pulpwood	6									
			8									
			10	36.7	20.0	4.6	9.4	$66.71	286	35.6	73.1	$519.97
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**36.7**	**20.0**	**4.6**	**9.4**	**$66.71**	**286**	**35.6**	**73.1**	**$519.97**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	11.3	20.0	3,364.3	15.7	$545.01	88	26,224.7	122.6	$4,248.40
			20	9.2	20.0	3,364.3	15.7	$545.01	71	26,224.7	122.6	$4,248.40
			22	15.2	40.0	6,728.6	31.5	$1,090.03	118	52,449.4	245.3	$8,496.81
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**35.6**	**80.0**	**13,457.2**	**62.9**	**$2,180.06**	**278**	**104,898.9**	**490.6**	**$16,993.62**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	1,979.6	12.9	$255.37	146	15,431.0	100.5	$1,990.60
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**18.7**	**20.0**	**1,979.6**	**12.9**	**$255.37**	**146**	**15,431.0**	**100.5**	**$1,990.60**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14									
			16	14.3	20.0	1,634.4	13.3	$210.83	112	12,739.9	103.7	$1,643.45
			18	11.3	20.0	1,634.4	13.3	$210.83	88	12,739.9	103.7	$1,643.45
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**25.6**	**40.0**	**3,268.7**	**26.6**	**$421.67**	**200**	**25,479.8**	**207.4**	**$3,286.89**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
14	**58.13**	Hardwood pulpwood	6									
			8	12.1	4.2	1.0	1.9	$13.72	701	55.3	112.2	$797.73
			10	13.5	7.4	1.7	3.4	$23.94	785	96.7	195.7	$1,391.38
			12	17.4	13.7	3.1	6.3	$44.52	1,013	179.7	364.0	$2,587.98
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**43.0**	**25.3**	**5.7**	**11.6**	**$82.18**	**2,499**	**331.8**	**671.9**	**$4,777.09**
		Chip-n-saw	6									
			8									
			10	3.9	2.1	204.8	1.2	$23.97	224	11,906.1	69.1	$1,393.01
			12	2.7	2.1	204.8	1.2	$23.97	156	11,906.1	69.1	$1,393.01
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**6.5**	**4.2**	**409.7**	**2.4**	**$47.93**	**380**	**23,812.2**	**138.1**	**$2,786.02**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	4.9	5.3	885.3	4.1	$143.42	286	51,461.5	240.7	$8,336.76
			16	6.8	9.5	1,593.6	7.5	$258.16	394	92,630.7	433.2	$15,006.17
			18	6.6	11.6	1,947.7	9.1	$315.53	381	113,215.3	529.5	$18,340.87
			20	10.1	22.1	3,718.4	17.4	$602.38	589	216,138.2	1,010.8	$35,014.39
			22	6.4	16.8	2,833.1	13.2	$458.96	371	164,676.7	770.2	$26,677.63
			24	4.4	13.7	2,301.9	10.8	$372.90	253	133,799.8	625.8	$21,675.58
			26	0.6	2.1	354.1	1.7	$57.37	33	20,584.6	96.3	$3,334.70
			28	0.7	3.2	531.2	2.5	$86.05	43	30,876.9	144.4	$5,002.06
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**40.4**	**84.2**	**14,165.4**	**66.2**	**$2,294.80**	**2,351**	**823,383.7**	**3,850.8**	**$133,388.16**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16	0.8	1.1	108.7	0.9	$20.86	44	6,316.1	51.4	$1,212.69
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**0.8**	**1.1**	**108.7**	**0.9**	**$20.86**	**44**	**6,316.1**	**51.4**	**$1,212.69**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	3.0	3.2	312.6	2.0	$40.32	172	18,168.4	118.3	$2,343.73
			16	5.3	7.4	729.3	4.7	$94.08	307	42,393.0	276.1	$5,468.69
			18	2.4	4.2	416.8	2.7	$53.76	138	24,224.6	157.7	$3,124.97
			20	1.0	2.1	208.4	1.4	$26.88	56	12,112.3	78.9	$1,562.48
			22									
			24	0.3	1.1	104.2	0.7	$13.44	19	6,056.1	39.4	$781.24
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**11.9**	**17.9**	**1,771.2**	**11.5**	**$228.49**	**693**	**102,954.4**	**670.4**	**$13,281.12**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	5.9	6.3	516.1	4.2	$66.58	343	29,999.8	244.1	$3,869.97
			16	6.0	8.4	688.2	5.6	$88.77	351	39,999.7	325.5	$5,159.97
			18	2.4	4.2	344.1	2.8	$44.39	138	19,999.9	162.8	$2,579.98
			20	1.0	2.1	172.0	1.4	$22.19	56	9,999.9	81.4	$1,289.99
			22	0.8	2.1	172.0	1.4	$22.19	46	9,999.9	81.4	$1,289.99
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**16.1**	**23.2**	**1,892.4**	**15.4**	**$244.12**	**935**	**109,999.3**	**895.2**	**$14,189.91**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
15	**5.58**	Hardwood pulpwood	6									
			8	57.3	20.0	4.5	9.2	$65.19	320	25.2	51.2	$363.72
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**57.3**	**20.0**	**4.5**	**9.2**	**$65.19**	**320**	**25.2**	**51.2**	**$363.72**
		Chip-n-saw	6									
			8									
			10	18.3	10.0	972.9	5.6	$113.83	102	5,428.4	31.5	$635.13
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**18.3**	**10.0**	**972.9**	**5.6**	**$113.83**	**102**	**5,428.4**	**31.5**	**$635.13**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	3,364.3	15.7	$545.01	104	18,770.6	87.8	$3,040.84
			16	7.2	10.0	1,682.1	7.9	$272.51	40	9,385.3	43.9	$1,520.42
			18	34.0	60.0	10,092.9	47.2	$1,635.04	189	56,311.9	263.4	$9,122.53
			20	27.5	60.0	10,092.9	47.2	$1,635.04	153	56,311.9	263.4	$9,122.53
			22	7.6	20.0	3,364.3	15.7	$545.01	42	18,770.6	87.8	$3,040.84
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**94.9**	**170.0**	**28,596.5**	**133.7**	**$4,632.63**	**529**	**159,550.5**	**746.2**	**$25,847.18**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	817.2	6.7	$105.42	52	4,559.4	37.1	$588.16
			16									
			18									
			20	4.6	10.0	817.2	6.7	$105.42	26	4,559.4	37.1	$588.16
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**13.9**	**20.0**	**1,634.4**	**13.3**	**$210.83**	**78**	**9,118.7**	**74.2**	**$1,176.32**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
16	**13.58**	Hardwood pulpwood	6									
			8	45.8	16.0	3.6	7.2	$51.54	622	48.9	98.4	$699.95
			10	7.3	4.0	0.9	1.9	$13.34	100	12.4	25.5	$181.17
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**53.2**	**20.0**	**4.5**	**9.1**	**$64.89**	**722**	**61.3**	**123.9**	**$881.12**
		Softwood pulpwood	6									
			8	11.5	4.0	0.9	1.9	$24.66	156	12.4	25.5	$334.81
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**11.5**	**4.0**	**0.9**	**1.9**	**$24.66**	**156**	**12.4**	**25.5**	**$334.81**
		Chip-n-saw	6									
			8									
			10									
			12	10.2	8.0	778.4	4.5	$91.07	138	10,569.7	61.3	$1,236.66
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**10.2**	**8.0**	**778.4**	**4.5**	**$91.07**	**138**	**10,569.7**	**61.3**	**$1,236.66**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16	20.1	28.0	4,710.0	22.0	$763.02	272	63,959.6	299.1	$10,361.46
			18	18.1	32.0	5,382.9	25.2	$872.02	246	73,096.7	341.9	$11,841.66
			20	12.8	28.0	4,710.0	22.0	$763.02	174	63,959.6	299.1	$10,361.46
			22	7.6	20.0	3,364.3	15.7	$545.01	103	45,685.4	213.7	$7,401.04
			24	6.4	20.0	3,364.3	15.7	$545.01	86	45,685.4	213.7	$7,401.04
			26									
			28	1.9	8.0	1,345.7	6.3	$218.01	25	18,274.2	85.5	$2,960.42
			30	1.6	8.0	1,345.7	6.3	$218.01	22	18,274.2	85.5	$2,960.42
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**68.4**	**144.0**	**24,222.9**	**113.3**	**$3,924.11**	**929**	**328,935.1**	**1,538.4**	**$53,287.49**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	3.7	4.0	395.9	2.6	$51.07	51	5,376.4	35.0	$693.56
			16	5.7	8.0	791.8	5.2	$102.15	78	10,752.8	70.0	$1,387.11
			18	2.3	4.0	395.9	2.6	$51.07	31	5,376.4	35.0	$693.56
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**11.7**	**16.0**	**1,583.7**	**10.3**	**$204.29**	**159**	**21,505.6**	**140.0**	**$2,774.22**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	3.7	4.0	326.9	2.7	$42.17	51	4,438.8	36.1	$572.60
			16									
			18	4.5	8.0	653.7	5.3	$84.33	61	8,877.5	72.2	$1,145.20
			20	3.7	8.0	653.7	5.3	$84.33	50	8,877.5	72.2	$1,145.20
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36	0.5	4.0	326.9	2.7	$42.17	7	4,438.8	36.1	$572.60
		sweetgum sawtimber Total		**12.4**	**24.0**	**1,961.2**	**16.0**	**$253.00**	**169**	**26,632.6**	**216.7**	**$3,435.61**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
17	**21.57**	Hardwood pulpwood	6									
			8	25.5	8.9	2.0	4.0	$28.64	549	43.1	86.9	$617.65
			10	12.2	6.7	1.5	3.0	$21.56	264	32.4	65.4	$465.05
			12	22.6	17.8	4.0	8.1	$57.61	488	86.5	174.8	$1,242.57
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**60.3**	**33.3**	**7.5**	**15.2**	**$107.81**	**1,301**	**162.0**	**327.0**	**$2,325.27**
		Chip-n-saw	6									
			8									
			10	8.1	4.4	432.4	2.5	$50.59	176	9,326.9	54.1	$1,091.25
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**8.1**	**4.4**	**432.4**	**2.5**	**$50.59**	**176**	**9,326.9**	**54.1**	**$1,091.25**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	1,121.4	5.2	$181.67	135	24,188.1	113.1	$3,918.47
			16	9.5	13.3	2,242.9	10.5	$363.34	206	48,376.2	226.2	$7,836.94
			18	7.5	13.3	2,242.9	10.5	$363.34	163	48,376.2	226.2	$7,836.94
			20	3.1	6.7	1,121.4	5.2	$181.67	66	24,188.1	113.1	$3,918.47
			22	4.2	11.1	1,869.0	8.7	$302.79	91	40,313.5	188.5	$6,530.78
			24	2.1	6.7	1,121.4	5.2	$181.67	46	24,188.1	113.1	$3,918.47
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**32.7**	**57.8**	**9,719.1**	**45.5**	**$1,574.49**	**706**	**209,630.1**	**980.4**	**$33,960.08**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	4.2	4.4	439.9	2.9	$56.75	90	9,488.4	61.8	$1,224.01
			16	3.2	4.4	439.9	2.9	$56.75	69	9,488.4	61.8	$1,224.01
			18	1.3	2.2	220.0	1.4	$28.37	27	4,744.2	30.9	$612.00
			20									
			22									
			24	0.7	2.2	220.0	1.4	$28.37	15	4,744.2	30.9	$612.00
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**9.3**	**13.3**	**1,319.7**	**8.6**	**$170.25**	**201**	**28,465.3**	**185.4**	**$3,672.02**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	1,634.4	13.3	$210.83	404	35,251.5	286.9	$4,547.44
			16	9.5	13.3	1,089.6	8.9	$140.56	206	23,501.0	191.3	$3,031.63
			18	5.0	8.9	726.4	5.9	$93.70	108	15,667.3	127.5	$2,021.09
			20	1.0	2.2	181.6	1.5	$23.43	22	3,916.8	31.9	$505.27
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**34.3**	**44.4**	**3,631.9**	**29.6**	**$468.52**	**740**	**78,336.7**	**637.5**	**$10,105.43**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
18	**3.80**	Hardwood pulpwood	6	50.9	10.0	2.2	4.5	$31.84	194	8.5	17.0	$121.02
			8									
			10	18.3	10.0	2.2	4.5	$31.84	70	8.5	17.0	$121.02
			12	12.7	10.0	2.2	4.5	$31.84	48	8.5	17.0	$121.02
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**82.0**	**30.0**	**6.7**	**13.4**	**$95.51**	**312**	**25.5**	**51.1**	**$363.05**
		Chip-n-saw	6									
			8									
			10									
			12	12.7	10.0	972.9	5.6	$113.83	48	3,698.4	21.5	$432.72
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**12.7**	**10.0**	**972.9**	**5.6**	**$113.83**	**48**	**3,698.4**	**21.5**	**$432.72**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	28.1	30.0	5,046.4	23.6	$817.52	107	19,182.8	89.7	$3,107.61
			16	28.6	40.0	6,728.6	31.5	$1,090.03	109	25,577.1	119.6	$4,143.48
			18	17.0	30.0	5,046.4	23.6	$817.52	65	19,182.8	89.7	$3,107.61
			20	18.3	40.0	6,728.6	31.5	$1,090.03	70	25,577.1	119.6	$4,143.48
			22	7.6	20.0	3,364.3	15.7	$545.01	29	12,788.5	59.8	$2,071.74
			24	6.4	20.0	3,364.3	15.7	$545.01	24	12,788.5	59.8	$2,071.74
			26	2.7	10.0	1,682.1	7.9	$272.51	10	6,394.3	29.9	$1,035.87
			28									
			30	2.0	10.0	1,682.1	7.9	$272.51	8	6,394.3	29.9	$1,035.87
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**110.7**	**200.0**	**33,642.9**	**157.3**	**$5,450.15**	**421**	**127,885.3**	**598.1**	**$20,717.42**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
19	**2.12**	Hardwood pulpwood	6									
			8	114.6	40.0	9.0	18.3	$130.38	243	19.2	38.9	$276.24
			10	36.7	20.0	4.5	9.0	$63.67	78	9.5	19.0	$134.91
			12	76.4	60.0	13.4	26.9	$191.02	162	28.5	56.9	$404.72
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**227.7**	**120.0**	**27.0**	**54.2**	**$385.07**	**482**	**57.1**	**114.8**	**$815.88**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	3,364.3	15.7	$545.01	40	7,128.2	33.3	$1,154.77
			16	14.3	20.0	3,364.3	15.7	$545.01	30	7,128.2	33.3	$1,154.77
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**33.0**	**40.0**	**6,728.6**	**31.5**	**$1,090.03**	**70**	**14,256.4**	**66.7**	**$2,309.53**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	1,634.4	13.3	$210.83	40	3,462.9	28.2	$446.71
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**18.7**	**20.0**	**1,634.4**	**13.3**	**$210.83**	**40**	**3,462.9**	**28.2**	**$446.71**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
26	**11.28**	Hardwood pulpwood	6									
			8	11.5	4.0	0.9	1.9	$13.34	129	10.3	21.2	$150.54
			10	58.7	32.0	7.3	15.0	$106.73	662	82.5	169.4	$1,204.28
			12	56.0	44.0	10.0	20.6	$146.75	632	113.4	232.9	$1,655.89
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**126.2**	**80.0**	**18.3**	**37.5**	**$266.82**	**1,423**	**206.2**	**423.4**	**$3,010.71**
		Carolina ash sawtimber	6									
			8									
			10									
			12									
			14	15.0	16.0	1,583.7	10.3	$204.29	169	17,869.5	116.4	$2,305.16
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Carolina ash sawtimber Total		**15.0**	**16.0**	**1,583.7**	**10.3**	**$204.29**	**169**	**17,869.5**	**116.4**	**$2,305.16**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	1,979.6	12.9	$255.37	211	22,336.8	145.5	$2,881.45
			16	2.9	4.0	395.9	2.6	$51.07	32	4,467.4	29.1	$576.29
			18	2.3	4.0	395.9	2.6	$51.07	26	4,467.4	29.1	$576.29
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**23.8**	**28.0**	**2,771.4**	**18.0**	**$357.52**	**269**	**31,271.6**	**203.6**	**$4,034.03**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	3.7	4.0	326.9	2.7	$42.17	42	3,688.3	30.0	$475.79
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**3.7**	**4.0**	**326.9**	**2.7**	**$42.17**	**42**	**3,688.3**	**30.0**	**$475.79**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
31	**5.35**	Hardwood pulpwood	6									
			8									
			10	36.7	20.0	4.5	9.0	$63.67	196	24.0	48.0	$340.96
			12	12.7	10.0	2.3	4.7	$33.35	68	12.2	25.1	$178.60
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**49.4**	**30.0**	**6.8**	**13.6**	**$97.03**	**265**	**36.2**	**73.1**	**$519.57**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20	4.6	10.0	1,682.1	7.9	$272.51	25	9,007.8	42.1	$1,459.26
			22									
			24	3.2	10.0	1,682.1	7.9	$272.51	17	9,007.8	42.1	$1,459.26
			26									
			28	2.3	10.0	1,682.1	7.9	$272.51	13	9,007.8	42.1	$1,459.26
			30	2.0	10.0	1,682.1	7.9	$272.51	11	9,007.8	42.1	$1,459.26
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**12.1**	**40.0**	**6,728.6**	**31.5**	**$1,090.03**	**65**	**36,031.2**	**168.5**	**$5,837.05**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	989.8	6.4	$127.68	50	5,300.3	34.5	$683.74
			16									
			18	5.7	10.0	989.8	6.4	$127.68	30	5,300.3	34.5	$683.74
			20	4.6	10.0	989.8	6.4	$127.68	25	5,300.3	34.5	$683.74
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**19.6**	**30.0**	**2,969.4**	**19.3**	**$383.05**	**105**	**15,901.0**	**103.5**	**$2,051.22**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	817.2	6.7	$105.42	50	4,376.0	35.6	$564.50
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**9.4**	**10.0**	**817.2**	**6.7**	**$105.42**	**50**	**4,376.0**	**35.6**	**$564.50**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
32	**12.95**	Hardwood pulpwood	6	34.0	6.7	1.5	3.1	$22.24	440	19.7	40.5	$287.95
			8	52.5	18.3	4.1	8.3	$58.87	680	53.3	107.2	$762.40
			10	27.5	15.0	3.4	6.7	$47.75	356	43.5	87.0	$618.43
			12	25.5	20.0	4.7	10.0	$71.09	330	61.3	129.5	$920.69
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**139.4**	**60.0**	**13.7**	**28.1**	**$199.96**	**1,806**	**177.9**	**364.2**	**$2,589.47**
		Softwood pulpwood	6									
			8	9.5	3.3	0.8	1.6	$20.55	124	9.9	20.2	$266.08
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**9.5**	**3.3**	**0.8**	**1.6**	**$20.55**	**124**	**9.9**	**20.2**	**$266.08**
		Chip-n-saw	6									
			8									
			10	12.2	6.7	648.6	3.8	$75.89	158	8,399.9	48.7	$982.79
			12	17.0	13.3	1,297.3	7.5	$151.78	220	16,799.8	97.4	$1,965.58
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**29.2**	**20.0**	**1,945.9**	**11.3**	**$227.67**	**378**	**25,199.7**	**146.2**	**$2,948.36**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	1,682.1	7.9	$272.51	121	21,784.0	101.9	$3,529.02
			16	4.8	6.7	1,121.4	5.2	$181.67	62	14,522.7	67.9	$2,352.68
			18	1.9	3.3	560.7	2.6	$90.84	24	7,261.3	34.0	$1,176.34
			20	1.5	3.3	560.7	2.6	$90.84	20	7,261.3	34.0	$1,176.34
			22	1.3	3.3	560.7	2.6	$90.84	16	7,261.3	34.0	$1,176.34
			24	2.1	6.7	1,121.4	5.2	$181.67	27	14,522.7	67.9	$2,352.68
			26	0.9	3.3	560.7	2.6	$90.84	12	7,261.3	34.0	$1,176.34
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**21.8**	**36.7**	**6,167.9**	**28.8**	**$999.19**	**283**	**79,874.8**	**373.6**	**$12,939.72**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18									
			20									
			22	1.3	3.3	344.1	2.8	$66.07	16	4,456.1	36.3	$855.57
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**1.3**	**3.3**	**344.1**	**2.8**	**$66.07**	**16**	**4,456.1**	**36.3**	**$855.57**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16	2.4	3.3	329.9	2.1	$42.56	31	4,272.7	27.8	$551.18
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**2.4**	**3.3**	**329.9**	**2.1**	**$42.56**	**31**	**4,272.7**	**27.8**	**$551.18**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	4.7	5.0	408.6	3.3	$52.71	61	5,291.3	43.1	$682.58
			16	2.4	3.3	272.4	2.2	$35.14	31	3,527.5	28.7	$455.05
			18	1.9	3.3	272.4	2.2	$35.14	24	3,527.5	28.7	$455.05
			20	3.1	6.7	544.8	4.4	$70.28	40	7,055.1	57.4	$910.11
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**12.0**	**18.3**	**1,498.2**	**12.2**	**$193.26**	**155**	**19,401.5**	**157.9**	**$2,502.79**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
33	**8.07**	Hardwood pulpwood	6									
			8									
			10	36.7	20.0	4.6	9.4	$66.71	296	36.9	75.8	$538.59
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**36.7**	**20.0**	**4.6**	**9.4**	**$66.71**	**296**	**36.9**	**75.8**	**$538.59**
		Chip-n-saw	6									
			8									
			10	18.3	10.0	972.9	5.6	$113.83	148	7,855.7	45.6	$919.11
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**18.3**	**10.0**	**972.9**	**5.6**	**$113.83**	**148**	**7,855.7**	**45.6**	**$919.11**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	11.3	20.0	3,364.3	15.7	$545.01	91	27,163.6	127.0	$4,400.50
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**11.3**	**20.0**	**3,364.3**	**15.7**	**$545.01**	**91**	**27,163.6**	**127.0**	**$4,400.50**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	1,979.6	12.9	$255.37	151	15,983.4	104.1	$2,061.86
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**18.7**	**20.0**	**1,979.6**	**12.9**	**$255.37**	**151**	**15,983.4**	**104.1**	**$2,061.86**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	9.4	10.0	817.2	6.7	$105.42	76	6,598.0	53.7	$851.14
			16	14.3	20.0	1,634.4	13.3	$210.83	116	13,196.0	107.4	$1,702.28
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**23.7**	**30.0**	**2,451.5**	**20.0**	**$316.25**	**191**	**19,794.0**	**161.1**	**$2,553.42**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
34	**13.79**	Hardwood pulpwood	6	40.7	8.0	1.8	3.6	$25.47	562	24.7	49.4	$351.09
			8	22.9	8.0	1.8	3.6	$25.47	316	24.7	49.4	$351.09
			10	14.7	8.0	1.8	3.6	$25.47	202	24.7	49.4	$351.09
			12	20.4	16.0	3.6	7.2	$50.94	281	49.4	98.8	$702.18
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**98.7**	**40.0**	**9.0**	**17.9**	**$127.35**	**1,361**	**123.5**	**246.9**	**$1,755.46**
		Softwood pulpwood	6	20.4	4.0	0.9	1.9	$24.66	281	12.6	25.9	$339.88
			8	22.9	8.0	1.8	3.8	$49.31	316	25.2	51.7	$679.76
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**43.3**	**12.0**	**2.7**	**5.6**	**$73.97**	**597**	**37.8**	**77.6**	**$1,019.65**
		Chip-n-saw	6									
			8									
			10	33.0	18.0	1,751.3	10.2	$204.90	455	24,141.9	140.0	$2,824.60
			12	40.7	32.0	3,113.4	18.1	$364.27	562	42,918.9	248.9	$5,021.51
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**73.7**	**50.0**	**4,864.7**	**28.2**	**$569.17**	**1,017**	**67,060.8**	**388.9**	**$7,846.11**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	20.6	22.0	3,700.7	17.3	$599.52	284	51,014.6	238.6	$8,264.37
			16	11.5	16.0	2,691.4	12.6	$436.01	158	37,101.5	173.5	$6,010.45
			18	6.8	12.0	2,018.6	9.4	$327.01	94	27,826.2	130.1	$4,507.84
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**38.8**	**50.0**	**8,410.7**	**39.3**	**$1,362.54**	**535**	**115,942.3**	**542.2**	**$18,782.66**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	2.3	4.0	395.9	2.6	$51.07	31	5,457.8	35.5	$704.05
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**2.3**	**4.0**	**395.9**	**2.6**	**$51.07**	**31**	**5,457.8**	**35.5**	**$704.05**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	3.7	4.0	326.9	2.7	$42.17	52	4,506.0	36.7	$581.27
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**3.7**	**4.0**	**326.9**	**2.7**	**$42.17**	**52**	**4,506.0**	**36.7**	**$581.27**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
37	**12.46**	Hardwood pulpwood	6	50.9	10.0	2.2	4.5	$31.84	635	27.9	55.8	$396.68
			8	71.6	25.0	5.7	11.6	$82.62	892	70.9	144.8	$1,029.49
			10	55.0	30.0	6.9	14.1	$100.06	685	85.4	175.3	$1,246.73
			12	12.7	10.0	2.3	4.7	$33.35	159	28.5	58.4	$415.58
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**190.3**	**75.0**	**17.1**	**34.9**	**$247.87**	**2,371**	**212.6**	**434.4**	**$3,088.48**
		Chip-n-saw	6									
			8									
			10									
			12	12.7	10.0	972.9	5.6	$113.83	159	12,122.9	70.3	$1,418.38
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**12.7**	**10.0**	**972.9**	**5.6**	**$113.83**	**159**	**12,122.9**	**70.3**	**$1,418.38**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	3,364.3	15.7	$545.01	233	41,918.9	196.0	$6,790.86
			16	10.7	15.0	2,523.2	11.8	$408.76	134	31,439.2	147.0	$5,093.15
			18	19.8	35.0	5,887.5	27.5	$953.78	247	73,358.1	343.1	$11,884.01
			20	4.6	10.0	1,682.1	7.9	$272.51	57	20,959.4	98.0	$3,395.43
			22	3.8	10.0	1,682.1	7.9	$272.51	47	20,959.4	98.0	$3,395.43
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**57.6**	**90.0**	**15,139.3**	**70.8**	**$2,452.57**	**718**	**188,635.0**	**882.2**	**$30,558.88**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
38	**10.75**	Softwood pulpwood	6									
			8	19.1	6.7	1.5	3.1	$41.09	205	16.4	33.6	$441.66
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**19.1**	**6.7**	**1.5**	**3.1**	**$41.09**	**205**	**16.4**	**33.6**	**$441.66**
		Chip-n-saw	6									
			8									
			10									
			12	8.5	6.7	648.6	3.8	$75.89	91	6,971.4	40.4	$815.66
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**8.5**	**6.7**	**648.6**	**3.8**	**$75.89**	**91**	**6,971.4**	**40.4**	**$815.66**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	37.4	40.0	6,728.6	31.5	$1,090.03	402	72,317.8	338.2	$11,715.49
			16	43.0	60.0	10,092.9	47.2	$1,635.04	462	108,476.7	507.3	$17,573.23
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**80.4**	**100.0**	**16,821.4**	**78.7**	**$2,725.07**	**864**	**180,794.5**	**845.5**	**$29,288.72**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
39	**46.14**	Softwood pulpwood	6									
			8	6.4	2.2	0.5	1.0	$13.70	294	23.4	48.1	$632.00
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**6.4**	**2.2**	**0.5**	**1.0**	**$13.70**	**294**	**23.4**	**48.1**	**$632.00**
		Chip-n-saw	6									
			8									
			10	12.2	6.7	648.6	3.8	$75.89	564	29,927.2	173.6	$3,501.48
			12	8.5	6.7	648.6	3.8	$75.89	392	29,927.2	173.6	$3,501.48
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**20.7**	**13.3**	**1,297.3**	**7.5**	**$151.78**	**956**	**59,854.4**	**347.1**	**$7,002.97**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	31.2	33.3	5,607.1	26.2	$908.36	1,439	258,707.8	1,209.9	$41,910.67
			16	23.9	33.3	5,607.1	26.2	$908.36	1,101	258,707.8	1,209.9	$41,910.67
			18	13.8	24.4	4,111.9	19.2	$666.13	638	189,719.1	887.3	$30,734.49
			20	4.1	8.9	1,495.2	7.0	$242.23	188	68,988.8	322.6	$11,176.18
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**73.0**	**100.0**	**16,821.4**	**78.7**	**$2,725.07**	**3,366**	**776,123.5**	**3,629.8**	**$125,732.00**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
41	**45.68**	Hardwood pulpwood	6	50.9	10.0	2.3	4.7	$33.35	2,327	104.3	214.3	$1,523.65
			8	78.8	27.5	6.3	12.9	$91.72	3,599	286.9	589.3	$4,190.05
			10	36.7	20.0	4.6	9.4	$66.71	1,675	208.7	428.6	$3,047.31
			12	15.9	12.5	2.9	5.9	$41.69	727	130.4	267.9	$1,904.57
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**182.3**	**70.0**	**16.0**	**32.8**	**$233.47**	**8,328**	**730.4**	**1,500.1**	**$10,665.57**
		baldcypress sawtimber	6									
			8									
			10									
			12									
			14	2.3	2.5	204.3	1.7	$26.35	107	9,332.8	76.0	$1,203.93
			16	1.8	2.5	204.3	1.7	$26.35	82	9,332.8	76.0	$1,203.93
			18	1.4	2.5	204.3	1.7	$26.35	65	9,332.8	76.0	$1,203.93
			20									
			22	0.9	2.5	204.3	1.7	$26.35	43	9,332.8	76.0	$1,203.93
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		baldcypress sawtimber Total		**6.5**	**10.0**	**817.2**	**6.7**	**$105.42**	**297**	**37,331.0**	**303.8**	**$4,815.70**
		Carolina ash sawtimber	6									
			8									
			10									
			12									
			14									
			16	1.8	2.5	247.4	1.6	$31.92	82	11,304.2	73.6	$1,458.24
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Carolina ash sawtimber Total		**1.8**	**2.5**	**247.4**	**1.6**	**$31.92**	**82**	**11,304.2**	**73.6**	**$1,458.24**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	2.3	2.5	247.4	1.6	$31.92	107	11,304.2	73.6	$1,458.24
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**2.3**	**2.5**	**247.4**	**1.6**	**$31.92**	**107**	**11,304.2**	**73.6**	**$1,458.24**
		water tupelo sawtimber	6									
			8									
			10									
			12									
			14	4.7	5.0	494.9	3.2	$63.84	214	22,608.3	147.2	$2,916.48
			16	1.8	2.5	247.4	1.6	$31.92	82	11,304.2	73.6	$1,458.24
			18	1.4	2.5	247.4	1.6	$31.92	65	11,304.2	73.6	$1,458.24
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water tupelo sawtimber Total		**7.9**	**10.0**	**989.8**	**6.4**	**$127.68**	**360**	**45,216.7**	**294.4**	**$5,832.95**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
42	**72.26**	Hardwood pulpwood	6	152.8	30.0	6.9	14.1	$100.06	11,040	495.1	1,016.9	$7,230.09
			8	171.9	60.0	13.7	28.1	$200.12	12,420	990.2	2,033.8	$14,460.18
			10	36.7	20.0	4.6	9.4	$66.71	2,650	330.1	677.9	$4,820.06
			12	9.5	7.5	1.7	3.5	$24.64	690	123.0	250.4	$1,780.12
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**370.9**	**117.5**	**26.8**	**55.1**	**$391.52**	**26,800**	**1,938.4**	**3,979.0**	**$28,290.46**
		baldcypress sawtimber	6									
			8									
			10									
			12									
			14	2.3	2.5	204.3	1.7	$26.35	169	14,762.0	120.1	$1,904.30
			16	1.8	2.5	204.3	1.7	$26.35	129	14,762.0	120.1	$1,904.30
			18									
			20	2.3	5.0	408.6	3.3	$52.71	166	29,524.1	240.3	$3,808.61
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		baldcypress sawtimber Total		**6.4**	**10.0**	**817.2**	**6.7**	**$105.42**	**464**	**59,048.2**	**480.5**	**$7,617.21**
		water tupelo sawtimber	6									
			8									
			10									
			12									
			14	4.7	5.0	494.9	3.2	$63.84	338	35,760.6	232.9	$4,613.12
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water tupelo sawtimber Total		**4.7**	**5.0**	**494.9**	**3.2**	**$63.84**	**338**	**35,760.6**	**232.9**	**$4,613.12**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
100	**52.86**	Hardwood pulpwood	6	4.6	0.9	0.2	0.4	$2.89	245	10.8	21.5	$152.99
			8	18.2	6.4	1.4	2.9	$20.40	964	75.5	151.7	$1,078.25
			10	33.3	18.2	4.1	8.3	$59.26	1,762	217.4	440.6	$3,132.78
			12	8.1	6.4	1.5	3.2	$22.97	428	80.1	170.8	$1,214.41
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**64.3**	**31.8**	**7.3**	**14.8**	**$105.53**	**3,399**	**383.7**	**784.6**	**$5,578.43**
		Softwood pulpwood	6	9.3	1.8	0.4	0.9	$11.21	490	22.0	45.1	$592.44
			8	18.2	6.4	1.5	3.0	$39.23	964	76.8	157.8	$2,073.54
			10									
			12									
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Softwood pulpwood Total		**27.5**	**8.2**	**1.9**	**3.8**	**$50.43**	**1,453**	**98.8**	**202.9**	**$2,665.98**
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	2.6	2.7	458.8	2.1	$74.32	135	24,251.5	113.4	$3,928.74
			16	0.7	0.9	152.9	0.7	$24.77	34	8,083.8	37.8	$1,309.58
			18									
			20	0.8	1.8	305.8	1.4	$49.55	44	16,167.6	75.6	$2,619.16
			22	1.4	3.6	611.7	2.9	$99.09	73	32,335.3	151.2	$5,238.32
			24	0.3	0.9	152.9	0.7	$24.77	15	8,083.8	37.8	$1,309.58
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**5.7**	**10.0**	**1,682.1**	**7.9**	**$272.51**	**301**	**88,922.1**	**415.9**	**$14,405.37**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	3.4	3.6	359.9	2.3	$46.43	180	19,026.6	123.9	$2,454.43
			16	1.3	1.8	180.0	1.2	$23.22	69	9,513.3	61.9	$1,227.21
			18	3.1	5.5	539.9	3.5	$69.65	163	28,539.9	185.8	$3,681.64
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**7.8**	**10.9**	**1,079.8**	**7.0**	**$139.29**	**412**	**57,079.7**	**371.7**	**$7,363.28**
		sweetgum sawtimber	6									
			8									
			10									
			12									
			14	0.9	0.9	74.3	0.6	$9.58	45	3,927.1	32.0	$506.60
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		sweetgum sawtimber Total		**0.9**	**0.9**	**74.3**	**0.6**	**$9.58**	**45**	**3,927.1**	**32.0**	**$506.60**
		unknown hardwood sawtimber	6									
			8									
			10									
			12									
			14	1.7	1.8	180.0	1.2	$23.22	90	9,513.3	61.9	$1,227.21
			16									
			18	0.5	0.9	90.0	0.6	$11.61	27	4,756.6	31.0	$613.61
			20									
			22	0.3	0.9	90.0	0.6	$11.61	18	4,756.6	31.0	$613.61
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		unknown hardwood sawtimber Total		**2.6**	**3.6**	**359.9**	**2.3**	**$46.43**	**135**	**19,026.6**	**123.9**	**$2,454.43**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
101	**281.49**	Hardwood pulpwood	6	18.5	3.6	0.8	1.7	$12.13	5,213	233.8	480.2	$3,414.07
			8	88.5	30.9	7.1	14.5	$103.09	24,926	1,987.3	4,081.5	$29,019.58
			10	50.0	27.3	6.2	12.8	$90.96	14,076	1,753.5	3,601.3	$25,605.51
			12	50.9	40.0	9.1	18.8	$133.41	14,336	2,571.7	5,282.0	$37,554.75
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**208.0**	**101.8**	**23.3**	**47.8**	**$339.59**	**58,551**	**6,546.2**	**13,445.0**	**$95,593.90**
		baldcypress sawtimber	6									
			8									
			10									
			12									
			14									
			16	5.2	7.3	594.3	4.8	$76.67	1,466	167,296.2	1,361.5	$21,581.21
			18									
			20									
			22	0.7	1.8	148.6	1.2	$19.17	194	41,824.0	340.4	$5,395.30
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		baldcypress sawtimber Total		**5.9**	**9.1**	**742.9**	**6.0**	**$95.83**	**1,660**	**209,120.2**	**1,701.9**	**$26,976.51**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	5.1	5.5	539.9	3.5	$69.65	1,436	151,976.4	989.7	$19,604.95
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**5.1**	**5.5**	**539.9**	**3.5**	**$69.65**	**1,436**	**151,976.4**	**989.7**	**$19,604.95**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		water tupelo sawtimber	6									
			8									
			10									
			12									
			14	10.2	10.9	1,079.8	7.0	$139.29	2,873	303,952.8	1,979.3	$39,209.91
			16	6.5	9.1	899.8	5.9	$116.08	1,833	253,294.0	1,649.4	$32,674.92
			18	3.1	5.5	539.9	3.5	$69.65	869	151,976.4	989.7	$19,604.95
			20									
			22	0.7	1.8	180.0	1.2	$23.22	194	50,658.8	329.9	$6,534.98
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		water tupelo sawtimber Total		**20.5**	**27.3**	**2,699.5**	**17.6**	**$348.23**	**5,768**	**759,881.9**	**4,948.3**	**$98,024.77**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
102	**7.74**	Hardwood pulpwood	6									
			8	19.1	6.7	1.5	3.1	$22.24	148	11.8	24.2	$172.01
			10	36.7	20.0	4.5	9.2	$65.69	284	35.1	71.5	$508.21
			12	42.4	33.3	7.6	15.4	$109.15	328	58.4	118.8	$844.40
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**98.2**	**60.0**	**13.6**	**27.7**	**$197.08**	**760**	**105.3**	**214.4**	**$1,524.62**
		red oak sawtimber	6									
			8									
			10									
			12									
			14									
			16									
			18	3.8	6.7	688.2	5.6	$132.13	29	5,323.7	43.3	$1,022.16
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		red oak sawtimber Total		**3.8**	**6.7**	**688.2**	**5.6**	**$132.13**	**29**	**5,323.7**	**43.3**	**$1,022.16**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	18.7	20.0	1,979.6	12.9	$255.37	145	15,313.9	99.7	$1,975.50
			16	14.3	20.0	1,979.6	12.9	$255.37	111	15,313.9	99.7	$1,975.50
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**33.0**	**40.0**	**3,959.2**	**25.8**	**$510.74**	**256**	**30,627.9**	**199.4**	**$3,951.00**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		swamp chestnut oak sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	688.2	5.6	$132.13	48	5,323.7	43.3	$1,022.16
			16	4.8	6.7	688.2	5.6	$132.13	37	5,323.7	43.3	$1,022.16
			18									
			20	3.1	6.7	688.2	5.6	$132.13	24	5,323.7	43.3	$1,022.16
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		swamp chestnut oak sawtimber Total		**14.1**	**20.0**	**2,064.6**	**16.8**	**$396.40**	**109**	**15,971.2**	**130.0**	**$3,066.48**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

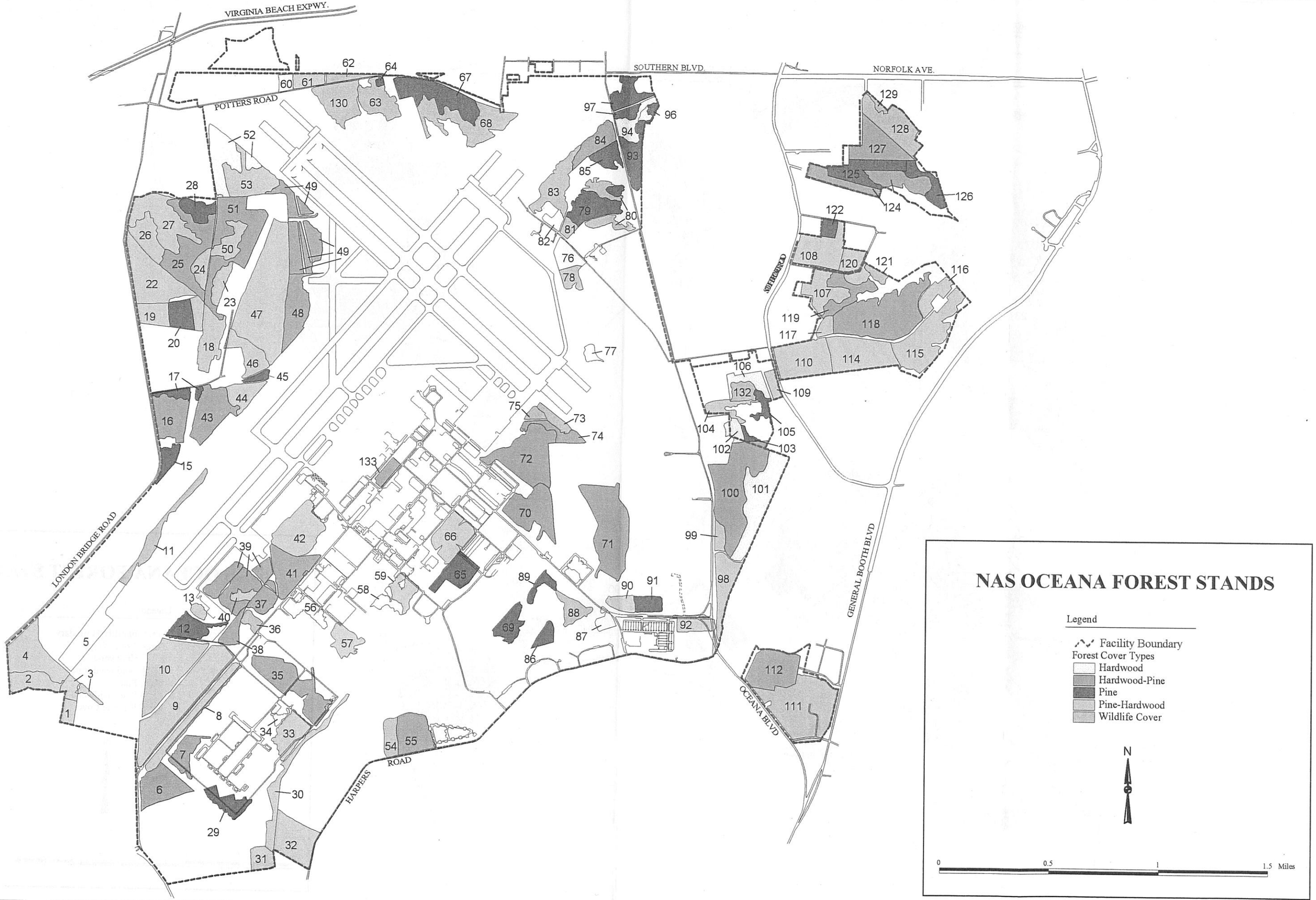
Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
103	**7.03**	Hardwood pulpwood	6									
			8	19.1	6.7	2.0	4.9	$35.06	134	13.9	34.7	$246.56
			10	36.7	20.0	5.0	11.2	$79.53	258	35.3	78.7	$559.32
			12	59.4	46.7	10.6	21.6	$153.62	418	74.5	152.0	$1,080.44
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Hardwood pulpwood Total		**115.2**	**73.3**	**17.6**	**37.7**	**$268.21**	**810**	**123.7**	**265.3**	**$1,886.31**
		Chip-n-saw	6									
			8									
			10									
			12	17.0	13.3	1,297.3	7.5	$151.78	119	9,123.6	52.9	$1,067.46
			14									
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		Chip-n-saw Total		**17.0**	**13.3**	**1,297.3**	**7.5**	**$151.78**	**119**	**9,123.6**	**52.9**	**$1,067.46**
		blackgum sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	659.9	4.3	$85.12	44	4,640.8	30.2	$598.66
			16	4.8	6.7	659.9	4.3	$85.12	34	4,640.8	30.2	$598.66
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		blackgum sawtimber Total		**11.0**	**13.3**	**1,319.7**	**8.6**	**$170.25**	**77**	**9,281.6**	**60.4**	**$1,197.33**

NALFF Forest Stand Stock Tables
Based on field reconnaisance 3/14 - 5/14

Volume units are:
·Hardwood sawtimber: Board-feet, Doyle log rule (form class 78)
·Softwood sawtimber and chip-n-saw: Board-feet, Int'l ¼ inch log rule (form class 80)
·Hardwood and softwood pulpwood: Cords; 80 ft^3 of wood and bark in one cord

Weight units are:
·Tons, equivalent to the cubic volume of wood and bark in the merchandised portion of the tree, converted to green weight in tons

Stand no.	Acres	Stock class	DBH class	Values Trees/ acre	BA (ft^2)/acre	Volume/ acre	Weight (t)/acre	$/acre	Total trees	Total volume	Total weight (t)	Total $
		loblolly pine sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	1,121.4	5.2	$181.67	44	7,887.0	36.9	$1,277.69
			16	4.8	6.7	1,121.4	5.2	$181.67	34	7,887.0	36.9	$1,277.69
			18	7.5	13.3	2,242.9	10.5	$363.34	53	15,773.9	73.8	$2,555.38
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		loblolly pine sawtimber Total		**18.6**	**26.7**	**4,485.7**	**21.0**	**$726.69**	**131**	**31,547.9**	**147.5**	**$5,110.76**
		soft maple sawtimber	6									
			8									
			10									
			12									
			14	6.2	6.7	659.9	4.3	$85.12	44	4,640.8	30.2	$598.66
			16									
			18									
			20									
			22									
			24									
			26									
			28									
			30									
			32									
			34									
			≥36									
		soft maple sawtimber Total		**6.2**	**6.7**	**659.9**	**4.3**	**$85.12**	**44**	**4,640.8**	**30.2**	**$598.66**


VIRGINIA BEACH EXPWY.
POTTERS ROAD
SOUTHERN BLVD.
NORFOLK AVE.
SOUTHERN BLVD
LONDON BRIDGE ROAD
HARPERS ROAD
OCEANA BLVD
GENERAL BOOTH BLVD
NAS OCEANA FOREST STANDS
Legend
Facility Boundary
Forest Cover Types
Hardwood
Hardwood-Pine
Pine
Pine-Hardwood
Wildlife Cover
N
0
0.5
1
1.5 Miles

NALF FENTRESS FOREST STANDS

Legend

Facility Boundary

Forest Cover Stands

- Ecological Reserve Area
- Hardwood
- Hardwood-Pine
- Pine
- Pine-Hardwood
- Wildlife Cover

N

0.5 0 0.5 1 Miles

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Enclosure 19. NASO Cattail Removal Plan (Pending)

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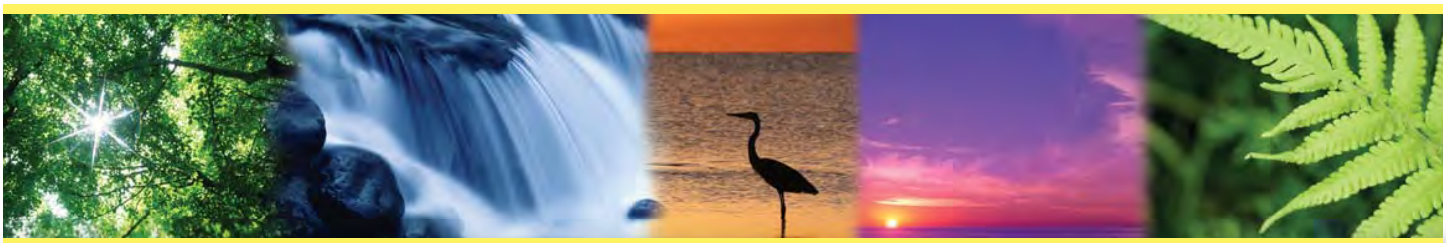
Enclosure 20. NASO Grass Carp Control Plan (Pending)

Enclosure 21. Fish, Pond, and Stream Assessments

NAVFAC Atlantic Biological Resource Services

Contract: N62470-08-D-1008; Task Order: WE85

FINAL - 01 June 2015



Stream and Pond Assessment Surveys for Naval Air Station Oceana (NASO)

Prepared for:
NAVFAC Mid-Atlantic
9742 Maryland Ave.
Building Z-144
Norfolk, VA 23508

Prepared by:
Tetra Tech, Inc.
1320 North Courthouse Road, Suite 600
Arlington, VA 22201

NAVFAC Atlantic Biological Resource Services

Contract: N62470-08-D-1008; Task Order: WE85

Stream and Pond Assessment Surveys for Naval Air Station Oceana (NASO)

FINAL

01 June 2015

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EXECUTIVE SUMMARY

This Project assessed the current condition of selected streams and ponds at Naval Air Station Oceana (NASO). The pond assessments included seasonal boat electrofishing surveys, water quality, shoreline habitat, and fish habitat improvements. The stream assessments included seasonal backpack electrofishing surveys, evaluating the current suitability of habitat (e.g., fish passage) and the potential for enhancements to habitat accessibility.

These data will be used to supplement the existing data and used in current and future environmental planning and management at NASO. Additionally, these data were analyzed to develop improvement recommendations to habitat as well as fish populations, which are presented in this report. Survey biologists used a modified version of the U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols (RBP) for fish to collect a representative sample of the fish assemblage from the appropriate habitat composition in NASO ponds and streams (Barbour et al. 1999). Field crews used the Habitat Assessment Field Data Sheets for Low Gradient Streams, as provided in Barbour et al. (1999). The RBP protocols are included as Appendix D to this report. A "score" was assigned to each of these categories for each surveyed reach so that relative comparisons can be made between reaches and streams. Qualitative habitat surveys were also used to assess pond habitat quality. Additionally, a barrier survey using a combination of assessment protocols was used to identify potential impediments to fish migration within NASO streams. Water quality was recorded *in situ* at every stream and pond during each sampling event, using a hand held multi-parameter meter. Additionally, water grab samples were obtained with a horizontal water sampler in ponds and submitted for laboratory analyses.

In accordance with EPA RBP standards, NASO streams all fell within marginal and suboptimal categories for habitat quality. Fish surveys at NASO steams yielded fish assemblages typical of degraded, channelized coastal plain steams. NASO streams yielded 1,350 individual fishes represented by 22 species. Notably, migratory species were present in NASO waterbodies (gizzard shad and American eel). Barrier survey data recorded both potential and apparent impediments to fish migration through the NASO Installation. These data show that NASO streams offer little to no recreational value and periodic monitoring and repair of some culverts is necessary. NASO ponds offered suitable habitat to support healthy fish communities and a recreational fishery. NASO-P1 and NASO-P2 both can support healthy fish assemblages and recreational fisheries. Pond fish survey results yielded 1,167 individual fish represented by 10 species.

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1 INTRODUCTION

1.1 OBJECTIVES

The purpose of this survey was to assess the current condition of the biological resources and habitats of select streams and ponds at Naval Air Station Oceana (NASO). The stream assessment included seasonal backpack electrofishing surveys, habitat and water quality measurements, and the characterization of physical barriers to migratory fishes, especially American eel (*Anguilla rostrata*) and alosines, including alewife (*Alosa pseudoharengus*), blueback herring (*A. aestivalis*), American shad (*A. sapidissima*), and hickory shad (*A. mediocris*). The pond assessment included seasonal electrofishing surveys, shoreline habitat, and water quality measurements.

The results of this survey and assessment will be used to supplement the existing data and be incorporated into current and future environmental planning documents, such as the Integrated Natural Resources Management Plans (INRMP) or Environmental Assessments (EA) at NASO.

1.2 SITE DESCRIPTION

Naval Air Station Oceana (NASO) is located in the southeastern portion of the City of Virginia Beach, Virginia (Figure 1) and encompasses 5,846 acres (ac) (2,366 hectares [ha]). The Installation is bound by the Norfolk and Southern Railroad to the north, Oceana Boulevard to the east, Harper's Road to the south, and London Bridge Road to the west. Several additional parcels lie north of the railroad tracks and east of Oceana Boulevard. A detailed description of the site's current and historical operations and land use can be found in the facility's Final INRMP (Navy 2014).

Surface waters at NASO are limited to mostly drainage ditches, channelized streams, and several small ponds. The ponds of NASO were formed as a result of borrow pit excavations including the 2-ac (1-ha) Concrete Dump Pond, which is located north of the airfield across London Bridge Road; the 9-ac (4-ha) Oceana Pond, which is located just east of Oceana Boulevard; two small ponds located in the VACAPES area that have a combined area of 3.5 ac (1.4 ha); two small ponds adjacent to Building 78 (Natural Resources Center [NRC]); the Aeropines Mitigation Site and Stormwater Retention Pond (between the weapons compound and the Golf Course); several stormwater retention ponds across the Installation; and numerous small golf course ponds. The eastern parcel abuts Owl's Creek, which includes two small ephemeral streams draining into Rudee Inlet and the Atlantic Ocean. The Virginia Aquarium is adjacent to this parcel, and has been collecting water quality data in the estuarine portion of Owl's Creek since 1998.

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Figure 1: Naval Air Station Oceana (NASO) Site Overview of Proposed Stream and Pond Survey Locations

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1.3 FISHERIES MANAGEMENT

Previous fish surveys at NASO have documented several species of fish that were either intentionally stocked or released into the ponds by fishermen. Largemouth bass, bluegill, redear sunfish (*Lepomis microlophus*), and channel catfish (*Ictalurus punctatus*) were stocked to provide recreational fishing opportunities. Other species collected during previous fisheries surveys are listed in Table 1.

NASO is primarily a landlocked installation, therefore the ichthyofauna is largely comprised of freshwater species; however, Owl's Creek, a small tidal estuary that empties into the Atlantic Ocean through Rudee Inlet is used as a nursery area by marine and estuarine fish species. The current study focused on the freshwater streams and ponds at NASO. Therefore only freshwater and migratory (i.e., anadromous and catadromous) fishes are discussed. The drainage ditches and channelized streams that occur at NASO provide habitat that supports a limited diversity of fish, though (Navy 2008). The eastern mosquitofish (*Gambusia holbrooki*) is found in these types of habitats at NASO. The ponds at NASO support several species of fish that were either intentionally stocked or released by fishermen. Largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), and channel catfish (*Ictalurus punctatus*) were stocked to provide recreational fishing opportunities.

Table 1: Historical Fish Species Observed at Naval Air Station Oceana

Date of Observation	Common Name	Species	Abundance	Length (mm)	Weight (g)
2012 Oceana Pond[1]	Black crappie	*Pomoxis nigromaculatus*	5	89–116	9–18
	Bluegill	*Lepomis macrochirus*	28	38–184	4–113
	Redear sunfish	*Lepomis microlophus*	16	144–223	49–72
	Warmouth	*Lepomis gulosus*	1	120	31
	Largemouth bass	*Micropterus salmoides*	13	93–410	12–1004
	Yellow perch	*Perca flavescens*	3	98–177	10–53
1994 Oceana Pond[2]	Bluegill	*Lepomis macrochirus*	74	102*	19*
	Black Crappie	*Pomoxis nigromaculatus*	2	134*	25*
	Largemouth bass	*Micropterus salmoides*	24	258*	396*
	Redear sunfish	*Lepomis microlophus*	16	105*	24*
	Pumpkinseed	*Lepomis gibbosus*	1	104*	17*
	Channel catfish	*Ictalurus punctatus*	1	225*	90*
1989 Borrow Pond[3]	Largemouth bass	*Micropterus salmoides*	14	163–430	61–1080
	Redear sunfish	*Lepomis microlophus*	17	98–218	18–120
	Bluegill	*Lepomis macrochirus*	77	100–149	19–56
	White perch	*Lepomis microlophus*	1	284	294
	Golden shiner	*Notemigonus crysoleucas*	1	240	145
	Common carp	*Cyprinus carpio*	1	730	4950
1990 Concrete Dump Pond[3]	Largemouth bass	*Micropterus salmoides*	25	80–390	8–800
	Bluegill	*Lepomis macrochirus*	55	129–178	37–97

Sources:

[1] Mark Edwards, *Comprehensive Water Quality Analysis and Tissue Analysis of Fish in Naval Air Station Oceana Pond* (2012).

[2] Gary Swihart, Louis Daniel, and Cynthia Otey, *An Assessment of Fishery Resources on Oceana Naval Air Station Virginia Beach, Virginia* (White Marsh, VA: October 1994).

[3] USFWS electrofishing data, *Fishery Management Report Fiscal Year 1989–1990 Naval Air Station, Oceana Virginia Beach, Virginia* (White Marsh, VA: May 1990).

* Average across survey(s)

No rare, threatened, or endangered fish species listed under the federal Endangered Species Act (ESA) have been identified at the Installation; however, blueback herring (*Alosa aestivalis*) and American eel (*Anguilla rostrata*) have been petitioned for listing with ranges that overlap NASO. American eel has been identified on the NASO Installation (Navy 2008). A 2013 status review by the National Marine Fisheries Service (NMFS) of blueback herring found that a listing under the ESA was not warranted (78 FR 48943-48994), however this determination continues to be controversial and could be revisited by regulators and petitioners. The American eel was petitioned for listing under the ESA in 2010. In 2011, the U.S. Fish and Wildlife Service (USFWS) issued a finding that listing of the species may be warranted, and initiated a status review (76 FR 60431-60444), which has not yet been completed.

Oceana Pond at NASO has been managed as a recreational fishery to varying degrees since the early 1990s (Navy 2014). In the early 1990s, 2,000 fingerling channel catfish, 150 trophy-sized largemouth bass (up to 6 lb. [3 kg]) and 50 channel catfish (up to 14 lb. [6 kg]) were stocked for a catch-and-release tournament. Active management at Oceana Pond includes periodic fish stocking; maintaining boat ramp; patrolling to ensure that recreational fishers have the appropriate permits; and conducting surveys of fish populations. Previous biological surveys indicate that the Installation supports a diverse warmwater fish population with excellent size classes of largemouth bass and good water quality. Fishing is a relatively popular outdoor recreation at NASO with an average of 123 fishing permits being sold annually by the Navy's Morale, Welfare & Recreation (MWR) division (Navy 2008). Portions of the streams and ponds at NASO are impaired for recreation and aquatic life use due to reported *Enterococcus* bacteria concentrations and low dissolved oxygen concentrations (VDEQ 2012). Recommendations for the management of fish resources, such as conservation of fish diversity, cooperation with state and federal agencies, and regular monitoring of natural resources, have been included in the most recent INRMP from 2014 (Navy 2014). The Navy also supports the protection of watersheds through initiatives such as establishing or enhancing riparian forest buffers along unprotected waterways.

2 ASSESSMENT METHODS

The purpose of this study was to perform fish community assessments on targeted streams and ponds located at NASO. An additional goal was to qualitatively characterize habitat and identify barriers to fish movement that may affect anadromous and catadromous species by performing a walk-over survey of the streams. In total, seven streams and two ponds were surveyed on a seasonal basis (spring, early summer, late summer, and fall); habitat and barrier surveys were conducted once. The resulting data and analyses presented here will help characterize existing fish populations and habitat within these Installations; this characterization will aid in ensuring compliance with applicable federal, state, and local statutes and regulations, and with Department of Defense (DOD) policies, instructions, and guidance.

2.1 WATERBODY SELECTION

Geographic Information System (GIS) layers were used to identify all freshwater stream reaches and ponds within the NASO boundaries. Identified waterbodies were cross-referenced with the U.S. Geological Survey (USGS) stream layer and the surface water course centerlines layer to focus only on freshwater streams (no marine or estuarine areas). A list of streams and ponds were selected during a site visit on 19 September 2013, based on data needs, accessibility, and scoping requirements. The streams and ponds listed in Table 2 represent those selected for evaluation during this survey (Figure 2).

Table 2: Streams and Ponds Surveyed at Naval Air Station Oceana

Waterbody type	Site ID	Name	Location and description
Streams	NASO-S1	Unnamed	Near VACAPES Pond, running parallel to northeast portion of runway; intermittent flow
	NASO-S2	Unnamed	Drains into residential area off of London Bridge Rd. northwest portion of runway; intermittent flow
	NASO-S3	Unnamed	Drains southwest portion of runway towards London Bridge Rd.; intermittent flow
	NASO-S4	Unnamed	Tributary of Golf Course Stream, east of Hornet Dr.
	NASO-S5	Unnamed	Tributary of Golf Course Stream, east of Hornet Dr.
	NASO-S6	Golf Course Stream	Lower Reach – below mitigation site; perennial flow
	NASO-S7	Golf Course Stream	Upper Reach – above mitigation site; perennial flow
Ponds	NASO-P1	Oceana Pond	East of Oceana Blvd.
	NASO-P2	VACAPES Pond	Off of Bells Rd. Gate

For consistency throughout this report, the streams (S1 to S7) and ponds (Oceana Pond [P1], VACAPES Pond [P2]) surveyed will be referred to by their assigned numbers, as shown in Table 2.

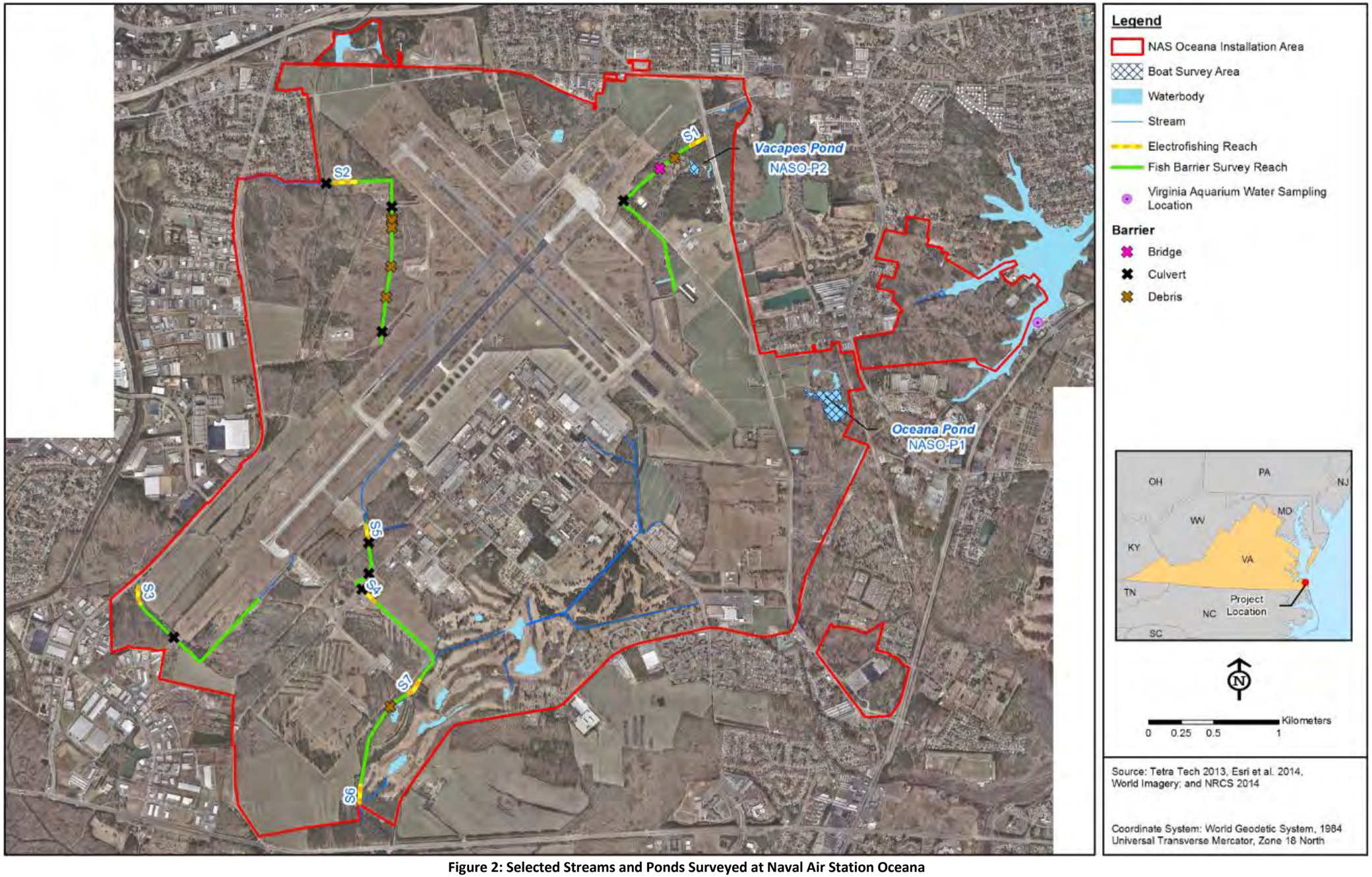

Figure 2: Selected Streams and Ponds Surveyed at Naval Air Station Oceana

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2.2 STREAMS

The stream survey methods consisted of a biological (fish) and physical habitat assessment, as modified from the U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols (RBP) developed by Barbour et al. (1999) (Appendix D). Fish surveys at all stream locations used backpack electrofishing methods in accordance with the modified RBP. The one-time habitat assessment used visual-based observations to quantify the conditions of the habitat. Water quality was collected seasonally.

2.2.1 HABITAT SURVEY

Most of the stream habitat assessment parameters are based on physical characteristics; therefore, the habitat characterization was conducted as a "one-time" characterization for each stream reach. Other parameters, such as water quality (*in-situ* and grab samples), flow, channel depth, wetted channel width, etc. are dynamic and were recorded during each visit.

The RBP habitat survey was performed once on each stream reach that was also sampled for the fish assessment by a small field team during a walk-over survey. Tetra Tech biologists attempted to walk the wadeable portions of each stream, ensuring that the 150-m survey reaches would capture a representative sample of stream features (e.g., riffles, runs, pools). Where applicable, natural fish barriers or habitat breaks were used to delineate the start or end of a reach.

For this study, Tetra Tech used the Habitat Assessment Field Data Sheets for Low Gradient Streams, as provided in Barbour et al. (1999) (see Appendix B for blank data sheets). A "score" was assigned to each of these categories for each surveyed reach (NASO-1 to NASO-7) so that relative comparisons can be made between reaches and streams (Table 3). Further detail on scoring and criteria used can be found in Barbour et al. 1999.

By assigning a score and condition category to the ten visual-based habitat assessment parameters described in Table 3, a stream can be assessed and given a total score related to its condition. Scores ranging from 0 to 20 were assigned to each of the ten visual-based habitat assessment parameters, with 0 being a "poor" score and 20 being an "optimal" score. After scoring all parameters, a final score was determined for each reach. The final score can range from 0 to 200 with a score of 0 to 59 representing a "poor" condition; 60 to 112 representing a "marginal" condition; 113 to 165 representing a "suboptimal" condition; and 166 to 200 representing an "optimal" condition. This rapid, qualitative physical habitat assessment was conducted at each NASO stream reach that was also assessed for fish populations. Water quality sampling methods were similar between streams and ponds, and are therefore described in Section 2.3.2.

Table 3 : Rapid Bioassessment Protocol (RBP) Parameters

RBP habitat parameter	Components analyzed in this survey
Physical characterization (one-time)	• Riparian and watershed land use • Stream origin and type • Riparian/canopy vegetation features • Instream parameters – channel width, depth, relative flow, high water mark, and substrate • Proportion of riffles, runs, and pools • Degree of channelization • Potential fish barriers (not part of RBP, but included in this survey)

Water quality (each visit)	• *In situ* measurements, such as water temperature, dissolved oxygen, and conductivity were collected for each stream reach.
	• Grab samples were collected to measure a total of three parameters (listed below) for each stream reach:
	  ○ Total Nitrogen (TN)
	  ○ Total Phosphorus (TPhos) & ortho-Phosphate (SRP) – Method 365.1
	  ○ Total Suspended Solids (TSS) – Method SM 2340D

Habitat features (one-time)	• Large woody debris/debris dams • Aquatic vegetation • Available cover
Visual-based habitat assessment (low gradient streams) (one-time)	• Epifaunal substrate/available cover • Pool substrate characterization • Pool variability • Sediment deposition • Channel flow status • Channel alteration • Channel sinuosity • Bank stability • Bank vegetative protection • Riparian vegetative zone width

2.2.2 BARRIER SURVEY

A combination of assessment protocols was used to identify potential barriers to fish migration within NASO streams. Fish barrier surveys are typically implemented to assess the potential for habitat use by migratory fishes that may encounter obstacles in their migration, such as culverts, debris dams, beaver dams, or other physical blockages to migration. Additional data forms were included to facilitate the fish barrier survey as a supplement to the modified RBP survey. The fish barrier survey and accompanying data forms were adapted from a similar survey on the Rappahannock River (McIninch and Garman 2004, 1999), which were also applied to a stream habitat survey at NSA Northwest Annex (Tetra Tech and Stell 2014). Additional culvert and bridge data forms were adapted from the Vermont Agency of Natural Resources (2009). Copies of field data forms are included in Appendix C. During the modified RBP survey, each of the potential barriers to fish migration were inventoried for as much of a stream as possible, beyond the reaches assessed for habitat and fish. The entire stream was walked by two field scientists starting at the downstream end of each stream (at the installation boundary, or confluence

with another stream) and walking upstream until reaching an apparent habitat break or other boundary. Tetra Tech staff walked the entire wadeable length of each stream to the furthest extent practical to record and characterize potential barriers to fish migration. Each bridge or culvert crossing and other potential barrier (e.g., beaver dam or large debris dam) was inventoried during the survey and physical measurements of the barrier were obtained in accordance with the data sheet. Photographs were also taken for each potential barrier and included in the photograph log (Appendix A).

2.2.3 FISH SURVEY

Fish surveys were conducted at seven stream sites within NASO. The goal was to sample all seven sites during each sampling event, but high water conditions precluded the fish survey at NASO-S6 and NASO-S7 in April. The fish sampling methods were modified from the EPA's RBP for fish (Barbour et al. 1999). Field biologists used the 150 meters (m) fixed-distance sampling as outlined in the RBP to collect a representative sample of the fish assemblage from the appropriate habitat composition (e.g., riffles, runs, pools) (further details described in USEPA 2007). Where applicable, natural fish barriers or habitat breaks were used to delineate the start or end of a reach.

The downstream start point at each surveyed reach was marked with a temporary pin flag and recorded as a GPS point. A tape measure was used to delineate the 150-m reach of the stream. The upstream end of the reach was also marked with a temporary pin flag and a GPS point. Water quality measurements, including temperature, specific conductance, dissolved oxygen, and percent oxygen saturation, were obtained at the downstream start point of each surveyed reach.

A Smith-Root LR-24 backpack electrofishing unit was used for all stream sites. The LR-24 was calibrated through the "auto-setup" function; then settings such as voltage, frequency, and duty-cycle were fine-tuned according to water parameters to maximize the effectiveness of the electrofishing unit and safety of the fish and operator. A single-pass protocol was used. Backpack electrofishing protocols were consistent with those used by the U.S. Fish and Wildlife Service (USFWS 2010) and the American Fisheries Society (AFS 2008). The survey began at the downstream end of each reach at physical fish barriers to prevent fish escape, as recommended by the RBP protocol. The fish survey continued upstream in a bank-to-bank sweeping technique, covering all wadeable habitats within the reach. Effort was measured in duration (seconds) of active electrofishing, or "trigger" time. Variation between reaches is typical due to stream width, depth, and habitat types.

At the end of the reach, fish were identified and counted. A subsample of up to 30 specimens of each species were measured (total length [TL] to the nearest millimeter [mm]], mass in grams [g]), prior to being released back into the stream. All individuals were observed for any deformities, erosion, lesions, or tumors (DELT anomalies). All individuals were identified to lowest practicable taxonomic level in the field based on external characteristics using taxonomic keys, including "The Freshwater Fishes of Virginia" (Jenkins and Burkhead 1994). Page et al. (2013) was used to ensure accurate common and scientific fish names.

2.3 PONDS

Similar to streams, most of the pond habitat assessment parameters are based on physical characteristics; therefore the habitat characterization was conducted as a "one-time" characterization for each pond. Other parameters, such as water quality (*in-situ* and grab samples) and vegetation are dynamic and were recorded during each visit.

The methods used for pond surveys for this study consisted of a biological (fish) assessment, as well as a physical habitat assessment, within a similar framework as outlined above for streams.

2.3.1 HABITAT SURVEY

The pond habitat assessment at NASO included a site-walk (or by boat) around the perimeter of each pond to collect qualitative habitat data. Data sheets modified from the EPA National Lakes Assessment Program (USEPA 2012) were used to support the qualitative assessment of the ponds, by characterizing the shoreline/littoral zone, macrophytes, and water quality (see Appendix B). Table 4 lists the parameters included in the pond habitat assessment. These data were used to develop an overall assessment of fisheries habitat for the selected NASO ponds.

Table 4: Pond Habitat Survey Parameters

Pond habitat parameter	Components analyzed in this survey
Physical characterization (one-time)	• Shoreline and watershed land use • Pond origin and type • Inlet/outlet stream(s) • Shoreline vegetation features • Hydrology – depth, high water mark, modifications, and substrate • Shoreline stability/erosion

Water quality (seasonal)	• *In situ* measurements, such as water temperature, dissolved oxygen, and conductivity was collected from the middle, or deepest point, of each pond.
	• Grab samples were collected to measure a total of three parameters (listed below) for each stream reach:
	  ○ Total Nitrogen (TN)
	  ○ Total Phosphorus (TPhos) & ortho-Phosphate (SRP) – Method 365.1
	  ○ Total Suspended Solids (TSS) – Method SM 2340D

Habitat features (one-time)	• Aquatic vegetation • Available cover

2.3.2 WATER QUALITY

Water quality was recorded *in situ* at every stream and pond during each sampling event, using a hand held multi-parameter meter (YSI 556). Parameters measured included water temperature (degrees Celsius [°C]), dissolved oxygen (milligrams per liter [mg/L] and percent [%] saturation), pH, and conductivity (milliSiemens per centimeter [mS/cm]).

Additionally, water grab samples were obtained with a horizontal water sampler in ponds and submitted for laboratory analyses at TestAmerica Laboratories Inc. in Savannah, GA. Laboratory analysis measured total nitrogen (TN), total phosphorus (TPhos), ortho-phosphate (SRP), and total suspended solids (TSS). TN was measured using EPA Method 351.2, as well as a calculated method. TPhos was analyzed in accordance with EPA Method 365.4. SRP analysis used EPA Method 365.1. TSS was measured using SM 2540D.

2.3.3 FISH SURVEY

Fish surveys at all pond locations used boat electrofishing, with hook-and-line as a back-up option. Both NASO-P1 and NASO-P2 were most effectively sampled by electrofishing boat, which occurred April/May, June, August, and October.

A 12-ft. jon-boat equipped with a Smith-Root 1.5 KVA pulse box electrofishing unit was used to sample fish inhabiting these ponds. In general, boat electrofishing protocols were consistent with those used by the USFWS (USFWS 2010) and the American Fisheries Society (AFS 2008). Boat electrofishing occurred in and along littoral habitats, targeting structure and beds of submerged aquatic vegetation. Stunned fish were captured and stored in a livewell until they were processed at the end of the survey.

Qualitative hook-and-line methods were also used to provide supplementary qualitative data for sportfish populations; therefore, these methods included gear and level of effort typically used by recreational fishers. Hook and line surveys were performed in the West Concrete Dump Pond and East Concrete Dump Pond on 14 August and 02 October during the 2014 sampling efforts. Each hook and line survey was conducted for 45 minutes.

At the end of each survey (for each method), fish were identified and counted. A subsample of up to 25 specimens of each species were measured (TL to the nearest mm), prior to being released back into the pond. All individuals were observed for any deformities, erosion, lesions, or tumors (DELT anomalies). All individuals were identified to lowest practicable taxonomic level in the field using the same resources as described for streams in Section 2.2.3.

2.4 DATA ANALYSIS

Field data were transferred from field data sheets to a Microsoft Excel spreadsheet. Metrics calculated from the data included catch per unit effort (CPUE) and a species diversity index. CPUE allows for a standardization of the fishing effort across streams, which enables comparisons where effort was not consistent. CPUE was calculated by dividing the total number of fish collected at each stream by the total sampling time (in seconds) of each stream. Species richness, commonly denoted as *R*, is simply the number of different species present in the dataset. A diversity index allows for comparisons of species diversity among multiple locations (streams in this case). The Simpson index (λ) measures the degree of concentration and is calculated by:

$$\lambda = \sum_{i=1}^{R} {p_i}^2$$

where p_i is the proportional abundance of each species within each sampling reach (number of individuals of species *i*, divided by the total number of individuals [*n*] in each sampling reach) and *R* is species richness. Values of λ range from 0 to 1, with lower values representing higher diversity. Another diversity parameter that is often used is the Shannon-Wiener diversity index (*H'*), which is calculated by using the proportional abundance of each species observed in the sample, as follows:

$$H' = -\sum_{i=1}^{R} p_i \cdot \ln p_i$$

In this equation, p_i is again the proportional abundance of each species and *R* is species richness. The resulting *H'* values are the Shannon-Wiener diversity index values for each sampling reach, with higher values corresponding to greater diversity.

3 RESULTS

In general, fish surveys encountered a wide range of species, with 22 species captured in the NASO streams and 10 species in the NASO ponds. NASO stream surveys captured over 1,300 individual fishes with the most abundant species being pirate perch, eastern mosquitofish, and bluegill, respectively. The average time spent electrofishing the NASO streams was 1,536 seconds. NASO ponds yielded similar total abundance as NASO streams with over 1,100 individual fishes captured during the pond electrofishing efforts. The most abundant species were the recreationally important bluegill, largemouth bass, and American eel in order of abundance. The average time spent electrofishing the NASO ponds was 3,470 seconds. All fishes collected from the NASO stream and pond sampling efforts are shown in Table 5.

Table 5: All Fishes Collected from the 2014 NASO Stream and Pond Sampling

Common Name	Species	*NASO*	
		Streams	Ponds
American Eel	*Anguilla rostrata*	●	●
Banded Sunfish	*Enneacanthus obesus*	●	
Black Bullhead	*Ameiurus melas*	●	
Black Crappie	*Pomoxis nigromaculatus*	●	●
Bluegill	*Lepomis macrochirus*	●	●
Bluespotted Sunfish	*Enneacanthus gloriosus*	●	
Bowfin	*Amia calva*	●	
Brown Bullhead	*Ameiurus nebulosus*	●	
Common Carp	*Cyprinus carpio*	●	
Eastern Mosquitofish	*Gambusia holbrooki*	●	●
Eastern Mudminnow	*Umbra pygmaea*	●	●
Eastern Silvery Minnow	*Hybognathus regius*	●	
Gizzard Shad	*Dorosoma cepedianum*	●	
Golden Shiner	*Notemigonus crysoleucas*	●	
Green Sunfish	*Lepomis cyanellus*	●	
Largemouth Bass	*Micropterus salmoides*	●	●
Pirate Perch	*Aphredoderus sayanus*	●	
Pumpkinseed	*Lepomis gibbosus*	●	●
Redear Sunfish	*Lepomis microlophus*		●
Redfin Pickerel	*Esox americanus*	●	
Warmouth	*Lepomis gulosus*	●	●
Yellow Bullhead	*Ameiurus natalis*	●	
Yellow Perch	*Perca flavescens*	●	●
Unidentified Juvenile Sunfish	*Centrarchidae sp.*	●	●

3.1 STREAMS

3.1.1 HABITAT

The habitat and barrier surveys were conducted across two survey events from 29–30 April and 03–04 June 2014, with NASO-S1 through -S5 surveyed during the April event and NASO-S6 and S7 surveyed during the June survey event. All of the reaches were 150 m in length. The reach locations are shown in Figure 2. Table 6 highlights the physical characteristics of the stream, with full results of the habitat survey and RBP assessment provided in Appendix C.

Overall, the NASO streams were mostly perennial, originating as runway drainage. Only S3 exhibited ephemeral characteristics, with a dry stream channel noted in June (See Photo 00087, Appendix A). They were most often highly channelized and surrounded by forest, open field, and military lands, with trees providing partial to full shade. Nearly all of the banks were stable with minimal erosion or scouring within the surveyed reach. None of the surveyed reaches showed signs of non-point source pollution, or irregular odors or oils in the water and sediment. However, areas of fine-grained sedimentation in the stream channel were prevalent in S7 (see photo DSCF0149, Appendix A), suggesting an upstream or riparian source of erosion/sediment transport.

The results of the physical habitat surveys of NASO streams showed that they are highly disturbed and do not offer optimal habitat for aquatic organisms (Table 7). Most of the surveyed stream reaches fell within the "marginal" category, with the exception of NASO-S1 and S3, which were characterized as better "suboptimal" habitat. Most streams lacked suitable pool habitat, greatly limiting sufficient habitat variability throughout the surveyed streams. Channel sinuosity was a second parameter that most surveyed reaches lacked because of the channelization of each stream section. This also contributes to the lack of pool habitat throughout most reaches as well. Generally, NASO streams scored well on bank stability, falling within the "optimal" and "suboptimal" categories; although NASO-S6 scored in the "marginal" category (Table 7). Fish barriers are presented in Table 8.

NASO-S1. This reach averaged 6.6 m wide, and ranged from 0.1 to 0.6 m deep and was highly channelized. This reach was a drainage channel for the runway, and was surrounded by forest, field, military, and commercial use. The dominant riparian vegetation was a mix of scrub oak and pine, which provided a shaded canopy. The morphological stream types that comprised the reach were: 90% run, 5% riffle, and 5% pool. The water at NASO-S1 was opaque with very little rooted submergent vegetation throughout the reach. The bottom was soft and mostly consisted of silt (60%) and sand (30%), with some clay. Abundant organic detritus and muck-mud were present. NASO-S1 scored a 122 based on the RBP, which is considered "suboptimal."

The NASO-S1 barrier survey reach covered from Oceana Boulevard up to the road crossing/culvert near the VACAPES facility. There were three potential fish passage barriers encountered: a debris dam, a bridge, and a culvert; all had medium to high potential for fish passage. Debris dam #1, composed of leaf litter and small woody debris, had a medium likelihood of passage (Photo DSCF0040). Bridge #1 had a high likelihood of fish passage, due to its high clearance and lack of blockage (Photo DSCF0058). Culvert #1 also had a high potential for passage, because the concrete structure was at grade and was not obscured up or downstream (Photo DSCF0051). An additional three partial debris dams (not blocking the channel width) were observed within the surveyed reach.

NASO-S2. Similar to the S1 reach, S2 was also highly channelized and drained storm water from the runway. It was between 4 and 5 m wide, and 0.3 to 1.0 m deep, surrounded by forest and military uses.

Mixed hardwoods provided shade to most of the reach, which was dominated by runs (95%) with some pools (5%). The water at NASO-S2 was mostly clear to slightly turbid with no aquatic vegetation present. The bottom consisted almost entirely of sand (90%) with small portions of detritus and muck-mud present throughout the reach. With an RBP score of 91, this section was considered "marginal."

The NASO-S2 barrier survey covered from the western perimeter fence at the culvert beneath Sludge Rd., where "Boom 5" was deployed to prevent debris from clogging the culvert that drains this stream outside of the installation. There were nine potential fish passage barriers encountered: four culverts and five debris dams. Four of the barriers had no potential for fish passage, except for American eel which can easily climb instream or overland barriers. Culvert #1 showed no potential for fish passage, primarily due to the 0.3 m vertical drop from the culvert mouth to the stream below (Photo DSCF073). Debris dam #1 in NASO-S2 had no potential for fish passage, with a barrier height of 0.5 m (Photo DSCF087). NASO-S2's debris dam #4 had no potential for fish passage, with a 0.2 m barrier height (Photo DSCF0103). Culvert #4 appeared to prevent fish passage, due to a 1.2 m wide barrier (Photo DSCF0107). Culvert #2, which actually had two culverts, had a medium likelihood for fish passage, since there was no vertical drop from the concrete structures (Photo DSCF075). The third culvert in the S2 reach (culvert #3) had high potential for fish passage despite some upstream blockage. This culvert consisted of two culverts, one of which had an obstruction, but the other was clear (Photos DSCF065 and 66). Debris dams #2 and #3, both composed of leaf litter, showed low potential for fish passage, due to the 0.3 and 0.1 m respective barrier heights(Photos DSCF095 and 98) . Small woody debris and leaf litter made up debris dam #5, which had a barrier height of 0.2 m, which created a low potential for fish passage (Photo DSCF105). An additional 18 partial debris dams (not blocking the channel width) were observed within the surveyed reach.

NASO-S3. This reach was a channelized, shallow (0.1-0.2 m) stream about 2.8 m wide. This shaded portion drained storm water from the runway, and was bordered by forest, field, and military land. Runs comprised 100% of this reach, which had stained, turbid water. A very small portion of the reach (1%) contained rooted submergent aquatic vegetation. The bottom was primarily sand (75%) with pockets of silt and some clay mixed throughout. The RBP characterized this stretch as "suboptimal," with a score of 122.

The NASO-S3 barrier survey reach covered from the western perimeter fence, upstream of the culvert beneath London Bridge Rd., upstream to the runway clearing. There was one potential fish passage barrier encountered on this stream within the installation. One steel, double-arch culvert (culvert #5) was partially obscured, but was deemed to be highly passable for fish (Photo DSCF062). An additional five partial debris dams (not blocking the channel width) were observed within the surveyed reach.

NASO-S4. This reach was a 5.0 m-wide, highly channelized stream about 1.1 m deep, fed by storm water from the runway and surrounded by industrial and military land, with no forest canopy. S4 was located upstream from the confluence of the Golf Course Stream, alongside a former landfill. S3 was a continuous, straight run. It contained abundant vegetation (50% coverage), consisting of rooted submergent and floating algae. The water was opaque. The bottom was soft, consisting mostly of silt (70%) and sand (20%), with abundant organic detritus and muck-mud. A score of 100 from the RBP indicated the stream was "marginal" in quality.

The NASO-S4 barrier reach covered from the split of the Golf Course Stream with S4, up to the Hornet Drive culvert, marking the beginning of S5. There were no partial or full barriers to fish passage observed within the surveyed reach.

NASO-S5. This reach was also channelized, fed by drainage from the runway and surrounded by industrial and military land. S5 was located immediately upstream from S4, where the stream flows through a culvert beneath Hornet Dr. This reach was about 2.1 m wide and 0.3 m deep. The surrounding landscape consisted of military land (i.e., runway) and forest. The hardwood trees partly shaded this stream section, which was primarily runs (95%) with some pools (5%). Rooted emergent and floating algae was present in 50% of the reach. Clear water was underlain by substrate made up primarily of clay (70%), with some silt (20%) and sand (10%). The RBP score of 109 indicated that the habitat quality was "marginal."

The NASO-S5 barrier survey reach began at the Hornet Dr. culvert marking the end of the S4 reach, continuing upstream to the runway clearing. The first barrier, culvert #1, was a triple-pipe culvert with a gradual riffle down to the stream, creating a medium potential for fish passage (Photo DSCF012). The second barrier, culvert #2, was a four-pipe culvert with a gradual riffle down to the stream, creating a medium potential for fish passage. The third barrier, culvert #3, was a double-pipe culvert that was deemed to be highly passable for fish (Photo DSCF023). An additional partial debris dam (not blocking the channel width) was observed within the surveyed reach.

NASO-S6. This reach was a channelized stream section, about 5.0 m wide and 0.3 m deep. This reach is located downstream of the Aeropines wetland mitigation site, on the Golf Course Stream, beginning at the perimeter fence. S6 was surrounded by mixed pine/hardwood forest. Trees such as red maple (*Acer rubrum*), loblolly pine (*Pinus taeda*), and sweet gum (*Liquidambar*) shaded this reach. S6 only contained runs. Approximately 6 square meters of large woody debris occupied this reach. No aquatic vegetation was present. The water was opaque and slightly turbid, with a mix of clay (50%), sand (30%), and silt (20%) on the bottom, with abundant organic detritus and muck-mud present throughout. The stream quality was "marginal" according to the RBP score of 85.

The NASO-S6 barrier survey reach covered from the southern perimeter fence, upstream to the first opening to the Aeropines mitigation wetland, where the S7 reach began. There was a single debris dam barrier composed of woody debris (debris dam #1), but it was considered to be highly passable for migratory fish. There were no partial debris dams observed within the surveyed reach.

NASO-S7. This reach was channelized and originated in swamp and bog habitat. This reach was about 6.0 m wide and 0.2 m deep. This reach is located upstream of the Aeropines wetland mitigation site, on the Golf Course Stream. Surrounded by military land and forest, this reach was shaded mostly by red maple, sweet gum, and privet (*Ligustrum sp.*). S7 consisted primarily of pool habitat (80%), but also contained riffles (10%) and runs (10%). The dominant type of aquatic vegetation was rooted submergent, present in about 10% of the reach. The bottom was a mix of sand (75%) and silt (20%), with small amounts of detritus and muck-mud organic material. The S7 reach was classified as "marginal," scoring 101 with the RBP assessment.

The NASO-S7 barrier survey began at the first opening to the Aeropines mitigation wetland and continued to the confluence where the Golf Course Stream split from the S4 stream. There were no partial or full barriers to fish passage observed within the surveyed reach.

Table 6: Physical Habitat Assessment Data for Each Stream Reach Surveyed at Naval Air Station Oceana

Reach	NASO-S1	NASO-S2	NASO-S3	NASO-S4	NASO-S5	NASO-S6	NASO-S7
Date (2014)	29 April	29 April	29 April	30 April	30 April	04 June	04 June
Weather	Showers, 100% cloud cover	75% cloud cover, 18°C	100% cloud cover	70% cloud cover	70% cloud cover	Clear and sunny, 29°C	25% cloud cover, 28°C
Previous 24 hours	100% cloud cover, rain showers within past week, 18°C	100% cloud cover, rain showers within past week, 17°C	18°C, rain within past 24 hours	Occasional showers, 18°C	Occasional showers, 17°C	Rain, 21°C	25% cloud cover, rain within last week, 21°C
Watershed features	Predominantly mixed hardwood forest, field/pasture, commercial land use on Oceana Blvd.	Mixed hardwood forest with military use outside of riparian zone	Forest with field/pasture or military use outside of riparian zone	Industrial or military use outside of riparian zone	Hardwood forest military runway	No local watershed erosion, forested landscape	No local watershed erosion, forested landscape with military use in riparian zone
Reach length	150 m	150 m	150 m	150 m	150 m	150 m	150 m
Stream width	6.6 m	4-5 m	2.8 m	5 m	2.1 m	5 m	6 m
Stream depth	0.1 m	0.3-1.0 m	0.1-0.4m	1.1 m	0.3 m	0.3 m	0.2 m
High-water mark	0.5 m	0.4 m	0.5 m	0.5 m	0.9 m	0.7 m	0.8 m
Percent riffle	5%	0%	0%	0%	0%	0%	10%
Percent run	90%	95%	100%	100%	95%	100%	80%
Percent pool	5%	5%	0%	0%	5%	0%	10%
Channelization	high	high	high	high	high	high	high
Large woody debris	None	None	None	None	None	Sparse (6 m^2)	None
Dominant vegetation	Rooted Submergent	None	Rooted submergent	Floating algae and rooted submergent	Floating algae and rooted submergent	None	Rooted submergent
Percent of reach with vegetation	5%	0%	1%	50%	50%	0%	10%

Reach	NASO-S1	NASO-S2	NASO-S3	NASO-S4	NASO-S5	NASO-S6	NASO-S7
Dominant inorganic substrate (%)	Silt (60%)	Sand (90%)	Sand (75%)	Silt (70%)	Clay (70%)	Clay (50%)	Sand (75%)
Secondary inorganic substrate (%)	Sand (30%)	Silt (10%)	Silt (5%)	Sand (20%)	Silt (20%)	Sand (30%)	Silt (20%)
Tertiary inorganic substrate (%)	Clay (10%)	--	Clay (5%)	Silt (10%)	Sand (10%)	Silt (20%)	Clay (5%)
Dominant organic substrate (%)	Muck-mud (50%)	Detritus (25%)	Detritus (25%)	Muck-mud (50%)	Muck-mud (40%)	Detritus (75%)	Detritus (2%)
Secondary organic substrate (%)	Detritus (40%)	Muck-mud (25%)	Muck-mud (5%)	Detritus (50%)	Detritus (20%)	Muck-mud (75%)	Muck-mud (2%)

NOTE: Reference photographs are located in Appendix A

Table 7: Physical Habitat Assessment Scores and Condition Categories for Each Surveyed Reach within Naval Air Station Oceana Streams in the 2014 Surveys

Habitat parameter		NASO-S1		NASO-S2		NASO-S3		NASO-S4		NASO-S5		NASO-S6		NASO-S7	
		Score	Condition	Score	Condition	Score	Condition	Score	Condition	Score	Condition	Score	Condition	Score	Condition
Epifaunal substrate/available cover		9	Marginal	2	Poor	14	Sub-optimal	8	Marginal	9	Marginal	7	Marginal	8	Marginal
Pool substrate characterization		10	Marginal	6	Marginal	8	Marginal	11	Sub-optimal	14	Sub-optimal	6	Marginal	12	Sub-optimal
Pool variability		6	Marginal	2	Poor	1	Poor	1	Poor	3	Poor	1	Poor	8	Marginal
Sediment deposition		15	Sub-optimal	6	Marginal	19	Optimal	16	Optimal	15	Sub-optimal	12	Sub-optimal	9	Marginal
Channel flow status		17	Optimal	19	Optimal	19	Optimal	19	Optimal	18	Optimal	16	Optimal	7	Marginal
Channel alteration		13	Sub-optimal	7	Marginal	13	Sub-optimal	6	Marginal	7	Marginal	6	Marginal	8	Marginal
Channel sinuosity		2	Poor	1	Poor	1	Poor	1	Poor	3	Poor	1	Poor	7	Marginal
Bank stability	Left (east)	9	Optimal	9	Optimal	9	Optimal	9	Optimal	7	Sub-optimal	4	Marginal	7	Sub-optimal
	Right (west)	9	Optimal	9	Optimal	9	Optimal	9	Optimal	7	Sub-optimal	4	Marginal	7	Sub-optimal
Vegetative protection	Left (east)	7	Sub-optimal	8	Sub-optimal	9	Optimal	7	Sub-optimal	8	Sub-optimal	7	Sub-optimal	7	Sub-optimal
	Right (west)	7	Sub-optimal	8	Sub-optimal	9	Optimal	7	Sub-optimal	8	Sub-optimal	7	Sub-optimal	7	Sub-optimal
Riparian vegetative zone	Left (east)	9	Optimal	7	Sub-optimal	4	Marginal	3	Marginal	5	Marginal	7	Sub-optimal	9	Optimal
	Right (west)	9	Optimal	7	Sub-optimal	7	Sub-optimal	3	Marginal	5	Marginal	7	Sub-optimal	5	Marginal
TOTAL SCORE and OVERALL CONDITION CATEGORY		**122**	**Sub-optimal**	**91**	**Marginal**	**122**	**Sub-optimal**	**100**	**Marginal**	**109**	**Marginal**	**85**	**Marginal**	**101**	**Marginal**

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Table 8: Characteristics of Potential Barriers to Fish Migration in the Surveyed Reaches of Naval Air Station Oceana

Reach	NASO S1			NASO-S2									NASO-S3	NASO-S5			NASO-S6
Barrier Type and ID	**Debris-1**	**Bridge-1**	**Culvert-1**	**Culvert-1**	**Culvert-2**	**Culvert-3**	**Debris-1**	**Debris-2**	**Debris-3**	**Debris-4**	**Debris-5**	**Culvert-4**	**Culvert-1**	**Culvert-1**	**Culvert-2**	**Culvert-3**	**Debris-1**
Date	29 April	29 April	29 April	30 April	30 April	30 April	02 June	02 June	02 June	02 June	02 June	02 June	29 April	28 April	28 April	29 April	12 August
Barrier type	Debris dam	Timber with steel support	Culvert	Culvert	Culvert	Culvert	Debris dam	Debris dam	Debris dam	Debris dam	Debris dam	Culvert	Culvert	Culvert	Culvert	Culvert	Debris Dam
GPS Location (Lat., Long.)	36.8325277 -76.0151164	36.8317516 -76.0164051	38.8295198 -76.0194649	36.8304912 -76.0450682	36.8305038 -76.0450687	36.8289422 -76.0394091	36.8281393 -76.0393571	36.8279724 -76.0393571	36.8274773 -76.0393642	36.8248069 -76.0394210	36.8226862 -76.0397912	36.8202766 -76.0401344	36.7989972 -76.0577251	36.8024638 -76.0416174	36.8035519 -76.0410649	36.8056769 -76.0410915	36.7943738 -76.0390406
Photographs	DSCF0040	DSCF0058	DSCF0051	DSCF0073	DSCF0075	00065, 00066	DSCF0087	DSCF0095	DSCF0098	DSCF0103	DSCF0105	DSCF0107	DSCF0062	DSCF0012	DSCF0012	DSCF0023	No photo available
Barrier height	0.6 m streambed ; 0.4 m above	2.5 m	n/a	1.0 ft.	None	--	0.5 m	0.3 m	0.1 m	0.2 m	0.2 m	1.2 m	1.3m/1.1 m	n/a	n/a	n/a	0.3 m
Vertical water drop	0.2 m	n/a	None	Approx. 0.3 m	None	None	0.1 m	NONE	NONE	NONE	NONE	NONE	None	0.5 m	None	None	n/a
Channel wetted width	4.2 m	3.4 m	2.5 m	3.6 m	3.5 m	5.0 m	4.2 m	3.2 m	3.6 m	3.2 m	2.5 m	1.3 m	4.2 m	--	--	--	4.0 m
Structure width/culvert length	4.2 m	8.4 m	1.5 m	10 m long	16.7 m long	10.0 m	4.2 m	3.2 m	3.6 m	3.2 m	2.5 m	10 m	--	--	--	--	4.0 m
Structure span/culvert diameter	n/a	n/a	1.5m	3.3 m	n/a	1.0m	0.5 m	0.8 m	0.3 m	0.3 m	0.4 m	1.3 m	0.9m/1.0 m	1.5 m	1.1 m diameter	1.1 m diameter	1.8 m
Structure clearance	n/a	n/a	--	2.9 m	1.4 m	0.6 m	--	--	--	--	--	~1.3 m	--	n/a	n/a	n/a	--
Material	Woody debris, leaf litter	Timber	Concrete	Metal	Concrete	Concrete	small woody debris, leaf litter	leaf litter	leaf litter	small woody debris, leaf litter	small woody debris, leaf litter	plastic	Metal	Concrete	Concrete	Concrete	Woody debris
Number of arches/culverts	n/a	n/a	1 arch	1 arch	2 arch	2	n/a	n/a	n/a	n/a	n/a	2	2 arches	3 arches	4 arches	2 arches	n/a
Opening obscured upstream?	No	No	No	No	No	Yes	n/a	n/a	n/a	n/a	n/a	n/a	Yes	No	Yes	No	No
Pool immediately downstream?	Yes	No	No	Yes	No	Yes	No	No	--	No	No	No	No	Yes	Yes	Yes	No
Max pool depth - downstream	0.7 m	n/a	n/a	0.3 m	n/a	0.3 m	--	--	--	--	--	--	n/a	0.5 m	0.5 m	1.0 m	--
Water depth in structure	--	0.4 m	0.4 m	0.15 m	--	0.4 m							0.5 m	1.0 m, 0.5 m, 0.5	0.1-0.2 m	0.2 m	--
Bank erosion - left	No	Yes	Yes	No	Yes	No	No	No	No	No	No	No	No	Yes	No	No	Yes
Bank erosion - right	No	Yes	Yes	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	Yes
Armoring - left	No	No	No	Yes	Yes	Yes	--	--	--	--	--	No	None	Yes	Yes	Yes	No
Armoring - right	No	No	No	Yes	Yes	Yes	--	--	--	--	--	No	None	Yes	Yes	Yes	No
Scour - left	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Scour - right	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Beaver activity?	No	No	No	No	No	No	No	No	No	--	--	No	No	No	No	-	No

Reach	NASO S1			NASO-S2									NASO-S3	NASO-S5			NASO-S6
Barrier Type and ID	**Debris-1**	**Bridge-1**	**Culvert-1**	**Culvert-1**	**Culvert-2**	**Culvert-3**	**Debris-1**	**Debris-2**	**Debris-3**	**Debris-4**	**Debris-5**	**Culvert-4**	**Culvert-1**	**Culvert-1**	**Culvert-2**	**Culvert-3**	**Debris-1**
Beaver dam nearby? - downstream (distance)	No	No	No	No	No	No	No	No	No	No	No	No	No	n/a	n/a	n/a	n/a
Partial debris-dam tally for reach	3			18									5	1			0
Remarks	Medium potential for fish passage	High potential for fish passage	High potential for fish passage	No potential for fish passage. Concrete outside and first 10 ft. of culvert eroded away	Medium potential for fish passage. Two culverts separated by 2 ft. space.	High potential for fish passage. One 12 inch wide pipe in stream and one 8 inch pipe over stream	Perched Dam						High potential for fish passage	Medium potential for fish passage	Medium potential for fish passage, opening is partially obscured upstream	High potential for fish passage	High Potential for fish passage

NOTE: Reference photographs are located in Appendix A

3.1.2 FISH

A total of 1,350 fishes, represented by 22 species, were collected from electrofishing the seven NASO stream reaches across four different time periods (Table 9). All individuals were positively identified at the species level in the field with the exception of juvenile gizzard shad (*Dorosoma cepedianum*), which were vouchered on their first occurrence and later verified in the laboratory. Fish sampling at each stream reach was an average of 1,536 s (Table 9).

Table 9: Backpack Electrofishing Effort at Naval Air Station Oceana by Sampling Period and Stream

Stream ID	Sampling duration (seconds)			
	Apr	Jun	Aug	Sep/Oct
NASO-S1	2,028	1,680	1,237	1,793
NASO-S2	3,083	1,314	1,471	1,758
NASO-S3	1,737	233	461	801
NASO-S4	2,880	1,036	1,206	1,845
NASO-S5	1,481	1,159	2,646	966
NASO-S6	Not surveyed	1,524	1,830	1,632
NASO-S7	Not surveyed	1,608	1,217	1,322

Pirate perch (*Aphredoderus sayanus*) was the most abundant species, representing 24.7% of the total catch, followed by eastern mosquitofish (*Gambusia holbrooki*) at 16.4%, and bluegill (*Lepomis macrochirus*) at 14.4%. The frequency of occurrence for each species was different in each of the seven surveyed streams (Table 10). There were no fish species that were universally found in all seven surveyed stream reaches. Banded sunfish (*Enneacanthus obesus*), American eel (*Anguilla rostrata*), bluegill, eastern mudminnow (*Umbra pygmaea*), largemouth bass (*Micropterus salmoides*), pirate perch, and redfin pickerel (*Esox americanus*) occurred in six of seven streams. Eastern mosquitofish, golden shiner (*Notemigonus crysoleucas*), bluespotted sunfish (*Enneacanthus gloriosus*), pumpkinseed (*Lepomis gibbosus*), and yellow bullhead (*Ameiurus natalis)* occurred in five of seven streams. All other species occurred in only one to four streams. The overall length distributions for most species were comparable among all surveyed streams.

Table 10: Number, Relative Abundance, Frequency of Occurrence, and Length of All Fishes Collected in Naval Air Station Oceana Streams

Common name	Scientific name	Number of individuals	Total relative abundance (%)	Range of total length (mm)	Range of mass (g)
Pirate perch	*Aphredoderus sayanus*	333	24.7%	29-113	0.3-22.5
Eastern mosquitofish	*Gambusia holbrooki*	222	16.4%	20-56	0.1-2.0
Bluegill	*Lepomis macrochirus*	194	14.4%	38-162	1-87.5
Eastern mudminnow	*Umbra pygmaea*	133	9.9%	25-109	0.1-16.1
Banded sunfish	*Enneacanthus obesus*	90	6.7%	36-108	1.0-24.7
Pumpkinseed	*Lepomis gibbosus*	84	6.2%	73-188	6.5-121.3
Golden shiner	*Notemigonus crysoleucas*	58	4.3%	39-194	1.0-44.5
Yellow bullhead	*Ameiurus natalis*	40	3.0%	38-260	0.4-244.8
Redfin pickerel	*Esox americanus*	39	2.9%	48-289	0.5-137.0
American eel	*Anguilla rostrata*	35	2.6%	95-301	8.6-85.0
Eastern silvery minnow	*Hybognathus regius*	32	2.4%	34-89	0.6-6.1
Largemouth bass	*Micropterus salmoides*	27	2.0%	42-236	0.7-172.6
Bluespotted sunfish	*Enneacanthus gloriosus*	25	1.9%	32-83	0.5-11.0
Green sunfish	*Lepomis cyanellus*	12	0.9%	23-157	0.5-75.2
Warmouth	*Lepomis gulosus*	9	0.7%	88-131	11.2-50.7
Gizzard shad	*Dorosoma cepedianum*	6	0.4%	56-119	1.6-13.5
Brown bullhead	*Ameiurus nebulosus*	3	0.2%	128-182	23.9-39.7
Black crappie	*Pomoxis nigromaculatus*	2	0.1%	78-93	4.6-8.2
Black bullhead	*Ameiurus melas*	2	0.1%	141-155	33.2-43.6
Yellow perch	*Perca flavescens*	2	0.1%	124-229	19.7-134.5
Bowfin*	*Amia calva*	1	<0.1%	300*	--
Common carp	*Cyprinus carpio*	1	<0.1%	540	>1000
TOTAL		**1,350**	**100%**	--	--

*Bowfin escaped from net, estimated length

The time sampled was similar across all streams with the exception of NASO-S3 and NASO-S7. The total number of fishes collected, species richness, and resulting species diversity varied across the seven reaches, with the highest total number of individuals collected at NASO-S4 (318 individuals), NASO-S2 (305 individuals), the least number of species and individuals were collected at NASO-S3. The 18 species that occurred at NASO-S4 resulted in a species diversity index that was greater than any other surveyed stream; NASO-S6 and S7 followed closely with 17 species each. The following tables and summaries present results of the fish survey by stream reach to enable comparisons among streams and seasons.

NASO-S1. A total of 26 fish, represented by seven species, were collected from NASO-S1 on 29 April 2014. Bluegill was the most abundant species, representing 30.8% of the total catch, followed by eastern mudminnow at 23.1%, and pirate perch at 19.2% (Table 11). During the second sampling event, a total of 25 fish, represented by five species, were collected from NASO-S1 on 03 June 2014. Pirate perch was the most abundant species, representing 56.0% of the total catch, followed by eastern mudminnow at 24.0%, and redfin pickerel at 12.0%. A total of 36 fish, represented by eight species, were collected from NASO-S1 on 13 August 2014. Pirate perch was the most abundant species,

representing 47.2% of the total catch, followed by eastern mudminnow at 22.2%, and American eel at 8.3%. During the last sampling event, a total of 92 fish, represented by eight species, from NASO-S1 on 30 September 2014. Bluegill was the most abundant species, representing 37.0% of the total catch, followed by pirate perch at 30.4%, and eastern mudminnow at 15.2%.

Table 11: Fish Composition in NASO-S1 by Sampling Period

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Pirate perch	5	19.2%	14	56.0%	17	47.2%	28	30.4%	64
Bluegill	8	30.8%	1	4.0%	1	2.8%	34	37.0%	44
Eastern mudminnow	6	23.1%	6	24.0%	8	22.2%	14	15.2%	34
Redfin pickerel	4	15.4%	3	12.0%	2	5.6%	7	7.6%	16
American eel	1	3.8%	1	4.0%	3	8.3%	5	5.4%	10
Warmouth	1	3.8%	--	--	1	2.8%	1	1.1%	3
Yellow bullhead	--	--	--	--	2	5.6%	1	1.1%	3
Largemouth bass	--	--	--	--	2	5.6%	--	--	2
Banded sunfish	--	--	--	--	--	--	2	2.2%	2
Brown bullhead	1	3.8%	--	--	--	--	--	--	1
Total individuals	26		25		36		92		179
Time sampled	2,028		1,680		1,237		1,793		6,738
CPUE	0.013		0.015		0.029		0.051		0.027
Species richness (R)	7		5		8		8		10
Simpson Diversity Index (λ)	0.21		0.39		0.29		0.26		--
Shannon Diversity Index (H')	1.68		1.18		1.58		1.55		--

NASO-S2. A total of 30 fish, represented by four species, were collected from NASO-S2 on 29 April 2014. Pirate perch was the most abundant species, representing 80.0% of the total catch, followed by eastern mudminnow at 13.3%, and green sunfish and largemouth bass both at 3.3% (Table 12). In the second fish sampling event, a total of 153 fish, represented by eight species, were collected from NASO-S2 on 03 June 2014. Pirate perch was the most abundant species, representing 60.8% of the total catch, followed by eastern mudminnow at 27.5%, and eastern mosquitofish at 5.9%. A total of 38 fish, represented by four species, were collected from NASO-S2 on 13 August 2014. Pirate perch was the most abundant species, representing 81.6% of the total catch, followed by eastern mudminnow at 10.5%, and American eel at 5.3%. A total of 84 fish, represented by eight species, were collected from NASO-S2 on 30 September 2014. Pirate perch was the most abundant species, representing 70.2% of the total catch, followed by bluegill at 8.3%, and golden shiner at 7.1%.

Table 12: Fish Composition in NASO-S2 by Sampling Period

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Pirate perch	24	80.0%	93	60.8%	31	81.6%	59	70.2%	207
Eastern mudminnow	4	13.3%	42	27.5%	4	10.5%	4	4.8%	54
Golden shiner	--	--	4	2.6%	1	2.6%	6	7.1%	11
Eastern mosquitofish	--	--	9	5.9%	--	--	--	--	9
Bluegill	--	--	--	--	--	--	7	8.3%	7
American eel	--	--	2	1.3%	2	5.3%	1	1.2%	5
Pumpkinseed	--	--	--	--	--	--	4	4.8%	4
Largemouth bass	1	3.3%	--	--	--	--	2	2.4%	3
Green sunfish	1	3.3%	--	--	--	--	1	1.2%	2
Banded sunfish	--	--	1	0.7%	--	--	--	--	1
Bluespotted sunfish	--	--	1	0.7%	--	--	--	--	1
Redfin pickerel	--	--	1	0.7%	--	--	--	--	1
Total individuals	30		153		38		84		305
Time sampled	3,083		1,314		1,471		1,758		7,626
CPUE	0.010		0.116		0.026		0.048		0.040
Species richness (R)	4		8		4		8		12
Simpson Diversity Index (λ)	0.66		0.45		0.68		0.51		--
Shannon Diversity Index (H')	0.67		1.07		0.60		1.02		--

NASO-S3. A total of 3 eastern mudminnow were collected from NASO-S3 on 29 April 2014. This was the only species collected in the first sampling effort (Table 13). Again in June, only eastern mudminnow were found in NASO-S3, which consisted of isolated shallow pools of water; a total of 27 fish were collected on 05 June 2014. Sampling duration was short because the stream bed was dry, consisting of only seven small pools within 10% of the reach; there was zero flow. No fish were present during the August sampling event. Similar to the June event, sampling duration was short because the stream bed was dry or almost dry at various points of the stream. On 30 September 2014, 3 fish, represented by two species, were collected from NASO-S3. The eastern mosquitofish was more abundant (66.7%) than the eastern mudminnow (33.3%).

Table 13: Fish Composition in NASO-S3 by Sampling Period

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Eastern mudminnow	3	100.0%	27	100.0 %	--	--	1	33.3%	31
Eastern mosquitofish	--	--	--	--	--	--	2	66.7%	2
Total individuals	3		27		0		3		33
Time sampled	1,737		233		461		801		3,232
CPUE	0.002		0.116		0.000		0.004		0.010

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Species richness (R)	1		1		0		2		2
Simpson Diversity Index (λ)	1.00		1.00		--		0.56		--
Shannon Diversity Index (H')	0.00		0.00		--		0.64		--

NASO-S4. A total of 32 fish, represented by five species, were collected from NASO-S4 on 30 April 2014. The eastern mosquitofish was the most abundant species, representing 78.1% of the total catch, followed by redfin pickerel at 9.4%, and pumpkinseed at 6.3% (Table 14). A total of 136 fish, represented by 10 species, were collected from NASO-S4 on 04 June 2014. The eastern mosquitofish was the most abundant species, representing 84.6% of the total catch, followed by pirate perch at 3.7%, and largemouth bass and bluespotted sunfish both at 2.2%. During the third sampling event on 12 August 2014, a total of 7 fish, represented by six species, were collected from NASO-S4. The most abundant species in August was the eastern mosquitofish, representing 28.6% of the total catch, followed by pirate perch, yellow bull head, and eastern mudminnow, and largemouth bass all at 14.3%. On 01 October 2014, 155 fish, represented by 16 species, were collected from NASO-S4. One lesion was identified on one golden shiner. Banded sunfish was the most abundant species, representing 38.1% of the total catch, followed by bluegill at 12.9%, and golden shiner at 10.3%.

Table 14: Fish Composition in NASO-S4 by Sampling Period

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Eastern mosquitofish	25	78.1%	115	84.6%	2	28.6%	12	7.7%	154
Banded sunfish	--	--	--	--	--	--	59	38.1%	59
Bluegill	1	3.1%	--	--	1	14.3%	20	12.9%	22
Golden shiner	--	--	1	0.7%	--	--	16	10.3%	17
Pumpkinseed	2	6.3%	3	2.2%	--	--	11	7.1%	16
Eastern mudminnow	1	3.1%	5	3.7%	1	14.3%	3	1.9%	10
Largemouth bass	--	--	3	2.2%	1	14.3%	5	3.2%	9
Yellow bullhead	--	--	2	1.5%	1	14.3%	6	3.9%	9
Redfin pickerel	3	9.4%	1	0.7%	--	--	4	2.6%	8
Pirate perch	--	--	2	1.5%	--	--	6	3.9%	8
Green sunfish	--	--	--	--	--	--	7	4.5%	7
Bluespotted sunfish	--	--	3	2.2%	--	--	--	--	3
American eel	--	--	1	0.7%	--	--	2	1.3%	3
Gizzard shad	--	--	--	--	1	14.3%	--	--	1
Black bullhead	--	--	--	--	--	--	1	0.6%	1
Black crappie	--	--	--	--	--	--	1	0.6%	1
Bowfin	--	--	--	--	--	--	1	0.6%	1
Eastern silvery minnow	--	--	--	--	--	--	1	0.6%	1
Total individuals	32		136		7		155		318

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Time sampled	2,880		1,036		1,206		1,845		6,967
CPUE	0.011		0.131		0.006		0.084		0.046
Species richness (R)	5		10		6		15		18
Simpson Diversity Index (λ)	0.63		0.72		0.18		0.19		--
Shannon Diversity Index (H')	0.80		0.75		1.75		2.11		--

NASO-S5. Only two fish (both bluespotted sunfish) were collected from NASO-S5 on 30 April 2014. During the second sampling event on 04 June 2014, four individuals, each a different species, were collected from NASO-S5 (Table 15). American eel, bluespotted sunfish, eastern mosquitofish, and pirate perch were equally abundant with one individual each. A total of 55 fish, represented by six species were collected from NASO-S5 on 12 August 2014. The eastern mosquitofish was the most abundant species, representing 70.9% of the total catch, followed by bluespotted sunfish (14.5%), and yellow bullhead (9.1%). The last sampling event, on 01 October 2014, collected 51 fish, from eight species in NASO-S5. Bluegill was the most abundant species, representing 47.1% of the total catch, followed by eastern mosquitofish at 17.6%, and largemouth bass at 11.8%.

Table 15: Fish Composition in NASO-S5 by Sampling Period

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Eastern mosquitofish	--	--	1	25.0%	39	70.9%	9	17.6%	49
Bluegill	--	--	--	--	--	--	24	47.1%	24
Bluespotted sunfish	2	100.0%	1	25.0%	8	14.5%	--	--	11
Largemouth bass	--	--	--	--	1	1.8%	6	11.8%	7
Yellow bullhead	--	--	--	--	5	9.1%	--	--	5
Banded sunfish	--	--	--	--	--	--	3	5.9%	3
Pumpkinseed	--	--	--	--	--	--	3	5.9%	3
Eastern mudminnow	--	--	1	25.0%	1	1.8%	--	--	2
Golden shiner	--	--	--	--	--	--	2	3.9%	2
Redfin pickerel	--	--	--	--	--	--	2	3.9%	2
Warmouth	--	--	--	--	--	--	2	3.9%	2
American eel	--	--	1	25.0%	--	--	--	--	1
Pirate perch	--	--	--	--	1	1.8%	--	--	1
Total individuals	2		4		55		51		112
Time sampled	1,481		1,159		2,646		966		6,252
CPUE	0.001		0.003		0.021		0.053		0.015
Species richness (R)	1		4		6		8		13
Simpson Diversity Index (λ)	1.00		0.25		0.53		0.28		--
Shannon Diversity Index (H')	0.00		1.39		0.96		1.63		--

NASO-S6. No survey was conducted for NASO-S6 in April, because the water was too deep to effectively electrofish. During the next sampling event on 04 June 2014, 88 fish, from thirteen species, were collected from NASO-S6. Bluegill was the most abundant species, representing 25.3% of the total catch, followed by pirate perch at 19.5%, and pumpkinseed (*Lepomis gibbosus*) at 14.9% (Table 16). On 12 August 2014, 29 fish, represented by ten species, were collected from NASO-S6. Pirate perch was the most abundant species, representing 40.0% of the total catch, followed by American eel (13.3%), and golden shiner (13.3%). During the last sampling event on 01 October 2014, 97 fish from nine species were collected from NASO-S6. Bluegill was the most abundant species, representing 41.2% of the total catch, followed by eastern silvery minnow at 32.0%, and pirate perch at 12.4%. Gizzard shad ranged in size from 56 to 119 mm, which are most likely first year and second year age class shad (Ross 2001).

Table 16: Fish Composition in NASO-S6 by Sampling Period

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Bluegill	--	--	22	25.3%	1	3.3%	40	41.2%	63
Pirate perch	--	--	17	19.5%	12	40.0%	12	12.4%	41
Eastern silvery minnow	--	--	--	--	--	--	31	32.0%	31
Pumpkinseed	--	--	13	14.9%	2	6.7%	3	3.1%	18
Golden shiner	--	--	8	9.2%	4	13.3%	--	--	12
Bluespotted sunfish	--	--	7	8.0%	2	6.7%	--	--	9
Redfin pickerel	--	--	6	6.9%	1	3.3%	1	1.0%	8
Banded sunfish	--	--	--	--	--	--	7	7.2%	7
Gizzard shad	--	--	4	4.6%	--	--	1	1.0%	5
Yellow bullhead	--	--	2	2.3%	2	6.7%	1	1.0%	5
American eel	--	--	1	1.1%	4	13.3%	--	--	5
Largemouth bass	--	--	3	3.4%	--	--	--	--	3
Warmouth	--	--	2	2.3%	--	--	--	--	2
Green sunfish	--	--	--	--	1	3.3%	1	1.0%	2
Common carp	--	--	1	1.1%	--	--	--	--	1
Yellow perch	--	--	1	1.1%	--	--	--	--	1
Black crappie	--	--	--	--	1	3.3%	--	--	1
Total individuals	not sampled		88		29		97		214
Time sampled	--		1,524		1,830		1,632		4,986
CPUE	--		0.058		0.016		0.059		0.033
Species richness (R)	--		13		9		9		17
Simpson Diversity Index (λ)	--		0.15		0.21		0.29		--
Shannon Diversity Index (H')	--		2.14		1.90		1.47		--

NASO-S7. Similar to NASO-S6, a fish survey could not be conducted in April, due to high water at NASO-S7. On 04 June 2014, 45 fish from twelve species were collected from NASO-S7. The most abundant species was banded sunfish (31.1%), followed by pumpkinseed (20.0%), and American eel and pirate perch (both 8.9%) (Table 17). A total of 32 fish, represented by nine species, were collected from NASO-

S7 on 12 August 2014. Yellow bullhead was the most abundant species, representing 31.3% of the total catch, followed by golden shiner at 28.1%, and American eel and pirate perch at 9.4%. On 01 October 2014, a total of 97 fish, from 14 species, were collected in NASO-S7. Bluegill and pumpkinseed were the two most abundant species, each representing 34.0% of the total catch, followed by golden shiner, yellow bullhead, and yellow perch, all at 5.2%.

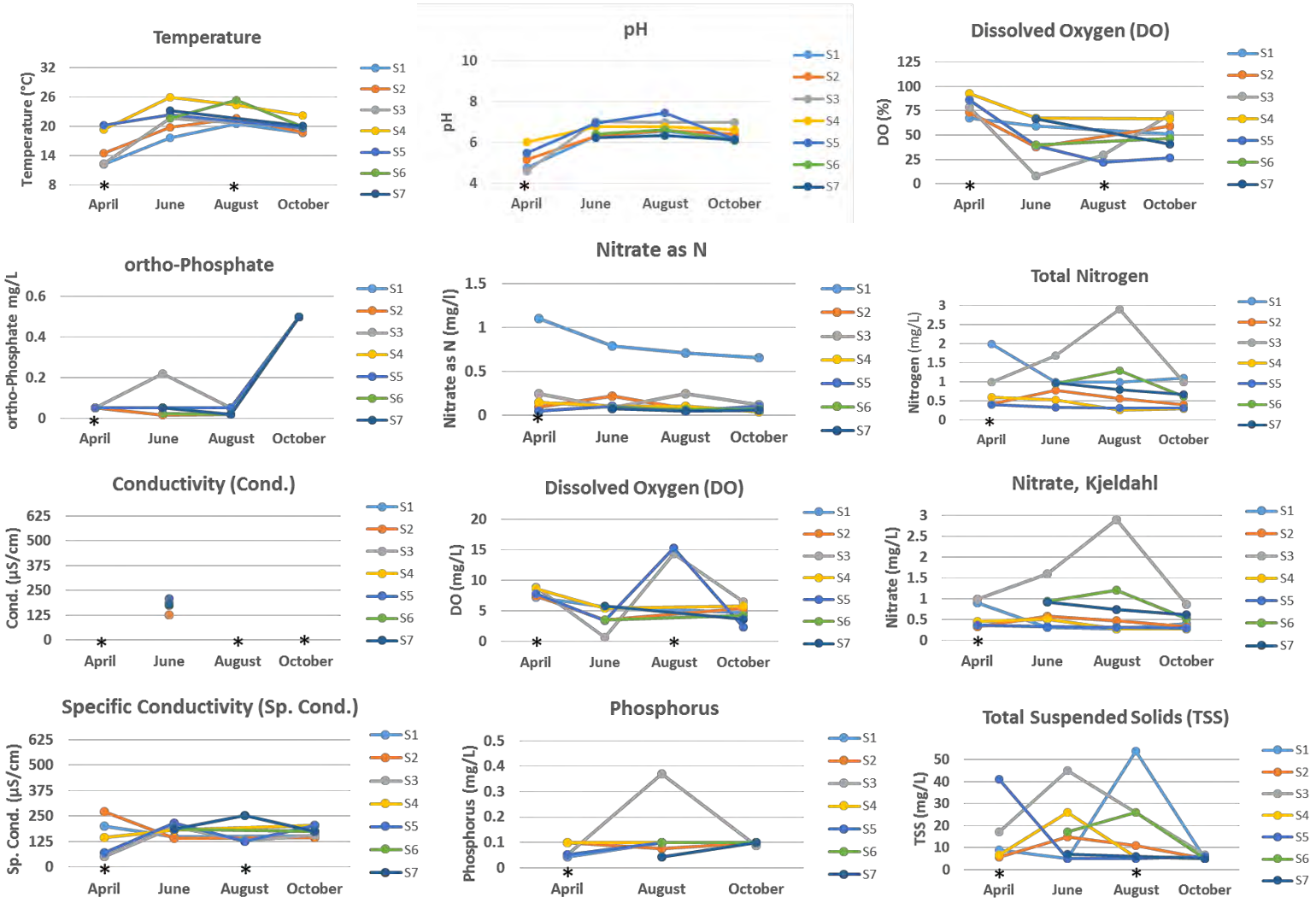
Table 17: Fish Composition in NASO-S7 by Sampling Period

Common name	April		June		Aug		Sept/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Pumpkinseed	--	--	9	20.0%	1	3.1%	33	34.0%	43
Bluegill	--	--	--	--	2	6.3%	33	34.0%	35
Banded sunfish	--	--	14	31.1%	--	--	4	4.1%	18
Yellow bullhead	--	--	3	6.7%	10	31.3%	5	5.2%	18
Golden shiner	--	--	2	4.4%	9	28.1%	5	5.2%	16
Pirate perch	--	--	4	8.9%	3	9.4%	5	5.2%	12
American eel	--	--	4	8.9%	3	9.4%	4	4.1%	11
Redfin pickerel	--	--	3	6.7%	--	--	1	1.0%	4
Eastern mosquitofish	--	--	1	2.2%	1	3.1%	1	1.0%	3
Largemouth bass	--	--	1	2.2%	--	--	2	2.1%	3
Eastern mudminnow	--	--	2	4.4%	--	--	--	--	2
Warmouth	--	--	1	2.2%	--	--	1	1.0%	2
Brown bullhead	--	--	--	--	2	6.3%	--	--	2
Yellow perch	--	--	1	2.2%	--	--	--	--	1
Bluespotted sunfish	--	--	--	--	1	3.1%	--	--	1
Black bullhead	--	--	--	--	--	--	1	1.0%	1
Green sunfish	--	--	--	--	--	--	1	1.0%	1
Juvenile sunfish sp.	--	--	--	--	--	--	1	1.0%	1
Total individuals	not sampled		45		32		97		171
Time sampled	--		1,608		1,217		1,322		4,147
CPUE	--		0.028		0.026		0.073		0.031
Species richness (R)	--		12		9		14		18
Simpson Diversity Index (λ)	--		0.17		0.21		0.24		--
Shannon Diversity Index (H')	--		2.09		1.84		1.82		--

3.1.3 WATER QUALITY

In-situ and laboratory analysis water quality results varied by stream and season. In general, NASO streams ranged from acidic to slightly basic (pH 4.58 to 7.44). Dissolved Oxygen levels were low, but relatively stable, throughout the survey period. NASO-S3 had an August spike in dissolved oxygen, Phosphorus, Nitrogen, and Kjeldahl Nitrate levels. Temperature patterns were consistent with expected seasonal trends at each stream. Water quality results for streams are presented in Figure 3.

The estuarine portion of Owl's Creek has been monitored for various water quality parameters since 1998, as summarized in Appendix E. This data is presented for informational purposes only and has limited applicability to the current survey because of its estuarine nature.



Note: * Missing data due to YSI malfunction.

Figure 3: *In-situ* and Laboratory Water Quality Analysis Results for Naval Air Station Oceana Streams

In general, NASO streams displayed low velocities, especially NASO S3 which was dry in June. All streams showed decreasing velocities as the seasons progressed, with many streams (NASO-S1, -S2, -S3, -S4, and -S5) displaying their lowest discharges in August (Table 18). Velocities are displayed in cubic feet per second (cfs).

Table 18: Naval Air Station Oceana Stream Discharge Results

Stream Name	Date	Discharge (cubic feet per second)
NASO-S1	4/29/14	5.83
	6/3/14	0.38
	8/13/14	0.20
NASO-S2	4/30/14	5.01
	6/5/14	0.62
	8/13/14	0.19
NASO-S3	4/29/14	4.61
	6/5/14	DRY STREAM
	8/13/14	0.04
NASO-S4	4/30/14	3.87
	6/4/14	0.04
	8/12/14	0.56
NASO-S5	4/30/14	1.26
	6/4/14	0.17
	8/12/14	0.56
NASO-S6	6/4/14	1.07
	8/12/14	1.37
NASO-S7	6/4/14	0.93
	8/12/14	2.37

3.2 PONDS

3.2.1 HABITAT

Habitat surveys were conducted for NASO-P1 and NASO-P2 on 14 August 2014. The results of the pond habitat survey are presented here for each pond (Table 19).

NASO-P1. This pond, categorized as eutrophic, was 3.1 m deep, with extensive forest surrounding the shore. Shrub and grass were also present, though sparse. Submergent vegetation and macrophytes were present along the shoreline, with small amounts of emergent or floating plants. Of the shoreline, 90% was stable, with 10% showing bare ground but no erosion lines. A man-made boat dock and natural ramp was present, but there were no other major anthropogenic disruptions. The bottom substrate consisted of gravel and sand, with some cobble. There was some light and dark brown organic muck-mud at the shoreline in addition to the vegetation. For fish cover, submerged aquatic vegetation provided the most habitat, supplemented with some woody debris, overhanging vegetation (e.g., shrubs or tree limbs), and man-made structures. American waterweed (*Elodea sp*.) and cattail were the most common aquatic vegetation observed. A blue heron (*Ardea herodias*) was present.

NASO-P2. This pond, categorized as mesotrophic, was 2.3 m deep, with forest, grass, and wetland, and sparse shrubs, around the pond. Emergent, submergent, and macrophytes all occurred in moderate amounts. All of the shoreline appeared stable, with no evidence of development. The substrate was primarily gravel, with sand and some silt/clay; no odor was detected in the light brown substrate. Some woody debris was observed. Aquatic vegetation provided the most fish cover, but woody debris, live trees, and overhanging plants also provided some cover for the sunfish species noted. Emergent shrubs and American waterweed covered approximately 20% of the shoreline. NASO-P2 had significant plots (30% of the shoreline) of invasive common reed (*Phragmites australis*) at the time of inspection. A wood duck box was present, but no wildlife was observed. The water appeared to have good clarity, with a slight green tint.

Table 19: Naval Air Station Oceana Ponds Habitat Survey Results

		NASO-P1 (Oceana Pond)	NASO-P2 (VACAPES Pond)
SUMMARY	**Date**	14 August 2014	14 August 2014
	Time	0830	0945
	Weather Conditions	Sunny, 21°C, No rain in past day.	Sunny, 24°C, No rain in past day.
	Pond Surface	Flat, calm	Flat, calm
	Depth Range	1 to 3 m	1 to 3 m
	Max Depth (m)	3.1	2.3
SHORELINE CHARACTERISTICS	**Forest**	Extensive	Moderate
	Grass	Sparse	Moderate
	Shrub	Sparse	Sparse
	Wetland	Absent	Moderate
	Bare Ground	Sparse	Absent
	Agriculture	Absent- soybean fields	Absent
	Shoreline Modification	Absent	Absent
	Development	Absent	Absent
MACROPHYES	**Emergent/Floating (%)**	Sparse	Moderate
	Submergent (%)	Moderate	Moderate
	Macrophyte Density (%)	Moderate	Moderate
SHORELINE STABILITY (%)	**Stable (%)**	90%	100%
	Eroding (%)	10%	--
	Comments	Bare ground but no erosion lines observed during visit	
LITTORAL BOTTOM SUBSTRATE	**Bedrock**	Absent	Absent
	Boulder	Absent	Absent
	Cobble	Sparse	Absent
	Gravel	Moderate	Heavy
	Sand	Moderate	Moderate
	Silt, Clay, Muck	--	Sparse
	Woody Debris	Sparse	Moderate
	Organic	Moderate	Absent

	Vegetation or Other	Moderate	Absent
	Substrate Odor/Color	Muck at shoreline, mix of light and dark brown	No odor, light brown
LITTORAL FISH COVER	**Aquatic and Inundated Herbaceous**	Moderate	Heavy
	Woody Debris/Snags	Sparse	Moderate
	Inundated Live Trees	Absent	Moderate
	Overhanging	Sparse	Moderate
	Sharp Ledges or Drop-	Absent	Absent
	Boulders	Absent	Absent
	Human Structures	Sparse	Absent
	Species Observed	Sunfish sp.	Sunfish sp.
	Comments	SAV is most prolific habitat	
OTHER OBSERVATIONS	**Fish Sampling**	Y	Y
	Gear Used	electrofishing	electrofishing
	Trophic State	Eutrophic	Mesotrophic
	Emergent/Submerged	*Elodea sp*., cattail	*Elodea sp*., emergent shrubs
	Invasive Species	--	*Phragmites* (~30% of
	Wildlife Observed	Blue heron	None, one birdhouse is present along shoreline, no birds observed at time of
	Additional Notes	Shoreline was covered with floating bubble algae, banks were mostly stable, only a few bare spots (> 2%)	Clarity of water was good with slight green tint ~50% of shoreline is inundated with Phragmites and shrubs present

3.2.2 FISH

A total of 1,167 fishes, represented by 10 species, were collected from the two NASO ponds during the April, June, August, and October 2014 survey periods. All individuals were positively identified at the species level in the field and no deformities, lesions, or abnormalities were observed in any of the specimens collected. Total electrofishing sampling effort duration was 31,238 seconds across all three ponds (Table 20). Table 21 presents the relative abundance, and range of length for all species collected.

Table 20 : Boat Electrofishing Effort at Naval Air Station Oceana, by Sampling Period and Pond

Stream ID	Sampling duration (seconds)			
	April	June	August	October
NASO-P1	3,811	4,225	5,818	5,749
NASO-P2	2,908	3,306	2,387	3,034

Table 21: Number, Relative Abundance, Frequency of Occurrence, and Length of Fishes Collected in Naval Air Station Oceana Ponds

Common name	Scientific name	Number of individuals	Total relative abundance (%)	Range of total length (mm)
Bluegill	*Lepomis macrochirus*	670	57.4%	20–324
Largemouth bass	*Micropterus salmoides*	202	17.3%	23–481
American eel	*Anguilla rostrata*	95	8.1%	<150–450
Pumpkinseed	*Lepomis gibbosus*	93	8%	28–73
Warmouth	*Lepomis gulosus*	39	3.3%	89–195
Yellow perch	*Perca flavescens*	24	2.1%	82–186
Black crappie	*Pomoxis nigromaculatus*	22	1.9%	65–115
Eastern mudminnow	*Umbra pygmaea*	19	1.6%	20–62
Redear sunfish	*Lepomis macrochirus*	2	<0.1%	78–164
Eastern mosquitofish	*Gambusia holbrooki*	1	<0.1%	28
	TOTAL	**1,167**	**100%**	--

* Weights not recorded for a portion of samples

NASO-P1. A total of 140 fish, represented by seven species, were collected from NASO-P1 on 29 April 2014. Bluegill was the most abundant species, representing 45.0% of the total catch, followed by American eel at 27.1%, warmouth at 12.9%, and largemouth bass at 12.1% (Table 22). A total of 69 fish, represented by eight species, were collected from NASO-P1 on 02 June 2014. American eel was the most abundant species, representing 36.2% of the total catch, followed by bluegill at 34.8%, and largemouth bass, pumpkinseed, and warmouth, all at 7.2%. A total of 143 fish, represented by eight species, were collected from NASO-P1 on 13 August 2014. Bluegill was the most abundant species, representing 33.6% of the total catch, followed by American eel at 19.6%, and largemouth bass at 16.8%. On 09 October 2014, a total of 268 fish, represented by nine species, were collected from NASO-P1. Bluegill was the most abundant species, representing 51.1% of the total catch, followed by pumpkinseed at 24.3%.

Table 22: Fish Composition of NASO-P1 (Oceana Pond) by Sampling Period

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Bluegill	63	45.0%	24	34.8%	48	33.6%	137	51.1%	272
American eel	38	27.1%	25	36.2%	28	19.6%	4	1.5%	95
Pumpkinseed	2	1.4%	5	7.2%	21	14.7%	65	24.3%	93
Largemouth bass	17	12.1%	5	7.2%	24	16.8%	22	8.2%	68
Warmouth	18	12.9%	5	7.2%	2	1.4%	14	5.2%	39
Yellow perch	1	0.7%	2	2.9%	6	4.2%	15	5.6%	24
Black crappie	--	--	1	1.4%	12	8.4%	9	3.4%	22
Eastern mudminnow	--	--	--	--	2	1.4%	1	0.4%	3
Redear sunfish	--	--	2	2.9%	--	--	--	--	2
Eastern mosquitofish	1	0.7%	--	--	--	--	--	--	1
Sunfish sp.	--	--	--	--	--	--	1	0.4%	1

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Total individuals	140		69		143		268		620
Time sampled	3811		4225		5818		5749		19,603
CPUE	0.037		0.016		0.025		0.047		0.032
Species richness (R)	7		8		8		9		11
Simpson Diversity Index (λ)	0.31		0.27		0.21		0.33		--
Shannon Diversity Index (H')	1.36		1.57		1.73		1.43		--

NASO-P2. Results of fish sampling at NASO-P2 are summarized below in Table 23. A total of 149 fish, represented by two species, were collected from NASO-P2 on 29 April 2014. Largemouth bass was the most abundant species, representing 57.7% of the total catch, followed by bluegill at 42.3% (Table 23). A total of 126 fish, represented by two species, were collected from NASO-P2 on 3 June 2014. During this second sampling effort, bluegill was the most abundant species, representing 87.3% of the total catch, followed by largemouth bass at 12.7%. On 13 August 2014, 141 fish, represented by two species, were collected from NASO-P2. Of these, bluegill was the most abundant species, representing 87.2% of the total catch, followed by largemouth bass at 12.8%. A total of 132 fish, represented by three species, were collected from NASO-P2 on 07 October 2014. Bluegill was the most abundant species, representing 77.3% of the total catch, followed by the eastern mudminnow at 12.1%.

Table 23: Fish Composition of NASO-P2 (VACAPES Pond) by Sampling Period

Common name	Apr		Jun		Aug		Sep/Oct		Total
	Number	%	Number	%	Number	%	Number	%	
Bluegill	63	42.3%	110	87.3%	123	87.2%	102	77.3%	398
Largemouth Bass	86	57.7%	16	12.7%	18	12.8%	14	10.6%	134
Eastern Mudminnow	--	--	--	--	--	--	16	12.1%	16
Total individuals	149		126		141		132		548
Time sampled	2908		3306		2387		3034		11,635
CPUE	0.051		0.038		0.059		0.044		0.047
Species richness (R)	2		2		2		3		3
Simpson Diversity Index (λ)	0.51		0.78		0.78		0.62		--
Shannon Diversity Index (H')	0.68		0.38		0.38		0.69		--

In addition to electrofishing, supplemental qualitative hook and line surveys were conducted at the Concrete Ponds at the north end of the installation. Hook and line fishing yielded just two species of fish in the West Concrete Pond and East Concrete Pond on NASO during August and October. The results are presented in Table 24.

Table 24: Hook and Line Fish Survey Results from the West Concrete Pond and East Concrete Pond

Location	Date	Total Effort	Species	Length (mm)	Weight (lb.)
West Concrete Pond	8/14/2014	45 min	Largemouth Bass	440	2.50
			Largemouth Bass	570	3.75
			Largemouth Bass	300	1.5
East Concrete Pond	10/2/2014	45 min	Common Carp	No recorded lengths (approx. range = 250 to 550 mm)	No recorded weights (approx. range = 1 to 3 lbs.)
			Largemouth Bass		
			Largemouth Bass		
			Largemouth Bass		
			Largemouth Bass		
			Largemouth Bass		
			Largemouth Bass		
			Largemouth Bass		
			Largemouth Bass		
			Largemouth Bass		

Length frequency data are often to derive growth estimates, and can also be used to get a first assessment of the demographics of a stock. For the purposes of this Project, length frequency graphs were generated for recreationally important and migratory species including: bluegill, and largemouth bass. Figures 4 and 5 illustrate length frequency data for combined surveys across NASO ponds. Bluegill size classes were skewed right, with disproportionately greater small size classes, with most individuals falling between 40 and 100 mm for both ponds. Bluegill were abundant in both ponds; however, NASO-P2 had more, yet smaller, individuals than NASO-P1.

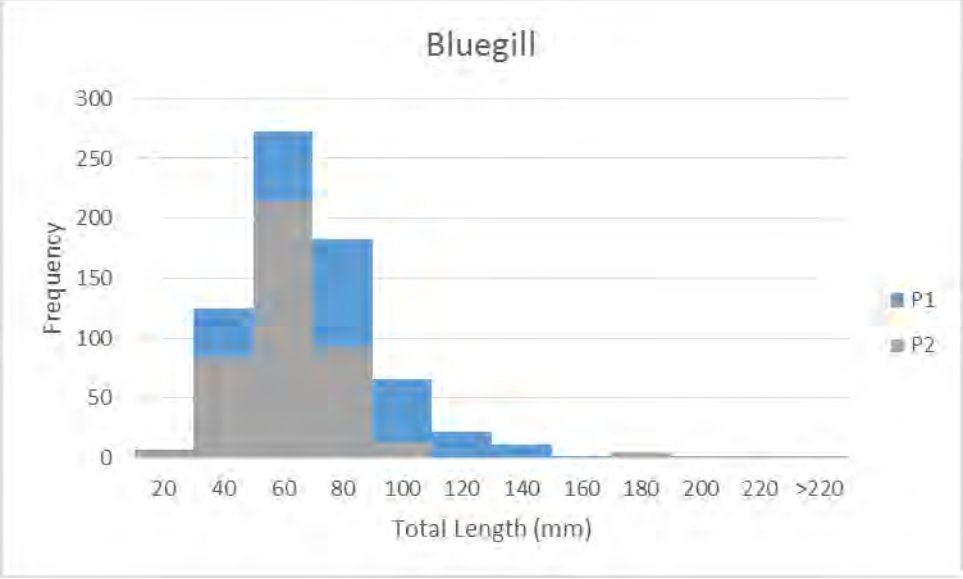


Figure 4: Length Frequency Results for Bluegill in Naval Air Station Oceana Ponds Surveyed in 2014

Largemouth bass length frequency results (Figure 5) show that these fish were more abundant in NASO-P2 than in NASO-P1. Size classes of largemouth bass were wide ranging, with both small and large size classes well represented in both ponds.

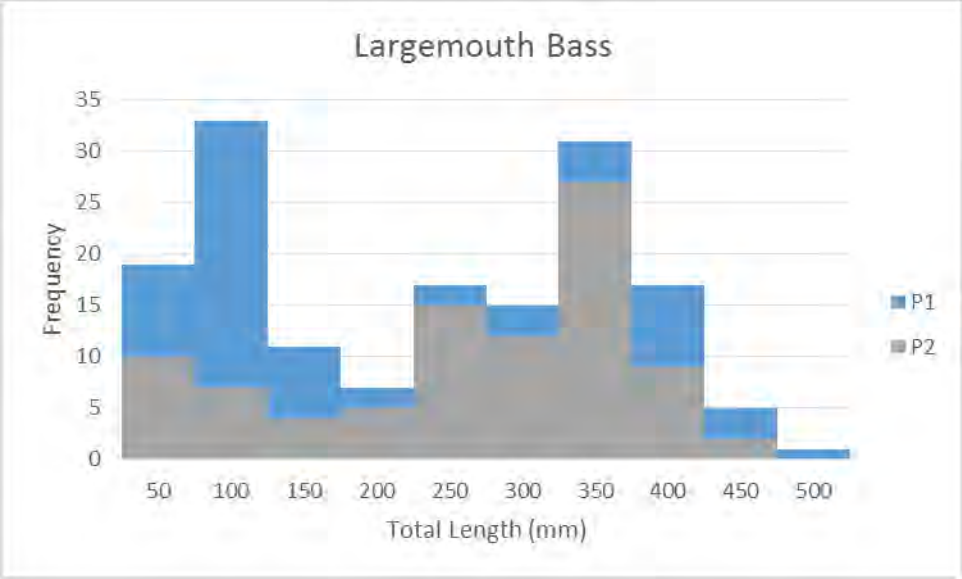
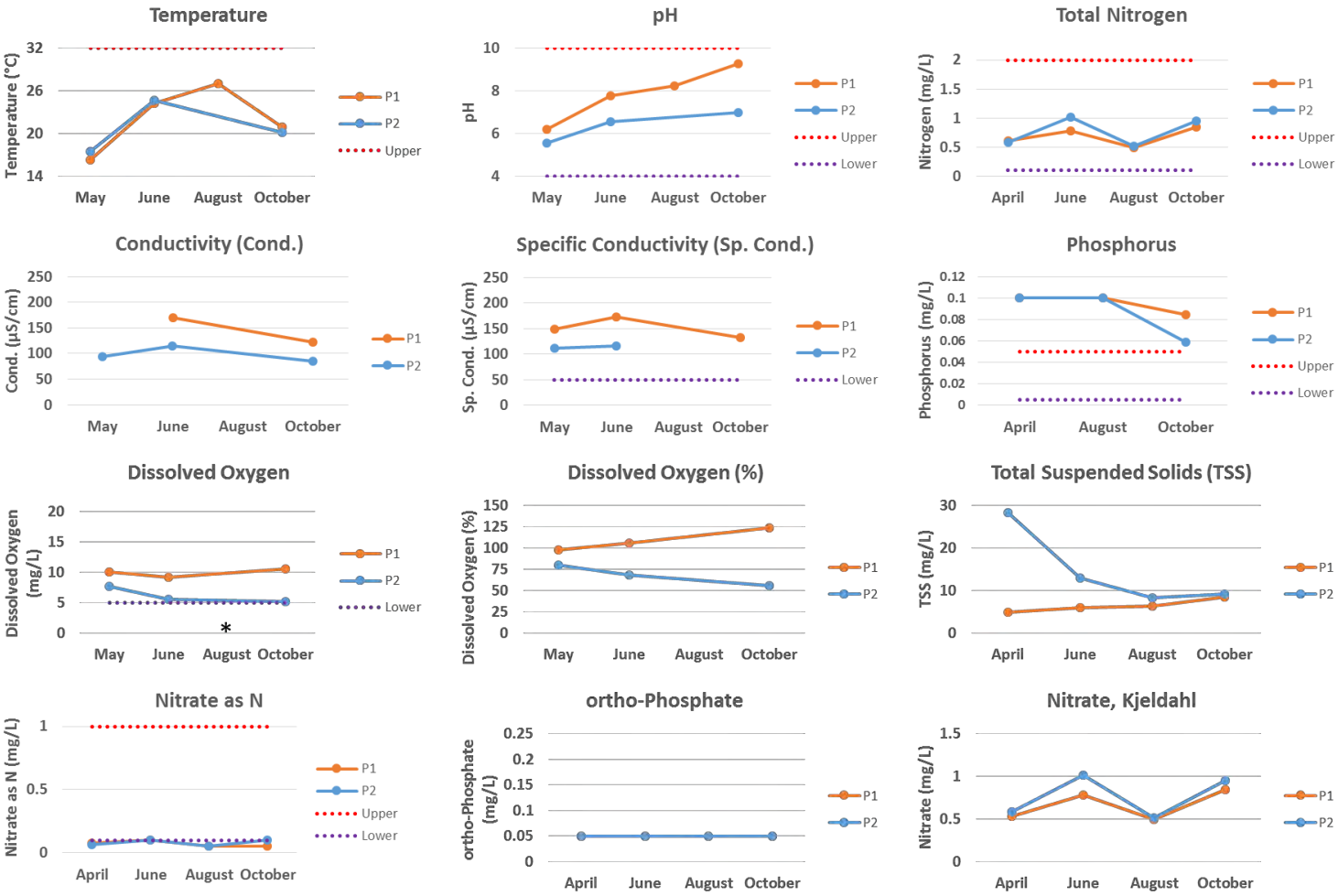


Figure 5: Length Frequency Results for Largemouth Bass in Naval Air Station Oceana Ponds Surveyed in 2014

3.2.3 WATER QUALITY

Water quality results varied by location and depth and are displayed in Figure 6. In general, NASO ponds ranged from acidic to very basic (pH 5.39 to 9.27). NASO-P1 showed the widest range of pH from 5.39 in the spring to 9.27 in the fall. (Figure 6). Dissolved oxygen levels remained fairly stable throughout the summer. Temperature patterns were consistent with expected seasonal trends at each pond.



Note: * Missing data dues to YSI malfunction.

Figure 6: Water Quality Parameters for Naval Air Station Oceana Ponds

4 DISCUSSION AND MANAGEMENT RECOMMENDATIONS

The discussion and management recommendations in this section include general suggestions, as well as more specific discussion based on the findings from this survey. Prior to implementing any changes to the natural resources management at NASO, a more thorough evaluation of all available options would be necessary to ensure the best possible outcome for the management objectives of the ponds and streams within the context of the NASO military mission.

4.1 RECREATIONAL FISHERIES

Length frequency analysis of the recreationally important species such as bluegill and largemouth bass in NASO streams showed that most individuals were generally too small to represent much recreational fishing potential. Largemouth bass were typically not very abundant, with less than 15 individuals captured across all streams during the most productive sampling period (October). According to EPA reports, largemouth bass between 50 and 150 mm are first-year fish, with second-year fish up to 250 mm long. They do no typically exceed 350 mm until three years of age; however, 100% are expected to reach sexual maturity at lengths of 229 mm (EPA 2000; Laarman and Schneider 1985). Therefore, most bass in the NASO streams have not yet reached spawning size. Stream conditions, including seasonal water level fluctuations, limited prey species, and unfavorable water quality, may contribute to the small size and limited abundance of largemouth bass.

Bluegill typically reach sexual maturity around 100 mm at age-1, which indicates that many of the individuals captured in NASO streams were capable of reproduction (IADNR 2015; Peterson et al. 2010). It can be assumed that bluegill were successfully spawning given the numerous young-of-the-year individuals under 100 mm that were recovered from NASO streams.

Both ponds surveyed at NASO offer favorable recreational fishing opportunities. Both ponds supported healthy populations of game fish including largemouth bass, yellow perch, black crappie, and bluegill. Additionally, electrofishing surveys showed that both ponds supported healthy populations of smaller forage fish to provide food sources for larger game fish.

Historical comparison of recreationally important fish species at Oceana reveals a potential absence of species that were once present and the addition of certain new species previously unseen in the 1994 and 2012 surveys. Overall, species composition remained relatively constant over the twenty year time span between the 1994 and 2014 surveys with sport fish such as largemouth bass, bluegill, yellow perch, and black crappie present most years. However, channel catfish were captured in 1994, but were not encountered in either the 2012 or 2014 surveys.

In the early 1990s, 2,000 fingerling channel catfish, 150 trophy-sized largemouth bass (up to 6 lb. [3 kg]) and 50 channel catfish (up to 14 lb. [6 kg]) were stocked for a catch-and-release tournament. Since the 1990s NASO-P1 has periodically been stocked with largemouth bass, channel catfish, and other sport fishes. Fish surveys performed in 1994 through the USFWS Office of Fishery Assistance (Swihart et al. 1994), indicate that NASO-P1 supports a diverse warmwater fish population with excellent size classes of largemouth bass and good water quality. The absence of channel catfish currently may have resulted from the stocked channel catfish not able to sustain populations due to predation of juveniles by more established fish species.

Also noteworthy is the absence of American eel in previous finfish surveys in NASO-P1, while eels were relatively common in the 2014 surveys. American eels were some of the most abundant species encountered in 2014, with eels captured in each sampling event, except October (only 4 individuals).

The habitat present at both NASO-P1 and NASO-P2 was of higher quality than most streams on NASO. The shorelines were stable and shoreline vegetation provides important nursery habitat for juvenile fish and aquatic insects. However, approximately 30% of NASO-P1's shoreline was covered with invasive *Phragmites* grass.

Managing a pond for recreational fisheries is often centered around the bass-bluegill system, and using the relative abundances of these two juvenile species observed in this survey, it is possible to infer any potential imbalances in the pond. Based on Schramm and Willis (2012), the scenarios presented in Table 25 are likely explanations of bass and bluegill results and feasible solutions or recommended actions to take in the pond. The bass population of NASO-P1 exhibited a bimodal distribution, while that of NASO-P2 was skewed towards larger individuals. Both ponds had abundant juveniles in the range of 50 to 150 mm size classes. The bluegill population of both NASO-P1 and NASO-P2 exhibited an abundance of juveniles in the 40 to 80 mm size classes. This suggests a balanced fish community, with both bass and bluegill successfully reproducing, and bass are keeping bluegill in control. No further action required in terms of management actions (e.g., stocking, fertilizing, etc.) (Schramm and Willis 2012).

If fish stocking is considered in the future for NASO ponds, a more targeted pre-stocking survey would be recommended prior to implementation. According to the VDGIF, when stocking a pond using fingerlings, stock numbers should be around 350 bluegill, 150 redear sunfish, 50 largemouth bass, and 50 channel catfish (all numbers per acre) (VDGIF 2013). Additionally, future surveys should consider a benthic habitat survey using side scan sonar or underwater video surveys of each pond to assess underwater habitat features and where improvements to structured habitat (snags, spawning areas, etc.) could be made.

Table 25: Interpreting the Results of an Annual Juvenile Fish Monitoring Program to Assess the Status of the Largemouth Bass Fishery*

Status of Juvenile Largemouth Bass		Status of Juvenile Bluegill		Status of Fishery	Recommended Action
Juvenile largemouth bass are absent	***AND*** →	Many small bluegill present, but no intermediate sizes	***THEN*** →	✓ Successful bluegill spawning ✓ Good spawning conditions for largemouth bass are likely ✓ Heavy predation by adult largemouth bass	Reduce adult largemouth bass numbers
		Few small bluegill present, with many intermediate sizes		✓ Either reduced spawning or survival of bluegill ✓ Adult largemouth bass are likely in good condition if present	Reduce intermediate bluegill population
		No small bluegill present, and few intermediate sizes		✓ Habitat may be unsuitable for spawning/rearing, or ✓ Intense predation by largemouth bass may be occurring	Sample adult populations of bluegill and largemouth bass to further diagnose problem
Juvenile largemouth bass are present		No small bluegill present, and many intermediate sizes		✓ Too many bluegill interfere with reproduction of bluegill but not largemouth bass	Reduce intermediate bluegill
		Many small bluegill present, and no intermediate sizes		✓ Bass and bluegill are successfully reproducing, but ✓ Predation by largemouth bass may be excessive	Reduce adult largemouth bass numbers
		Many small bluegill present, and few intermediate sizes		✓ Both bass and bluegill are successfully reproducing, and ✓ Bass are keeping bluegill in control	Balanced fish community, no action required

NOTE: *Results analysis based on Schramm and Willis (2012).

4.2 MIGRATORY FISHERIES

NASO is connected to coastal waters in several ways; The S1 stream drains into Owl's Creek, with direct access to the Atlantic Ocean via Rudee Inlet. The S2 and S3 and S4-S7 streams drain into London Bridge Creek, with direct access to the Chesapeake Bay via Lynnhaven Inlet. The S4-S7 streams are also connected to the West Neck Creek, which drains into the North Landing River, with access to Currituck Sound, a protected inlet of the Atlantic Ocean located in northeastern North Carolina and southeastern Virginia. Because of this connectivity, there is the potential access for migratory fishes. Several migratory fish species utilize freshwater stream habitat within the Mid-Atlantic coastal plain (Rhode et al. 1994), including the herrings: alewife, blueback herring, American shad, and hickory shad. River herring are anadromous, meaning that they are born in freshwater and migrate into saltwater to mature. The American eel is also a ubiquitous migratory fish within these stream systems (Rhode et al. 1994). American eel are catadromous, meaning that they are born in saltwater and migrate into freshwater to mature (Jessop et al. 2002). Alewife and blueback herring (collectively river herring) were recently candidate species for listing as endangered or threatened under the Endangered Species Act (ESA). In July 2013, the National Marine Fisheries Service (NMFS) decided that listing river herring as threatened or endangered under the ESA was not warranted (NMFS 2013). American eel are currently

under petition as a candidate for listing under the ESA by the USFWS because they have undergone substantial declines throughout their range (USFWS 2011a).

River herring spawn in a variety of habitats, ranging from swift moving rivers to small tributaries above the tidal zone (NMFS 2009). They migrate during the spring months to spawn in their natal rivers, then return to coastal waters in the summer. Juveniles mature for several years in coastal waters before making their first spawning run (NMFS 2009). River herring abundances are highly variable in Virginia coastal plain streams.

American eel migrate into freshwater streams as juveniles (i.e., elvers) where they mature into the yellow eel phase, remaining in freshwater for up to 30 years. After reaching spawning age (variable), they migrate back to the ocean (Jessop et al. 2002; USFWS 2011b). Eels are locally common, and often abundant, in Virginia coastal plain streams (Rhode et al. 1994). The eel's body form and anguilliform swimming mode is an important aspect of its ability to access freshwater habitats. The eel propels itself in an undulating motion, which they can adapt out to surfaces out of the water as well (Helfman et al. 2009). This allows juvenile elver and yellow-eel stages to "climb" under certain conditions (e.g., rough surfaces), enabling them to pass up and over what would otherwise be a barrier to migrating fishes (USFWS 2011a; Ellerby et al. 2001). Elvers have even been documented successfully climbing large vertical concrete structures, such as dams (Devine Tarbell & Associates 2006; Kleinschmidt 2000).

No river herring were observed during this survey, however gizzard shad were observed, which are known to move locally between fresh and brackish waters, and are sometimes included in the river herring category. Gizzard shad and American eel were captured during the survey throughout the season at various locations. American eel were present throughout the season at NASO-S2, although gizzard shad were completely absent. The size classes observed were consistent with the "elver" and "yellow" eel life stages. Therefore, the elvers present likely migrated into the NASO streams and ponds during spring 2014 and the yellow-phase individuals have been residents since at least the spring 2013 migration period, when they entered the streams and ponds as elvers. Yellow-phase eels reside in freshwater systems for 2 to 6 years (sometimes up to 18 years) until they reach maturity and migrate back to the ocean to spawn as "silver-phase" eels (VIMS 2015).

Additional targeted surveys of migratory fish species utilizing NASO streams to assess evidence of spawning runs of river herring or American eel would provide further evidence of migratory fish use of NASO streams and ponds. This can be done through:

- Periodic electrofishing surveys during migration windows of adult river herring or juvenile American eel, covering late-March through mid-April.
- Periodic electrofishing surveys during mid-summer, to document the presence of young-of-year river herring and juvenile/adult (yellow-phase) American eels

4.3 FISH PASSAGE

Migratory fishes may become excluded from available habitat by impediments to migration (i.e., fish barriers). Such barriers could be dams, perched culverts, or other physical structures. Coastal plain river systems in Virginia can lose portions of historical spawning and rearing habitat for migratory species because of such barriers. Many physical structures are not barriers to American eel, however, since they are capable of ascending (or "climbing") structures such as dams, or even moving over land (Devine Tarbell & Associates 2006; Kleinschmidt 2000; USFWS 2011a).

The Navy realizes the importance of ecosystem health and therefore uses the Virginia Department of Game and Inland Fish (VDGIF) guidance to ensure the protection of water resources on its installations. Due to future maintenance costs associated with culverts, and the loss of riparian and aquatic habitat, the VDGIF advises that stream crossings are constructed as clear-span bridges. However, if this is not possible, the VDGIF recommends countersinking any culverts below the streambed at least 6 in. (15 cm), or use of bottomless culverts, to allow passage of aquatic organisms. The VDGIF also recommends the installation of floodplain culverts to carry bankfull discharges (VDGIF 2007). Furthermore, culverts that are perched or blocked impede fish accessibility to upstream habitat. Culvert-1 at NASO-S2 was perched under the observed water conditions; therefore, although American eel may be able to pass, river herring would be limited. Improvements to NASO-S2 can be made through replacement or modification of the perched culvert to improve passage potential for migratory fish. Eliminating perched culverts and maintaining culvert clearance is recommended to support fish passage within existing conditions throughout the Installation.

While some of the debris dams currently in place may limit the upstream passage of river herring, their habitat value contributes to NASO streams' overall ecosystem. Therefore, dams should be left in the stream channel, even if only partially, whenever possible. As previously recommended, a routine culvert monitoring and maintenance plan would limit culvert blockages that form due to weather-related events or beaver activity. Periodic maintenance, through the removal of accumulated debris piles, downed trees, and other obstructions from these structures, would positively impact the overall fish population within the stream channel. However, it is important to note that debris dams are a natural habitat feature in streams and often provide high-quality structured fish habitat. Therefore any removal of debris from the stream should be limited to within the culverts only. A stream-wide removal of debris dams would be detrimental to the habitat quality of NASO streams.

While the habitat quality of NASO streams were suboptimal to marginal, fish passage is a relatively minor issue within NASO; although any fish passage issues downstream (off-installation) are not clear from this survey. In general, most barriers identified during the barrier survey were passable to migratory fish. However, NASO-S2 had five debris dams and two culverts that had low to no potential for non-eel fish passage. The culverts, identified in NASO-S2 that had no potential for fish passage were perched and prohibited fish from entering. At the outlet of these two culverts there was a change in stream elevation that the culvert outlet did not follow.

In summary, maintenance and alterations are recommended in the following tiered approach to improve habitat quality for migratory fish species within NASO:

1. Maintain culverts clear of debris or beaver dams.
2. Conduct a targeted survey of migratory fish species utilizing NASO streams to assess evidence of spawning runs of river herring or American eel (see Migratory Fisheries, Section 4.2)
3. Since migratory fishes are confirmed to be present, the first step at improving habitat for these fishes would be to modify the network of drainage ditches to minimize sedimentation within the stream channels, as suggested by EPA (2003).
4. Once sedimentation of the stream channel has been minimized, another step toward improving habitat quality would be to evaluate stream restoration options to include natural channel design options.

5. Determine which reach is most in need of immediate restoration by reviewing baseline information to determine if sediment removal would substantially improve migratory fish habitat.
6. Additional restoration-specific surveys would be needed to determine the appropriate restoration action and stabilization method(s) with the goal of improving fish habitat.
7. Restoration options like sediment removal, various bioengineering techniques, such as log or timber cribs, natural streambed substrate, live plantings, etc. should be given priority since they can provide enhanced habitat value.
8. Once the restoration option is determined, then the appropriate permitting application packages would be needed for submittal to state and federal agency approval, before executing the work.

4.4 CHANNELIZED STREAMS

All surveyed streams at NASO have been channelized to some degree. These modifications, likely made to improve drainage across the Installation, have had detrimental impacts on habitat quality. For example, channelization increases the streambed gradient and decreases the retention time of the water in the channel. The channelized streambed inhibits normal overbank flooding during storm events. The floodwater abatement and water quality protection functions normally provided by the floodplain and any adjacent wetlands are significantly diminished as a result (Navy 2014). This type of channelized system experiences drastic changes in water levels over a short time period, which can limit the diversity and sustainability of the fish populations. Results from this habitat assessment of NASO streams are consistent in characterizing them as a low-quality stream habitat.

4.5 WATER QUALITY

Currently, dissolved oxygen, pH, TSS, and nutrient levels recorded in NASO ponds and streams are considered sufficient to sustain native fish populations and promote productivity, without the need for supplemental fertilization. Water quality should continue to be monitored to determine any management actions. Poor water quality can be detrimental to both the physical and biological pond environment, therefore it should be monitored on a routine basis. Water quality parameters for NASO-P1 and NASO-P2 are described below in Table 26 along with corresponding proposed management actions. Water quality management (e.g., liming and fertilization) should be conducted prior to implementing a fish stocking program. In general, high turbidity in ponds reduces the amount of light that penetrates the water, reducing fish growth and algae photosynthesis. TSS measurements are directly related to turbidity and water clarity, therefore TSS concentrations between 40 and 80 mg/L result in water that appears cloudy (State of Michigan 2015). TSS in both NASO ponds was generally below 20 mg/L, with the exception of NASO-P2 in April (< 30 mg/L), therefore the turbidity is currently at healthy levels in both ponds. Water quality monitoring should continue to ensure these conditions persist.

Table 26: Proposed Water Quality Management

Water quality parameter	Current conditions in NASO-P2 and NASO-P1	Consequences	Proposed recommendation
pH and Alkalinity	Low pH (below 6 in May), indicative of low alkalinity and acidic water	Low pH alkalinity can cause toxic conditions lethal for fish fry	No action needed currently.

Water quality parameter	Current conditions in NASO-P2 and NASO-P1	Consequences	Proposed recommendation
Dissolved oxygen (DO)	Sufficient DO; all readings > 8.85 mg/L on top 2 m	Low DO can cause poor growth, disease, and suffocation	No action needed
Turbidity	Low turbidity and primary productivity	Increased turbidity results in slow growth throughout food web and aquatic vascular plant growth	No action needed

Water quality parameters such as pH, alkalinity, dissolved oxygen, and turbidity should all be considered in a pond management strategy to promote biological success. The continual assessment and monitoring of these indicators can help identify preventative management actions for issues such as eutrophication, sedimentation, and non-point source contamination. Regular water quality monitoring provides the baseline data necessary to inform a proactive pond management approach. Highlighted below are summaries for the water quality conditions at NASO and their implications for aquatic habitat quality.

- Laboratory water quality results showed that total nitrogen levels were not exceedingly high (ranged from 0.4 mg/L to 1.9 mg/L). Nitrogen concentrations above 3 mg/L can indicate pollutions from fertilizers, manures, or other nutrient-rich wastes (Swistock 2015). However, laboratory results also showed the phosphorus levels were high, both ponds reported results over 0.1 mg/L. Phosphorus levels above 0.025 mg/L can indicate a potential for nuisance algae and aquatic plant growth (Swistock 2015). Therefore both ponds have potential to reach eutrophic conditions.
- Laboratory nutrient analysis results showed that NASO-S3 had the highest total nitrogen concentrations for every sampling eventexcept October. Phosphorus also plays a key role in phytoplankton abundance and results were similar across most streams during most sampling events except August, when NASO-S3 had an almost three fold increase in phosphorus. Specific conductance was variable across locations and sampling event, with the large variations between streams in April. Dissolved oxygen was also highly variable for the most part. The most similar results were displayed in April; however, August had the most variable results for dissolved oxygen percentage, due to a malfunction in the water quality probe.
- Phosphorus is considered to be a more limiting nutrient with regard to freshwater algal growth. Bottom sediments are often more rich in phosphorus than the water column. Therefore, as these algae begin to form in the bottom sediments, they quickly can reach bloom levels as they rise to the surface and accumulate more nitrogen at the surface through atmospheric nitrogen fixation (Havens and Frasier 2012). This type of research shows that it is critical to control both nitrogen and phosphorus levels.
- Comparison with historical water quality data from a 2012 report conducted in NASO-P1 (Edwards 2012), reveals that the pH in NASO-P1 is variable (5.68 to 9.27 in 2014; 6.5 to 7.2 in 2012). While DO ranged from 7.68 to 13.9 mg/L in 2014, it remained more constant in 2012, ranging from 6.0 to 7.0 mg/L. However, water quality sampling depths were not reported in the 2012 report, which could explain some of the variations seen over time in NASO-P1. Overall, water quality parameters were very good with a pH measurement well within the suitable range

to support a diverse community of aquatic life. Dissolved oxygen was high enough to support a wide variety of finfish species.

- NASO-P1 appeared eutrophic because of abundant algae present along the shorelines. Nitrogen and phosphorus are two nutrients that are essential for the growth of plants and animals; however, excess nitrogen and phosphorus can lead to rapid increases of microscopic algae growth in the water column leading to less light penetration for aquatic plants and in extreme cases to hypoxic events that result in dissolved oxygen levels in the water, potentially harmful to fish.

One method to reduce nutrient input to the ponds and streams is to reduce the frequency of mowing or establishing no mowing zones along wetland edges to increase vegetative filters. Planting appropriate native trees, shrubs, and ground cover vegetation as wetland buffers is an effective method of establishing riparian buffers.

4.6 INVASIVE SPECIES

Invasive species that may affect ponds in the area include various types of aquatic algae, as well as free floating, submergent, and emergent species. Invasive fish species, such as snakehead, are also a concern in this region, but no individuals were observed during these surveys. Common carp are also invasive, but seem to be in control at NASO.

Fish kills can occur when high volumes of non-native vegetation die and decay, depleting oxygen in the process. Eutrophication is typically not an issue for well-constructed ponds that provide vegetation densities of less than 30 percent of the pond area (Boyd and Boyd 2012).

The common reed (*Phragmites australis*) is an invasive species that could potentially affect NASO-P1 and P2. Because this plant can be invasive in streams and ponds, and can tolerate both fresh and salt water. Alligator weed (*Alternanthera philoxeroides*), Asian spiderwort (*Murdannia keisak*), and Eurasian milfoil (*Myriophyllum spicatum*), and narrowleaf cattail (*Typha angustifolia*) have potential to become invasive species on the Installation and should be monitored for. Other invasive species to monitor include red-eared slider (*Chrysemys scripta elegans*) and Asian carp species.

The nutria (*Myocastor coypus*), a relative to the native muskrat (*Ondatra zibethicus*), is a semi-aquatic invasive species capable of negatively impacting environment. If present, nutria may feed on vegetation and outcompete native species, stunting growth of the aquatic ecosystem. The most effective method of controlling nutria populations is shooting or trapping. Other management actions include using hardwire cloth tubes and plastic seed protectors (USGS 2007). Although, no evidence of nutria was witnessed during these surveys, natural resource managers should respond with appropriate control measures if nutria are encountered on the Installation.

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6 APPENDIX A - PHOTOGRAPHIC LOG

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 20140930_081057

Date: 30 September 2014

Photographer: E. Foster

Comments: Start of NASO-S1 electrofishing reach at Oceana Blvd.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0040

Date: 29 April 2014

Photographer: D. Anderson

Comments: Partial barrier (Debris-1) formed by LWD at NASO-S1.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0058

Date: 29 April 2014

Photographer: D. Anderson

Comments: Bridge-1 at NASO-S1.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0051

Date: 29 April 2014

Photographer: D. Anderson

Comments: Culvert-1 at NASO-S1.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0073

Date: 30 April 2014

Photographer: B. Dresser

Comments: Culvert-1 at the start of NASO-S2 (perimeter fenceline), looking downstream. Note the opening of this culvert is eroded and perched with an approximately 2-ft. drop.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0075

Date: 30 April 2014

Photographer: B. Dresser

Comments: Culvert-2 at the start of NASO-S2, looking upstream. Note that Culvert-2 drains immediately into Culvert-1, with approx. 1-ft distance between the two culverts.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 20140930_105855

Date: 30 September 2014

Photographer: E. Foster

Comments: Typical section of NASO-S2.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 00063

Date: 30 April 2014

Photographer: B. Dresser

Comments: Instream large woody debris (LWD) at NASO-S2. LWD provide important habitat structure and riffle areas in streams, with an otherwise homogeneous run.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 00065

Date: 30 April 2014

Photographer: B. Dresser

Comments: Culvert-3 at NASO-S2.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 00066

Date: 30 April 2014

Photographer: B. Dresser

Comments: Upstream side of culvert-3 at NASO-S2, showing typical debris accumulation on the upstream side of a culvert.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0087

Date: 02 June 2014

Photographer: K. Lamontagne

Comments: Debris-1 at NASO-S2.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0095

Date: 02 June 2014

Photographer: K. Lamontagne

Comments: Debris-2 at NASO-S2.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0098

Date: 02 June 2014

Photographer: K. Lamontagne

Comments: Debris-3 at NASO-S2.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0103

Date: 02 June 2014

Photographer: K. Lamontagne

Comments: Debris-4 at NASO-S2.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0105

Date: 02 June 2014

Photographer: K. Lamontagne

Comments: Debris-5 at NASO-S2.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0107

Date: 02 June 2014

Photographer: K. Lamontagne

Comments: Culvert-1 at NASO-S2.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0026

Date: 28 April 2014

Photographer: T. Gaudet

Comments: Breach in perimeter fence at NASO-S3. Debris had accumulated high enough to fill the stream channel resulting in the channel shifting course and eroding beneath the fence.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 00086

Date: 04 June 2014

Photographer: B. Dresser

Comments: Lower portion of NASO-S3 is an ephemeral stream, shown here with intermittent pools of standing water with no flow.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 00087

Date: 04 June 2014

Photographer: B. Dresser

Comments: Lower portion of NASO-S3 is an ephemeral stream, shown here completely dry.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0062

Date: 29 April 2014

Photographer: D. Anderson

Comments: Culvert-1 at NASO S3.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 20141001_091528

Date: 01 October 2014

Photographer: B. Dresser

Comments: Typical section of NASO-S4.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: XXXX

Date: DD MMM YYYY

Photographer: B. Dresser

Comments: Typical section of NASO-S4.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0012

Date: 28 April 2014

Photographer: B. Dresser

Comments: Culvert-1 at NASO-S5. Surface boom deployed presumably for stormwater compliance.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0012

Date: 28 April 2014

Photographer: B. Dresser

Comments: Culvert-2 at NASO-S5.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0023

Date: 28 April 2014

Photographer: B. Dresser

Comments: Culvert-3 at NASO-S5.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0081

Date: 30 April 2014

Photographer: K. Lamontagne

Comments: Typical habitat at NASO-S5.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0025

Date: 28 April 2014

Photographer: B. Dresser

Comments: NASO-S5 end point at runway.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0122

Date: 04 June 2014

Photographer: D. Anderson

Comments: NASO-S6 at the perimeter fence, start of electrofishing reach. Note the accumulated debris in front of the reinforced fence. This pool is where the gizzard shad were initially found during the June survey.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0122

Date: 04 June 2014

Photographer: D. Anderson

Comments: Typical stream habitat at NASO-S6.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0001

Date: 28 April 2014

Photographer: B. Dresser

Comments: Middle section of NASO-S6 during high-water conditions.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0128

Date: 04 June 2014

Photographer: B. Dresser

Comments: Gizzard shad from NASO-S6.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 0174

Date: 30 September 2014

Photographer: B. Dresser

Comments: Pumpkinseed sunfish collected from NASO-S6 with caudal fin deformity.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: 0174

Date: 30 September 2014

Photographer: B. Dresser

Comments: Pumpkinseed sunfish collected from NASO-S6 with deformed lower jaw.

Site: NASO Dam Neck Annex, Virginia Beach, VA

Project: Task Order WE85 NASO-DNA Stream and Pond Assessment

Photo No.: DSCF0149

Date: 04 June 2014

Photographer: E. Foster

Comments: Typical NASO-S7 stream habitat. Note the considerable amount of sediment deposition in the stream channel.

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7 APPENDIX B - BLANK DATA SHEETS

TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project:______________________________ **Date and Time (Start-End):**________________________________ **Investigators:**____

Stream:____________________ **Reach:**____________ **Partial Debris Dam Tally for Reach:**________________________ **GPS @ Start Point:** □ Y □ N **Photo #'s:**_____________

Start of Reach located at: □ Confluence with _________________ □ Installation-Specific ___________________________ □ Arbitrary location_____________________________

	Observation Parameters	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE
	Barrier Height					
	Vertical Water Drop					
	Pool Immediately Below?	□ Y Depth_____ □ N	□ Y Depth_____ □ N	□ Y Depth_____ □ N	□ Y Depth_____ □ N	□ Y Depth_____ □ N
	Wetted Channel Width					
	Structure Width (length, for culverts)					
	Stream Channel	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural
	Bank Erosion?	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Scouring or undercutting of structure?	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Structure Span/Diameter					
	Beaver Activity?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
DEBRIS DAMS	Debris Dam Composition	□ woody debris □ leaf litter □ sediment □ other ___________	□ woody debris □ leaf litter □ sediment □ other ___________	□ woody debris □ leaf litter □ sediment □ other ___________	□ woody debris □ leaf litter □ sediment □ other ___________	□ woody debris □ leaf litter □ sediment □ other ___________
	Is this a Beaver Dam?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Alternate Channel Formation/Braiding?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
BRIDGE/CULVERT	Clearance					
	Bridge Material	□ concrete □ steel □ timber □ other ___________	□ concrete □ steel □ timber □ other ___________	□ concrete □ steel □ timber □ other ___________	□ concrete □ steel □ timber □ other ___________	□ concrete □ steel □ timber □ other ___________
	Culvert Material Corrugated? □ Y □ N	□ concrete □ steel □ plastic □ other ___________	□ concrete □ steel □ plastic □ other ___________	□ concrete □ steel □ plastic □ other ___________	□ concrete □ steel □ plastic □ other ___________	□ concrete □ steel □ plastic □ other ___________
	# of Arches/Culverts					
	Opening Obscured Up/Downstream	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Depth Inside Structure					
	Armoring?	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Overflow Pipe?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Substrate inside structure					
	Structure outlet is:	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall
	cross sectional schematic (draw)					

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	❑
____%❑	%cloud cover	❑____%
❑	clear/sunny	❑

Has there been a heavy rain in the last 7 days? ❑ Yes ❑ No

Air Temperature_____^{0} C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

STREAM CHARACTERIZATION

Stream Subsystem
❑ Perennial ❑ Intermittent ❑ Tidal

Stream Type
❑ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial
❑ Non-glacial montane
❑ Swamp and bog
❑ Spring-fed
❑ Mixture of origins
❑ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
❑ Forest ❑ Commercial
❑ Field/Pasture ❑ Industrial
❑ Agricultural ❑ Other _____
❑ Residential

Local Watershed NPS Pollution
❑ No evidence ❑ Some potential sources
❑ Obvious sources

Local Watershed Erosion
❑ None ❑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
❑ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length _____m

Estimated Stream Width _____m

Sampling Reach Area _____m^2

Area in km^2 (m^2x1000) _____km^2

Estimated Stream Depth _____m

Surface Velocity (at thalweg) _____m/sec

Canopy Cover
❑ Partly open ❑ Partly shaded ❑ Shaded

High Water Mark _____m

Proportion of Reach Represented by Stream Morphology Types
❑ Riffle_____% ❑ Run_____%
❑ Pool_____%

Channelized ❑ Yes ❑ No

Dam Present ❑ Yes ❑ No

LARGE WOODY DEBRIS

LWD _____m^2

Density of LWD _____m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating
❑ Floating Algae ❑ Attached Algae

dominant species present _____

Portion of the reach with aquatic vegetation _____%

WATER QUALITY

Temperature_____^{0} C

Specific Conductance_____

Dissolved Oxygen _____

pH _____

Turbidity _____

WQ Instrument Used _____

Water Odors
❑ Normal/None ❑ Sewage
❑ Petroleum ❑ Chemical
❑ Fishy ❑ Other_____

Water Surface Oils
❑ Slick ❑ Sheen ❑ Globs ❑ Flecks
❑ None ❑ Other_____

Turbidity (if not measured)
❑ Clear ❑ Slightly turbid ❑ Turbid
❑ Opaque ❑ Stained ❑ Other_____

SEDIMENT/ SUBSTRATE

Odors
❑ Normal ❑ Sewage ❑ Petroleum
❑ Chemical ❑ Anaerobic ❑ None
❑ Other_____

Oils
❑ Absent ❑ Slight ❑ Moderate ❑ Profuse

Deposits
❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand
❑ Relict shells ❑ Other_____

Looking at stones which are not deeply embedded, are the undersides black in color?
❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

FISH SAMPLING FIELD DATA SHEET (FRONT)

page _____ of _____

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
GEAR	INVESTIGATORS	
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ❑ back pack ❑ tote barge ❑ other _____ **Block nets used?** ❑ YES ❑ NO **Sampling Duration** Start time _____ End time _____ Duration _____ **Stream width (in meters)** Max_____ Mean_____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Riffles_____% ❑ Pools_____% ❑ Runs_____% ❑ Snags_____% ❑ Submerged Macrophytes_____% ❑ Other ( )_____%
GENERAL COMMENTS	

SPECIES	**TOTAL (COUNT)**	**OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)**					**ANOMALIES***							
							D	**E**	**F**	**L**	**M**	**S**	**T**	**Z**

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: FW08 DATE: ___/___/2 0___

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ○ cm	○ ft ○ cm	○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0			
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG ____

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

TETRA TECH

Water Quality - Streams, Sheet ___ of ___

Project:________________________________ **Site:**________________________________ **Meter:**________________________________

Investigators: ________________________________ **Remarks:**________________________________

____

Stream Reach	Location	Date/Time	In-situ Measurements					Grab Samples			Remarks
			pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Sp. Cond. °25C (µS/cm)	Temperature (C°)	Total Nitrogen (TN)	Total Phos. ortho-Phos. (SRP)	Total Suspended Solids (TSS)	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	

TETRA TECH

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Project: _____

Site: _____ **Date and Time (Start-End):** _____

Investigators: _____

Weather Conditions (current and past 24 hrs): _____

Pond Surface Conditions: _____

Index GPS Coordinates: LAT**:** _____ LONG: _____

Observed Approx. Depth Range: _____

SITE LOCATION MAP (Include locations sampled by gear type, water quality index location, inlet/outlet streams, cover, vegetation, and high water mark):

TETRA TECH

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Water Quality (*Recorded at Index Location*)	**In-situ Measurements**				**Grab Samples**			
Depth =_____ m	**pH**	**Dissolved Oxygen (mg/L)**	**Oxygen Saturation (%)**	**Conductivity (µS/cm)**	**Temperature (C°)**	**Total Nitrogen (TN)**	**Total Phosphorus & ortho-Phosphate (SRP)**	**Total Suspended Solids (TSS)**
Upper (Surface)						□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Middle						□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Lower						□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Remarks:								

Shoreline Characteristics				
	Rare (<5%)	Sparse (5 to 25%)	Moderate (26 to 75%)	Extensive (76 to 100%)
Forest				
Grass				
Shrub				
Wetland				
Bare Ground				
Agriculture				
Shoreline Modifications (concrete, rip rap, etc.)				
Development (residential/industrial)				
Shoreline Qualitative Macrophyte Survey				
Emergent/Floating				
Submergent				
Macrophyte Density (circle one)	Absent	Sparse	Moderate	High
Shoreline Stability (%)			Stable %	Eroding %

TETRA TECH

Littoral Bottom Substrate (*shoreline out to 10 m*)					
	Absent (0%)	Sparse (<10%)	Moderate (11-40%)	Heavy (41 to 70%)	Very Heavy (71 to 100%)
Bedrock					
Boulder					
Cobble					
Gravel					
Sand					
Silt, Clay, Muck					
Woody Debris					
Organic (leaf pack, detritus)					
Vegetation or other					
Substrate Odor/Color:					
Remarks:					
Littoral Fish Cover (*shoreline out to 10 m*)					
Aquatic and Inundated Herbaceous Vegetation					
Woody Debris/Snags					
Inundated Live trees					
Overhanging Vegetation					
Sharp Ledges or Dropoffs					
Boulders					
Human Structures (docks, barges, tires, car bodies, etc.)					
Species Observed:					
Remarks:					

Fish Sampling: ☐ yes ☐ no **Gear Used**: ☐ electrofishing ☐ exp. gill net ☐ seine ☐ minnow trap ☐ hook & line

Trophic State: ☐ Oligotrophic ☐ Mesotrophic ☐ Eutrophic ☐ Hypereutrophic

Emergent/Submerged Vegetation Observed:

Invasive Species Observed:

Wildlife Observed:

Additional Notes:

8 APPENDIX C - FIELD DATA SHEETS

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME NASO-S1	LOCATION OCEANA	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY NANFAC	
INVESTIGATORS		
FORM COMPLETED BY DRESSER, GAUDET	DATE 4/29 TIME 1100 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☒	showers (intermittent)	☐
100 % ☐	%cloud cover	☐ 100 %
☐	clear/sunny	☐

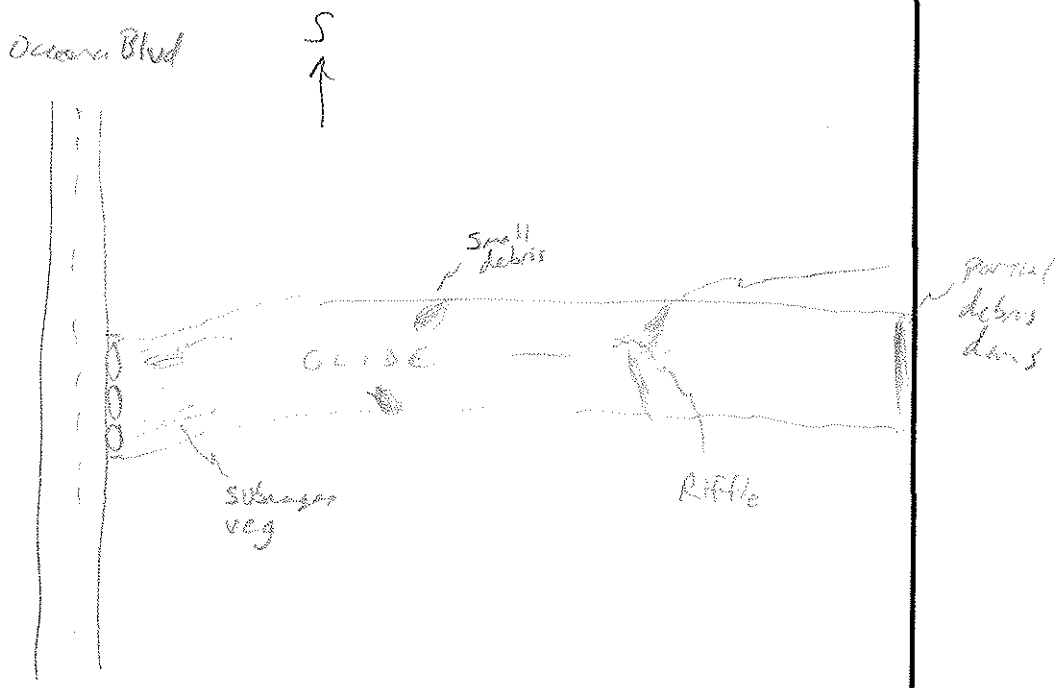
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No ~0.5"

Air Temperature 65° ☒ F

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☒ Other Storm water

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse Ocean Blvd.
- ☒ Forest
- ☒ Field/Pasture
- ☐ Agricultural
- ☐ Residential
- ☒ Commercial
- ☐ Industrial
- ☒ Other Military

Local Watershed NPS Pollution
- ☐ No evidence
- ☐ Some potential sources
- ☐ Obvious sources

Local Watershed Erosion
- ☒ None
- ☐ Moderate
- ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
- ☒ Trees
- ☒ Shrubs
- ☐ Grasses
- ☒ Herbaceous

dominant species present SCRUB OAK/PINE mix

INSTREAM FEATURES

Estimated Reach Length 150 m

Estimated Stream Width 6.6 m

Sampling Reach Area _____ m²

Area in km² (m²x1000) _____ km²

Estimated Stream Depth 0.4-2.1 m Ft

Surface Velocity (at thalweg) _____ m/sec See flow data sheet

Canopy Cover
- ☐ Partly open
- ☐ Partly shaded
- ☒ Shaded

High Water Mark 0.5 m

Proportion of Reach Represented by Stream Morphology Types
- ☒ Riffle 5 %
- ☒ Run 90 %
- ☒ Pool 5 %

Channelized ☒ Yes ☐ No

Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD 0 m²

Density of LWD 0 m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
- ☐ Rooted emergent
- ☒ Rooted submergent
- ☐ Rooted floating
- ☐ Free floating
- ☐ Floating Algae
- ☐ Attached Algae

dominant species present NOTE: See wetland report

Portion of the reach with aquatic vegetation 5 %

WATER QUALITY

Temperature 12.28 °C

Specific Conductance 0.202 mS/cm

Dissolved Oxygen 7.21

pH 4.76 67.3%

Turbidity _____

WQ Instrument Used YSI-556

Water Odors
- ☒ Normal/None
- ☐ Sewage
- ☐ Petroleum
- ☐ Chemical
- ☐ Fishy
- ☐ Other _____

Water Surface Oils
- ☐ Slick
- ☐ Sheen
- ☐ Globs
- ☐ Flocks
- ☐ None
- ☐ Other _____

Turbidity (if not measured)
- ☐ Clear
- ☐ Slightly turbid
- ☐ Turbid
- ☒ Opaque
- ☐ Stained
- ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
- ☒ Normal
- ☐ Sewage
- ☐ Petroleum
- ☐ Chemical
- ☐ Anaerobic
- ☐ None
- ☐ Other _____

Oils
- ☒ Absent
- ☐ Slight
- ☐ Moderate
- ☐ Profuse

Deposits
- ☐ Sludge
- ☐ Sawdust
- ☐ Paper fiber
- ☐ Sand
- ☐ Relict shells
- ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
- ☐ Yes
- ☐ No
- N/A

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	40%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	50%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	30%	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	60%			
Clay	< 0.004 mm (slick)	10%			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NASO-S2	LOCATION OCEANA	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY DRESSER CAUDRT	DATE 9/29 TIME 1100 AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover 9	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization 10	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
3. Pool Variability 6	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition 15	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status 17	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration 13	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity 2	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
8. Bank Stability (score each bank) 18	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. 14	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) 18	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

Total Score 122

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME S1 NASO	LOCATION OCEANA
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR L24 Smith-Root	INVESTIGATORS TG BD
FORM COMPLETED BY	DATE 4/29/14 TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 0845 End time 1015 Duration 2028s **Stream width (in meters)** Max _____ Mean 6.6
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☑ Runs 70% ☐ Snags 20% ☑ Submerged Macrophytes 10 % ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L / Wt / L / WT					ANOMALIES* D	E	F	L	M	S	T	Z
R.F. PICKEREL	4	145	22.0											
Redfin Pickerel		55	2.0											
		196	50.2											
		169	34.7											
BLUEGILL	8	141	39.7	90	12.4									
Bluegill		132	48.3	120	25.6									
		116	27.8	105	[illegible]									
		106	13.9											
		92	12.2											
BROWN BULLHEAD	1	138	39.7											
WARMOUTH	1	95	16.9											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		L	Wt	L	Wt		D	E	F	L	M	S	T	Z
B. MUDMINNOW	6	67	5.6	66	4.5									
		83	6.1											
		66	3.8											
		54	2.9											
		77	5.7											
P. PERCH	5	85	8.6											
		44	1.7											
		65	5.2											
		65	4.1											
		60	3.6											
Am. EEL	1	200	N/A											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: ~~FW08~~ S1 NASO DATE: 04 / 29 / 2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ◉ cm	◉ ft ○ cm	◉ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	.1	.01	
2	66	.7	.18	
3	132	.4	.29	
4	198	1.1	.30	
5	264	1.0	.51	
6	330	1.3	.47	
7	396	1.5	.37	
8	462	2.1	.15	
9	538	1.1	.06	
10	604	.7	.07	
11	670	0	00	
12	396			
13	462			
14	538			
15	594			
16	660			
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	____.__	____.__	
2	____.__	____.__	
3	____.__	____.__	
4	____.__	____.__	
5	____.__	____.__	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m	____	____	____
Float Time (s)	____.__	____.__	____.__
Flag	____	____	____

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	____.__	____.__	____.__
Depth 1 ○ ft ○ cm	____.__	____.__	____.__
Depth 2	____.__	____.__	____.__
Depth 3	____.__	____.__	____.__
Depth 4	____.__	____.__	____.__
Depth 5	____.__	____.__	____.__

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG [ ]

Flag	Comments
	Stream was 6.6m across.

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

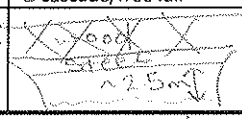
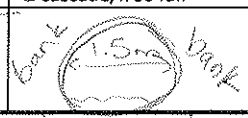
TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NASA/DNA Date and Time (Start-End): 4/29 @ 14:00 Investigators: Anderson, Gay

Stream: NASA-S1 Reach: S1 Partial Debris Dam Tally for Reach: III GPS @ Start Point: ☐ Y ☒ N Photo #'s: ___

Start of Reach located at: ☐ Confluence with ___ ☒ Installation-Specific NASA ☐ Arbitrary location ___

	Observation Parameters	Barrier Type ☐ Debris Dam # 1 ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N	Barrier Type ☐ Debris Dam # ___ ☐ Bridge # 1 Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N	Barrier Type ☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # 1 Name of Road ___ GPS Point? Y / N	Barrier Type ☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N	Barrier Type ☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	☐ HIGH ☒ MED ☐ LOW ☐ NONE	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	0.6m streambed 0.4m above	2.5 m	N/A		
	Vertical Water Drop	0.2 m	N/A	None		
	Pool Immediately Below?	☒ Y Depth 0.75m ☐ N	☐ Y Depth ___ ☒ N	☐ Y Depth ___ ☒ N	☐ Y Depth ___ ☐ N	☐ Y Depth ___ ☐ N
	Wetted Channel Width *	4.2 m	3.4 m	2.5 m		
	Structure Width (length, for culverts)	4.2 m	9.4 m	1.5 m		
	Stream Channel	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: n/a m long ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	N/A	N/A	1.5 m		
	Beaver Activity?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☒ woody debris ☒ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___
	Is this a Beaver Dam?	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance		2.5 m	N/A		
	Bridge Material	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☒ timber (w/ steel support) ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___
	Culvert Material Corrugated? ☐ Y ☐ N	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☒ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___
	# of Arches/Culverts		1	1		
	Opening Obscured Up/Downstream	☐ Y ☐ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure		0.4 m	0.4 m		
	Armoring?	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☐ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure		Sand/streambed	Concrete		
	Structure outlet is:	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☒ at grade ☐ cascade/free fall	☐ partially backwatered ☒ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

0.2 m drop cascade

at grade, no obstructions

at grade, no obstructions

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME NAFO -52	LOCATION OCEANA	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET # /	AGENCY NAVFAC	
INVESTIGATORS		
FORM COMPLETED BY DRESSER	DATE 4/30/14 TIME 1000 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
75 % ☒	%cloud cover	☒ 100 %
☐	clear/sunny	☐

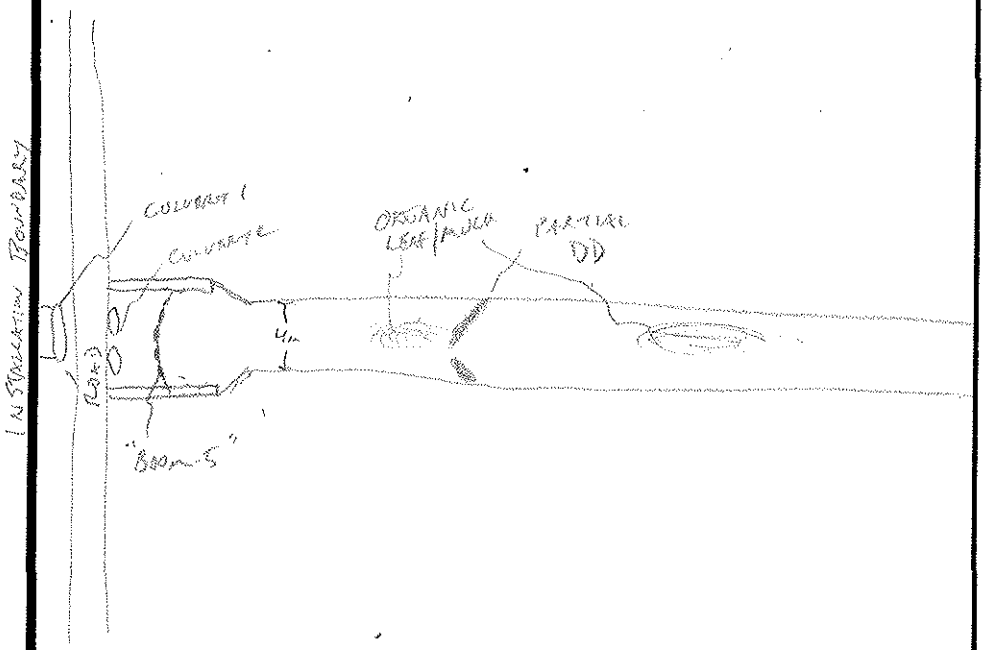
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No ~0.5

Air Temperature 65 °F

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☒ Other STORM WATER

Catchment Area _____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☒ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☒ Other MILITARY
☐ Residential

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☒ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present MIXED HARDWOODS

INSTREAM FEATURES

Estimated Reach Length 150 m
Estimated Stream Width 4-5 m
Sampling Reach Area 150 m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth 0.3-1.0 m
Surface Velocity (at thalweg) _____ m/sec — See flow sheet

Canopy Cover
☐ Partly open ☐ Partly shaded ☒ Shaded

High Water Mark 0.4 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 0 % ☒ Run 95 %
☒ Pool 5 %

Channelized ☒ Yes ☐ No
Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD 0 m²
Density of LWD 0 m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present NONE

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature 14.5 °C
Specific Conductance 0.270
Dissolved Oxygen 7.49 83.4%
pH 5.15
Turbidity _____
WQ Instrument Used YSI-556

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☐ None ☐ Other _____

Turbidity (if not measured)
☒ Clear ☒ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No N/A

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	25%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	25%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	90%	Marl	grey, shell fragments	0%
Silt	0.004-0.06 mm	10%			
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NASO - 52	LOCATION OCEANA	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY NAVFAC	
INVESTIGATORS		
FORM COMPLETED BY Dresser	DATE 4/30/14 TIME 10 00 (AM) PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover 2	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
2. Pool Substrate Characterization 6	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
3. Pool Variability 2	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
4. Sediment Deposition 6	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
5. Channel Flow Status 19	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration 7	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
7. Channel Sinuosity 1	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
8. Bank Stability (score each bank) 18	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. 16	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) 14	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Total Score 91

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of

STREAM NAME NASO S2	LOCATION NAS Oceana
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY NAVFAC
GEAR LR 24 Smith-Root	INVESTIGATORS Gaudet, Lomantagne
FORM COMPLETED BY	DATE 4/29/14 TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 16:15 End time 17:30 Duration 3083 s **Stream width (in meters)** Max _____ Mean 4.5 m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☑ Pools 5 % ☑ Runs 95 % ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
green sunfish	1	134	57.9											
largemouth bass	1	125	23.6											
mudminnow	4	61	2.1											
		61	2.8											
		56	3.3											
		77	4.9											
pirate perch	24	85	9.7	47	1.5									
		53	3.2	75	5.4									
		42	2.2	49	1.2									
		83	5.9	49	1.8									
		48	1.8	45	1.6									

↳ continued on back

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		TL	W	TL	W		D	E	F	L	M	S	T	Z
pirate perch		42	0.4	50	1.7									
		60	2.0	46	0.7									
		84	7.2	40	1.0									
		69	4.1	49	1.9									
		50	1.0	47	1.4									
pirate perch		43	0.5	42	0.7									
		57	2.1	47	0.3									

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~FW08~~ NASO-52 DATE: 04/30/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ◉ cm	◉ ft ○ cm	◉ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.8	0.07	
2	40	1.1	0.34	
3	80	1.0	0.40	
4	120	1.0	0.33	
5	160	1.1	0.41	
6	200	1.1	0.33	
7	240	1.1	0.39	
8	280	1.1	0.39	
9	320	1.1	0.43	
10	360	1.0	0.23	
11	400	1.0	0.29	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	____.__	____.__	
2	____.__	____.__	
3	____.__	____.__	
4	____.__	____.__	
5	____.__	____.__	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	____.__	____.__	____.__
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

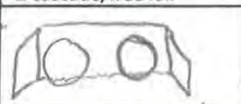
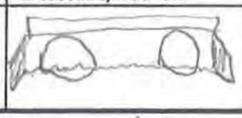
TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: OCEANA **Date and Time (Start-End):** 4/30/2014 **Investigators:** DRESSER, LAMONTAGNE

Stream: NASO-S2 **Reach:** ___ **Partial Debris Dam Tally for Reach:** 1 **GPS @ Start Point:** ☒ Y ☐ N **Photo #'s:** ___

Start of Reach located at: ☐ Confluence with ___ ☒ Installation-Specific BOUNDARY ☐ Arbitrary location ___

	Observation Parameters	Barrier Type	Barrier Type	Barrier Type	Barrier Type	Barrier Type
ALL BARRIER TYPES		☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☒ Culvert # 1 Name of Road ___ GPS Point? Y / N	☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☒ Culvert # 2 Name of Road ___ GPS Point? Y / N	☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☒ Culvert # 3 Name of Road SLUDGERD GPS Point? Y / N	☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N	☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N
	Potential for Fish Passage	☒ HIGH ☐ MED ☐ LOW ☒ NONE except eels	☐ HIGH ☒ MED ☐ LOW ☐ NONE	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	↑	↑	↑		
	Vertical Water Drop	est. 1' drop	NONE	NONE		
	Pool Immediately Below?	☒ Y Depth 1m+ ☐ N	☐ Y Depth ___ ☒ N	☒ Y Depth >1m ☐ N	☐ Y Depth ___ ☐ N	☐ Y Depth ___ ☐ N
	Wetted Channel Width	~~8'~~ 10m	3.5m	5m		
	Structure Width (length, for culverts)	~30' est.	55'	33'		
	Stream Channel	Upstream: ☒ channelized (culvert) ☐ natural Downstream: ☒ channelized ☒ natural	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☒ Y ☐ N minor Right: ☐ Y ☒ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☒ Y ☐ N ↑ Right: ☒ Y ☐ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	10'	5'	1m		
	Beaver Activity?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___
	Is this a Beaver Dam?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance	9.5'	4.5'	0.4m ~~[illegible]~~		
	Bridge Material	☐ concrete ☒ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___
	Culvert Material Corrugated? ☐ Y ☐ N	☐ concrete ☒ steel - concrete outside ☐ plastic - CORRUGATED ☐ other ___	☒ concrete NOT CORRUGATED ☐ steel ☐ plastic ☐ other ___	☒ concrete NON CORRUGATED ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___
	# of Arches/Culverts	1	2	2		
	Opening Obscured Up/Downstream	☐ Y ☒ N	☐ Y ☒ N	☒ Y ☐ N UPSTREAM	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure	0.5'		0.4		
	Armoring?	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure	Steel pipe	CONCRETE	CONCRETE		
	Structure outlet is:	☐ partially backwatered ☐ at grade ☒ cascade/free fall - 1' est.	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☒ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

- first 10' of culvert ended away
- ~drop to pool below

culvert outlet is outside of installation (NOT visible)

these 2 culverts are separated by only ~2'

~~PARTIAL D.D.~~ HHT

- One 12" dia pipe w/ [illegible]
- one 8" dia pipe on same

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME NASO-53	LOCATION NASO-53 Stream
STATION #______ RIVERMILE______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY NAVFAC
INVESTIGATORS Gundel, Dresser, Lamontagne	
FORM COMPLETED BY TG	DATE 4/29 TIME 1500 AM (PM) — REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	❑
100 % ☒	%cloud cover	☒ 100 %
❑	clear/sunny	❑

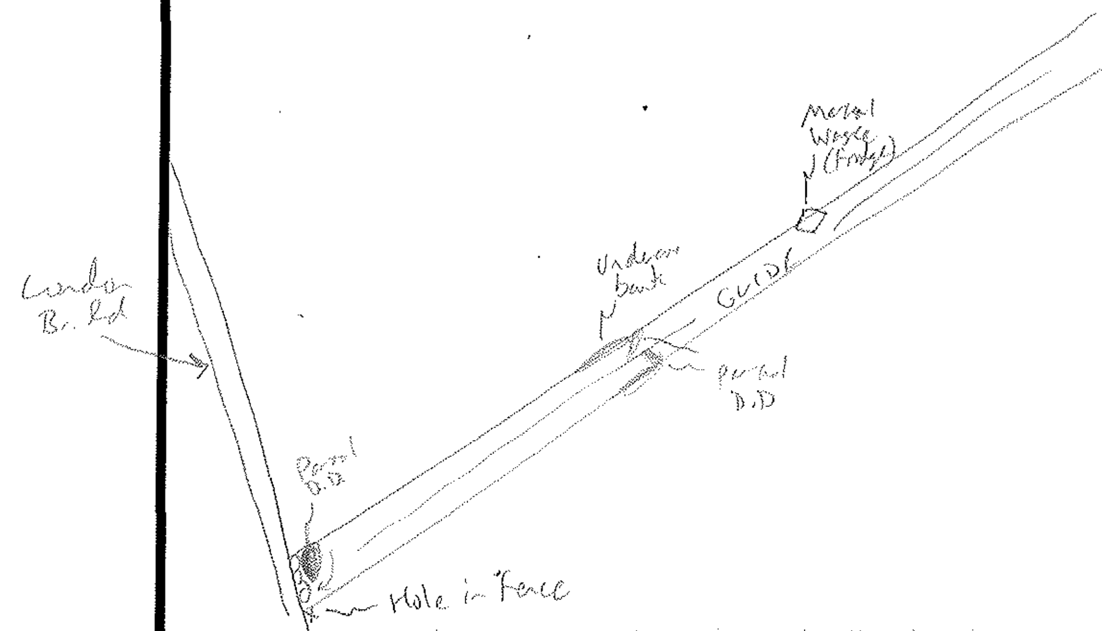
Has there been a heavy rain in the last 7 days? ☒ Yes ❑ No

Air Temperature 65° °F

Other__________

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ❑ Intermittent ❑ Tidal

Stream Type
❑ Coldwater ☒ Warmwater

Stream Origin
❑ Glacial ❑ Non-glacial montane ❑ Swamp and bog ❑ Spring-fed ❑ Mixture of origins ☒ Other Storm water Drainage

Catchment Area______ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☒ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☒ Other military
☐ Residential

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length 150 m
Estimated Stream Width 2.8 m
Sampling Reach Area 150 m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth 0.2-0.8m/84
Surface Velocity (at thalweg) _____ m/sec (see flow sheet)

Canopy Cover
☐ Partly open ☐ Partly shaded ☒ Shaded

High Water Mark 0.5 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 0 % ☒ Run 100 %
☐ Pool 0 %

Channelized ☒ Yes ☐ No
Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD 0 m²
Density of LWD 0 m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☒ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present see wetland report

Portion of the reach with aquatic vegetation 1 %

WATER QUALITY

Temperature 12.42 °C
Specific Conductance .054 ms/cm
Dissolved Oxygen ~~8.58~~ 8.87 mg/L
pH 4.58 46.7%
Turbidity _____
WQ Instrument Used YSI 556

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☒ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	25%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	5%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	75%	Marl	grey, shell fragments	0%
Silt	0.004-0.06 mm	20%			
Clay	< 0.004 mm (slick)	5%			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NASO-SG3	LOCATION Ocena
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS Gaudet, Dreps, Lemontagne	
FORM COMPLETED BY Lemontagne	DATE 4/29 TIME 1500 AM (PM)
REASON FOR SURVEY	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Total Score 122

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NASO S3	LOCATION NAS Oceana
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY NAVFAC
GEAR LR-24 Smith-Root	INVESTIGATORS Gaudet, Larrentagre, Dresser
FORM COMPLETED BY	DATE 4/29/14 TIME 1330 AM (PM) / REASON FOR SURVEY C

SAMPLE COLLECTION	**How were the fish captured?** ☒ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time 13:30 End time 15:02 Duration 1737 s **Stream width (in meters)** Max _____ Mean 2.8 m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☒ Runs 100 % ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	WT				ANOMALIES* D	E	F	L	M	S	T	Z
mudminnow	3	75	5.3											
		84	6.6											
		66	4.5											

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~FW08~~ NASO-53 DATE: 04/29/2013

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ● cm	● ft ○ cm	● ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.2	0.62	
2	28	0.2	1.02	
3	56	0.5	1.13	
4	84	0.7	1.02	
5	112	0.8	1.19	
6	140	0.7	1.15	
7	168	0.6	0.75	
8	196	0.6	1.03	
9	224	0.6	0.65	
10	252	0.5	0.39	
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

1
56
28
84
28
112
1
168
28
196
28
224
28
252

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	____.__	____.__	
2	____.__	____.__	
3	____.__	____.__	
4	____.__	____.__	
5	____.__	____.__	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	____.__	____.__	____.__
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments
	2-8 m is Stream width

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

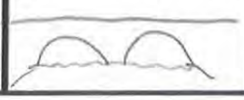
TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NASO/DNA **Date and Time (Start-End):** 4/29 @ 15:15 **Investigators:** Dresser, Gay, Anderson

Stream: NASO-S3 **Reach:** S3 **Partial Debris Dam Tally for Reach:** 卌 **GPS @ Start Point:** ☐ Y ☒ N **Photo #'s:** ___

Start of Reach located at: ☐ Confluence with ___ ☒ Installation-Specific NASO ☐ Arbitrary location ___

	Observation Parameters	Barrier Type	Barrier Type	Barrier Type	Barrier Type	Barrier Type
ALL BARRIER TYPES		☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # 1 Name of Road ___ GPS Point? Y / N	☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N	☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N	☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N	☐ Debris Dam # ___ ☐ Bridge # ___ Name of Road ___ ☐ Culvert # ___ Name of Road ___ GPS Point? Y / N
	Potential for Fish Passage	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	c1.3m/1.1m				
	Vertical Water Drop	N/A				
	Pool Immediately Below?	☐ Y Depth ___ ☒ N	☐ Y Depth ___ ☐ N	☐ Y Depth ___ ☐ N	☐ Y Depth ___ ☐ N	☐ Y Depth ___ ☐ N
	Wetted Channel Width	4.2 m				
	Structure Width (length, for culverts)	(0.9m diameter)				
	Stream Channel	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	0.9m / 1m				
	Beaver Activity?	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___
	Is this a Beaver Dam?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance					
	Bridge Material	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___
	Culvert Material Corrugated? ☐ Y ☐ N	☐ concrete ☒ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___
	# of Arches/Culverts	2				
	Opening Obscured Up/Downstream	☐ Y ☐ N partially	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure	0.5m				
	Armoring?	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure	Streambed				
	Structure outlet is:	☒ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME NaSo-54	LOCATION NAS Oceana
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY NAVFAC
INVESTIGATORS Grandet, Gay, Anderson	
FORM COMPLETED BY TG	DATE 4/20 TIME 1120 AM PM
REASON FOR SURVEY FUN	

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☒
10 % ☒	%cloud cover	☐ ___ %
☐	clear/sunny	☐

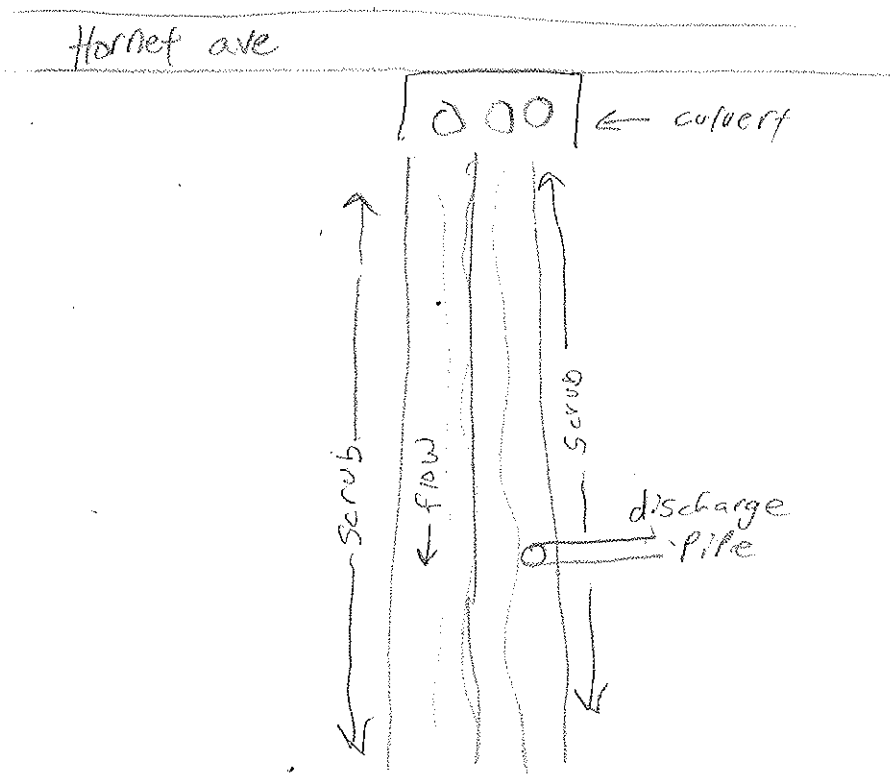
Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No

Air Temperature 65 °F

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☒ Other ditch/storm water

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☒ Industrial
☐ Agricultural ☐ Other military
☐ Residential

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☒ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present maple

INSTREAM FEATURES

Estimated Reach Length 150 m

Estimated Stream Width 5 m

Sampling Reach Area _____ m²

Area in km² (m²x1000) _____ km²

Estimated Stream Depth 1.1 m

Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☒ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark .5 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _____ % ☒ Run 100 %
☐ Pool _____ %

Channelized ☒ Yes ☐ No

Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD _____ m² N/A

Density of LWD _____ m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☒ Rooted submergent ☐ Rooted floating ☐ Free floating
☒ Floating Algae ☐ Attached Algae

dominant species present _____

Portion of the reach with aquatic vegetation 50 %

WATER QUALITY

Temperature 19.3 °C

Specific Conductance 0.147

Dissolved Oxygen 8.63 mg/L (93.1%)

pH 6.03

Turbidity _____

WQ Instrument Used YSI 556

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☒ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	50%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	50%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	20%	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	70%			
Clay	< 0.004 mm (slick)	10%			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NASO-S4	LOCATION NASOceana	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY NAVFAC	
INVESTIGATORS TG DA MG		
FORM COMPLETED BY TG	DATE 4/30 TIME 11:30 AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 11	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 19	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
8. Bank Stability (score each bank) 18	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. 14	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) 6	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0

Total Score 100

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NASO-54	LOCATION NASOceana	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY NAVFAC	
GEAR EB-24	INVESTIGATORS	
FORM COMPLETED BY Marybeth Gay	DATE 4/30 TIME 0900 (AM) PM	REASON FOR SURVEY Fish Survey

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☑ YES ☐ NO **Sampling Duration** Start time 0900 End time 1100 Duration 2880 sec **Stream width (in meters)** Max 5m Mean 4m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs 50 % ☐ Snags ____% ☐ Submerged Macrophytes 50 % ☐ Other ( ) ____%
GENERAL COMMENTS	Channelized stream

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z

See back of form

NASO S4

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Red fin pickerel	3	225/105.1	179/48.2	121/15.1										
Pumpkinseed	2	97/22.1	90/18.0											
Bluegill	1	61/3.7												
Mud minnow	1	63/5.8												
Mosquito fish	25	41/	40/	36/	33/	28/								
		31/	40/	27/	34/	27/	crooked spine } 4.9g							
		28/	36/	32/	29/ (end)	36/								
		26/	35/	35/	48/	29/								
		28/	30/	37/	49/	35/ (end)	} 5.9g (end 2)							

Group 1: 4.9g
Group 2: 5.9g
(end 1)
1 with a crooked spine

*ANOMALY CODES: D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: FW08 NASO-54 DATE: 04/30/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ● cm	● ft ○ cm	● ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.6	0	
2	51	1.1	0.28	
3	102	2.0	0.08	
4	153	2.1	0.14	
5	204	1.8	0.10	
6	255	1.6	0.08	
7	306	2.0	0.11	
8	357	2.1	0.14	
9	408	2.2	0.18	
10	457	2.0	0.14	
11	510	0.8	0.07	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Di.. ○ ft ○ m			
..at Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

14610

04/07/2009 NRSA Stream Discharge

WQ NASO-54 temp - 19.36°C
SCs - 0.147
DO - 8.63 (93.1%)
pH - 6.03
5.1 m

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Naso-55	LOCATION NAS Oceana	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY NAVFAC	
INVESTIGATORS TG, DH, ma		
FORM COMPLETED BY TG	DATE 4/30 TIME 12:30 AM (PM)	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
70 % ☒	%cloud cover	☐ ____ %
☐	clear/sunny	☐

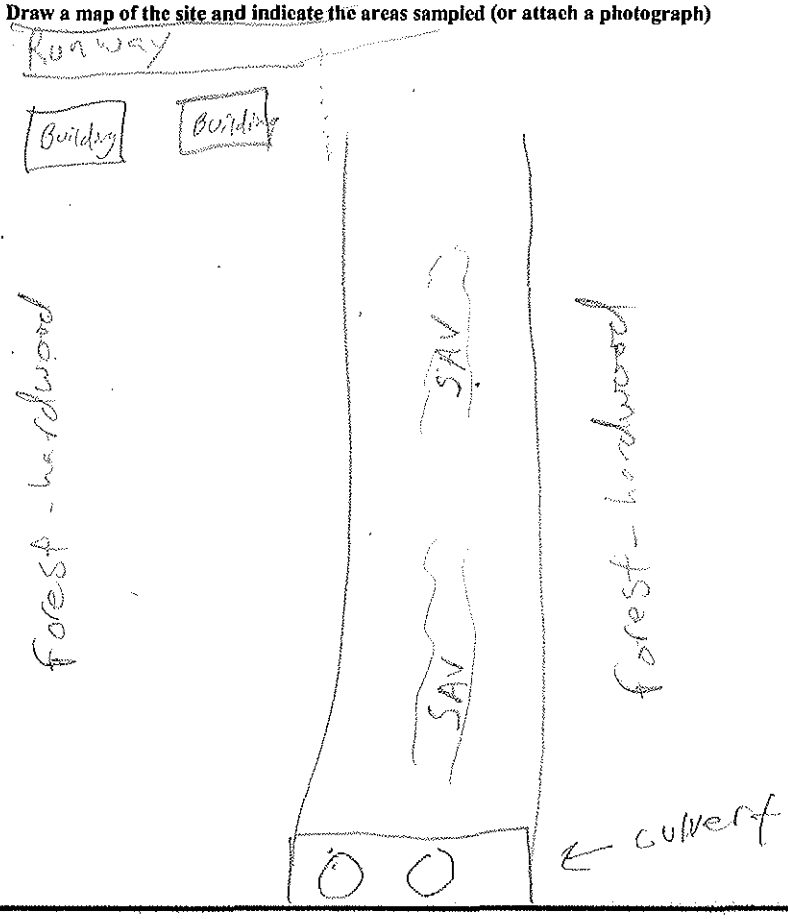
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature 65 °F

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other _____

Catchment Area _____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☒ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other military runway
☐ Residential

Local Watershed NPS Pollution
☒ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present hardwood

INSTREAM FEATURES

Estimated Reach Length 160 m

Estimated Stream Width 2.1 m

Sampling Reach Area _____ m²

Area in km² (m²x1000) _____ km²

Estimated Stream Depth .3 m

Surface Velocity (at thalweg) _____ m/sec See discharge sheet

Canopy Cover
☐ Partly open ☒ Partly shaded ☐ Shaded

High Water Mark .9 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 80 % ☒ Run 95 %
☐ Pool 5 %

Channelized ☒ Yes ☐ No

Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD 0 m²

Density of LWD _____ m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☒ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☒ Floating Algae ☐ Attached Algae

dominant species present _____

Portion of the reach with aquatic vegetation 50 %

WATER QUALITY

Temperature 20.19 °C

Specific Conductance 0.070

Dissolved Oxygen 7.85 mg/L (86.2%)

pH 5.48

Turbidity _____

WQ Instrument Used YSI 556

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other _____

Turbidity (if not measured)
☒ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	20
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	40
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	20			
Clay	< 0.004 mm (slick)	70			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NASO-S5	LOCATION NAS Oceana	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY NAVFAC	
INVESTIGATORS TG, DA, MC		
FORM COMPLETED BY TG	DATE 4/30 TIME 12:10 (AM) PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
8. Bank Stability (score each bank) 14	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. 16	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 8 (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone) 10	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 5 (LB)	Left Bank 10 9	8 7 6	(5) 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0

Total Score 109

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NaSO-S5	LOCATION NAS Oceana
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY NAVFAC
GEAR	INVESTIGATORS TB, DA, MB
FORM COMPLETED BY TB	DATE 4/30 TIME 4 AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 12:30 End time 13:30 Duration 1481 **Stream width (in meters)** Max 2.1 m Mean 1.8 m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools 5 % ☐ Runs 75 % ☐ Snags ____% ☐ Submerged Macrophytes 20 % ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Blue Spotted Sunfish	2	67/5.5	65/5.9											

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: FW08 NASO-55 DATE: 04/30/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ○ cm	○ ft ○ cm	○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0	0	
2	45	0.5	0.05	
3	90	0.7	0.08	
4	135	0.7	0.13	
5	180	0.9	0.14	
6	225	1.0	0.22	
7	270	1.0	0.18	
8	315	0.9	0.08	
9	360	0.7	0.11	
10	405	0.4	0.03	
11	450	0.1	0	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	____.__	____.__	
2	____.__	____.__	
3	____.__	____.__	
4	____.__	____.__	
5	____.__	____.__	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	____.__	____.__	____.__
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

14610

NASO-55

Temp - 20.1°C
SC - 0.070
DO - 7.83 (86.2%)
pH - 5.48

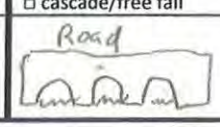
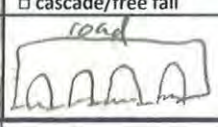
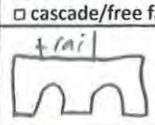
TETRA TECH

Freshwater Stream Barrier Assessment, Sheet 1 of ___

Project: NASO/DNA Date and Time (Start-End): 4/28 Investigators: DREESER, GAUDET

Stream: NASO Reach: S5 Partial Debris Dam Tally for Reach: 1 GPS @ Start Point: ☐ Y ☐ N Photo #'s: _____

Start of Reach located at: ☐ Confluence with _____ ☐ Installation-Specific _____ ☐ Arbitrary location _____

	Observation Parameters	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☒ Culvert # 1 Name of Road_____ GPS Point? Y / N	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☒ Culvert # 2 Name of Road_____ GPS Point? Y / N	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☒ Culvert # 3 Name of Road_____ GPS Point? Y / N	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☐ Culvert #_____ Name of Road_____ GPS Point? Y / N	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☐ Culvert #_____ Name of Road_____ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	☐ HIGH ☒ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	N/A	N/A	N/A		
	Vertical Water Drop	.05 m	None	None		
	Pool Immediately Below?	☒ Y Depth .5 ☐ N	☒ Y Depth .5 ☐ N	☒ Y Depth 1m ☐ N	☐ Y Depth_____ ☐ N	☐ Y Depth_____ ☐ N
	Wetted Channel Width					
	Structure Width (length, for culverts)	1.5 m ea.				
	Stream Channel	**Upstream:** ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	**Upstream:** ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	**Upstream:** ☒ channelized ☐ natural Downstream: ☐ channelized ☐ natural	**Upstream:** ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	**Upstream:** ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	**Left:** ☒ Y ☐ N minor Right: ☐ Y ☐ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☒ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☒ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	**Left:** ☐ Y ☒ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☒ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	1.5 m diameter	1.1 m	1.1m		
	Beaver Activity?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☐ **woody debris** ☐ leaf litter ☐ sediment ☐ other_____	☐ **woody debris** ☐ leaf litter ☐ sediment ☐ other_____	☐ **woody debris** ☐ leaf litter ☐ sediment ☐ other_____	☐ **woody debris** ☐ leaf litter ☐ sediment ☐ other_____	☐ **woody debris** ☐ leaf litter ☐ sediment ☐ other_____
	Is this a Beaver Dam?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance	N/A culv. dia.	N/A	N/A		
	Bridge Material	☒ **concrete** ☐ steel ☐ timber ☐ other_____	☒ **concrete** ☐ steel ☐ timber ☐ other_____	☒ **concrete** ☐ steel ☐ timber ☐ other_____	☐ **concrete** ☐ steel ☐ timber ☐ other_____	☐ **concrete** ☐ steel ☐ timber ☐ other_____
	Culvert Material Corrugated? ☐ Y ☐ N	☒ **concrete** ☐ steel ☐ plastic ☐ other_____	☒ **concrete** ☐ steel ☐ plastic ☐ other_____	☒ **concrete** ☐ steel ☐ plastic ☐ other_____	☐ **concrete** ☐ steel ☐ plastic ☐ other_____	☐ **concrete** ☐ steel ☐ plastic ☐ other_____
	# of Arches/Culverts	3	4	2		
	Opening Obscured Up/Downstream	☐ Y ☒ N	☒ Y ☐ N partial upstream	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure	0.1m, .05, .05	.1 → .2	.2		
	Armoring?	**Left:** ☒ Y ☐ N Right: ☒ Y ☐ N	**Left:** ☒ Y ☐ N Right: ☒ Y ☐ N	**Left:** ☒ Y ☐ N Right: ☒ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure	Concrete	Concrete	Concrete		
	Structure outlet is:	☐ **partially backwatered** ☒ at grade ☐ cascade/free fall	☐ **partially backwatered** ☐ at grade ☐ cascade/free fall	☐ **partially backwatered** ☒ at grade ☐ cascade/free fall	☐ **partially backwatered** ☐ at grade ☐ cascade/free fall	☐ **partially backwatered** ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

↓ with leaf litter/organics

Location:	RHASO - P2 .. P1	Gear	Boat e-fishing	Button Time (sec):	1520 (p1)	1388 (p2)
Date:	4/29/2014		Gill net	Effort:	Deployed (time):	Retrieved (time)
Time:	0830		Seine	Net Dimensions:	Length (m)	Height (m)
Personnel:	CM, CW		Minnow trap	Effort:	Deployed (time):	Retrieved (time)

Species	Length (max. 25 specimens)	Tally	DELT	Total
Largemouth bass	333, 421, 200, 288, 325, 292, 218, 331, 309, 333 336, 250, 354, 239, 288, 225, 258, 296, 309, 341 317, 281, 180, 205, 301, 244, 331, 346, 295, 203, 202 361, 381, 294, 320, 356, 420, 325, 325, 316, 330, 202	卌 卌 卌 卌 卌 卌 卌 卌 || (42)	|||	
Bluegill	168, 146, 42, 72, 44, 170, 82, 48, 46, 165, 76, 200 191, 75, 53, 58, 48, 44, 55, 52, 35, 37, 175, 69 52, 47, 324, 70, 53, 53, 54, 41, 29, 48, 44, 53, 50, 36 41, 43, 34, 43, 43, 63, 56, 51, 68, 54, 52, 48, 57, 46, 52, 52 55, 53, 44, 67, 48, 49, 53, 50, 59, 57, 50, 72, 54, 46, 49, 40, 61	卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 卌 | (86)		
	54, 47, 46, 51, 48, 37, 52, 79, 53, 46, 60, 58, 53, 47, 47			

Location: WASO-P1	**Gear**	**Boat e-fishing**	**Button Time (sec):** 3811	300 VOLTS	
Date: 4/29/2014		**Gill net**	**Effort:**	**Deployed (time):**	**Retrieved (time)**
Time: 1300		**Seine**	**Net Dimensions:**	**Length (m)**	**Height (m)**
Personnel: CM, CW		**Minnow trap**	**Effort:**	**Deployed (time):**	**Retrieved (time)**

Species	Length (max. 25 specimens)	Tally	DELT	WEIGHT	Total
Largemouth bass	410, 366, 448, 353, 284, 405, 338, 372, 368, 368, 355, 312, 249, 222, 363, 314,	16		1008, 640, 1303, 596, 824, 182, 489, 671, 633, 568, 572, 345, 182, 122, 664, 181	
Bluegill	59, 76, 56, 70, 38, 118, 46, 41, 80, 64, 34, 40, 97, 39, 50, 36, 36, 51, 42, 45, 73, 73, 72, 42, 36, 60, 58, 82, 110, 58, 36, 67, 43, 63, 65, 40, 30, 35, 38, 38, 71, 62, 58, 39, 43, 42, 35, 38, 40, 49, 35, 33, 32, 55, 40, 38, 43, 36, 43, 37, 42, 57	63 MORT			
Yellow perch	186,	1			
Warmouth	69, 88, 87, 71, 100, 86, 97, 87, 48, 84, 89, 49, 105, 81, 90, 99, 97, 195	18 MORT			
American eel	<150: 151-300: 301-450: >450	38			
Pumpkinseed	73, 107	2			

Oceanic Pond

NASO - P1 (cont)

4/29/2014

Species	Length (max. 25 specimens)	Tally	Total
Mosquitofish	25,	1 (1)	

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASO-S1	LOCATION NAS Oceana
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR LR-24	INVESTIGATORS
FORM COMPLETED BY D. Anderson, B. Dresser	DATE 6/3/14 TIME 16:00 AM (PM) / REASON FOR SURVEY NASO/ONA Fish Survey

SAMPLE COLLECTION	**How were the fish captured?** ☒ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time 15:00 End time 16:00 Duration 1680 s **Stream width (in meters)** Max 3 m Mean 2 m
HABITAT TYPES	**Indicate the percentage of each habitat type present** See habitat Survey ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other (____)____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL / WT		TL	WT		ANOMALIES* D	E	F	L	M	S	T	Z
Redfin Pickerel	3	170	37.0								1			
		183	42.8											
		170	33.6											
Pirate perch	14	87	9.4	57	3.1	55/2.5								
		76	5.8	62	3.1	73/5.3								
		81	6.7	49	1.7	56/2.6								
		56	2.8	82	7.8	46/1.5								
		85	9.9	56	2.6									
Mudminnow	6	87	8.0	85	7.7									
		84	6.8											
		71	3.5											
		67	3.1											
		106	13.5											
Bluegill	1	95	14.7											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		TL	W				D	E	F	L	M	S	T	Z
Am. eel	1	203	14.2											

*ANOMALY CODES: D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~FW08~~ NASD-51 DATE: 06/03/2014

340 cm

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ⊘ cm	⊘ ft ○ cm	⊘ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0	0	
2	34	0.5	0	
3	68	0.6	0.02	
4	102	0.7	0.03	
5	136	0.9	0.05	
6	170	0.7	0.10	
7	204	0.6	0.09	
8	238	0.8	0.08	
9	272	0.7	0.08	
10	306	0.5	0.04	
11	340	0.2	0	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	.	.	
2	.	.	
3	.	.	
4	.	.	
5	.	.	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	.	.	.
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASO - S2	LOCATION OCEANA / DAM NECK
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR LR-24	INVESTIGATORS
FORM COMPLETED BY Foster	DATE 8/06/03/14 TIME 9:00 AM PM
REASON FOR SURVEY Fish Survey	

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 9:02 End time _____ Duration 1314 s **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____% See Habitat survey
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Redfin Pickerel		289	137											
Golden Shiner		116	13.6											
		104	9.8											
		130	23.1											
		136	24.6											
Pirate Perch		72	4.0	46	1.3	48 1.3								
		68	4.9	59	2.9	55 2.1								
		76	5.3	67	3.5	48 1.7								
		51	1.8	61	3.5	52 1.6								
		67	3.8	42	1.0	53 1.0								
Mud minnow		51	1.5	39	0.7	74 4.9								
		47	0.7	33	0.3	40 0.6								
		41	0.6	36	0.4	37 0.9								
		95	9.6	32	0.3	41 0.7								
		58	2.0	109	14.2	66 3.6								

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Pirate Perch		74	5.0	58	2.1	77 5.9								
		45	0.9	46	1.3	55 2.5								
		73	4.1	51	2.4	66 3.9								
		54	2.0	56	2.3	48 1.6								
		67	3.8	51	2.2	60 3.7								
Mosquito Fish		38	0.6	38	0.6									
		28	0.1	36	0.6									
		37	0.5	32	0.4									
		33	0.2	25	0.1									
		26	0.1											
Bluespotted Sunfish		80	9.4											
Banded Sunfish		101	18.7											
Mud minnow		42	0.7	35	0.5	35 0.4								
		78	5.9	39	0.6	76 5.1								
		36	0.4	43	0.9	35 0.3								
		54	1.9	38	0.6	41 0.6								
		32	0.4	38	0.7	34 0.3								
American Eel		225	37.5											
		280	84.1											

~~HHT HHT HHT~~
~~HHT HHT HHT~~
~~HHT HHT HHT~~
~~HHT HHT HHT~~
111 (63)

~~HHT HHT~~
11 (12)

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (initials): EF/JC

SITE ID: ~~FW05~~ NAS0-52 DATE: 06/05/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ⌀ cm	⌀ ft ○ cm	⌀ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0	0	
2	40 ~~50~~	0.6	0.06	
3	80 ~~100~~	0.8	0.07	
4	120 ~~150~~	0.7	0.09	
5	160 ~~200~~	0.6	0.13	
6	200 ~~250~~	0.5	0.11	
7	240 ~~300~~	0.4	0.09	
8	280 ~~350~~	0.4	0.10	
9	320 ~~400~~	0.6	0.11	
10	360	0.7	0.	
11	400	0.6	0.07	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	.	.	
2	.	.	
3	.	.	
4	.	.	
5	.	.	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	.	.	.
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

EXAMPLE

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NASO Fish Survey Date and Time (Start-End): 6/2/14 Investigators: D. Anderson, K. Lamontagne

Stream: NASO-S2 Reach: 1 Partial Debris Dam Tally for Reach: HHT HHT HHT II GPS @ Start Point: ☐ Y ☒ N Photo #'s: _____

Start of Reach located at: ☐ Confluence with _____ ☐ Installation-Specific _____ ☐ Arbitrary location _____

	Observation Parameters	Barrier Type ☒ Debris Dam # 1 ☐ Bridge # _____ Name of Road _____ ☐ Culvert # _____ Name of Road _____ GPS Point? Y / (N)	Barrier Type ☒ Debris Dam # 2 ☐ Bridge # _____ Name of Road _____ ☐ Culvert # _____ Name of Road _____ GPS Point? Y / (N)	Barrier Type ☒ Debris Dam # 3 ☐ Bridge # _____ Name of Road _____ ☐ Culvert # _____ Name of Road _____ GPS Point? Y / (N)	Barrier Type ☒ Debris Dam # 4 ☐ Bridge # _____ Name of Road _____ ☐ Culvert # _____ Name of Road _____ GPS Point? Y / N	Barrier Type ☒ Debris Dam # 5 ☐ Bridge # _____ Name of Road _____ ☐ Culvert # _____ Name of Road _____ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	☐ HIGH ☐ MED ☐ LOW ☒ NONE	☐ HIGH ☐ MED ☒ LOW ☐ NONE	☐ HIGH ☐ MED ☒ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☒ NONE	☐ HIGH ☐ MED ☒ LOW ☐ NONE
	Barrier Height	0.5m	0.3m	0.1m	0.2m	0.2m
	Vertical Water Drop	Perched dam, 1m	None - even	None - even	None - even	None - even
	Pool Immediately Below?	☐ Y Depth ____ ☒ N	☐ Y Depth ____ ☒ N	☐ Y Depth ____ ☐ N	☐ Y Depth ____ ☒ N	☐ Y Depth ____ ☒ N
	Wetted Channel Width	4.2 m	3.2 m	3.6m	3.2m	2.5m
	Structure Width (length, for culverts)	4.2 m	3.2m	3.6 m	3.2m	2.5m
	Stream Channel	**Upstream:** ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	**Upstream:** ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	**Upstream:** ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	**Upstream:** ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	**Upstream:** ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural
	Bank Erosion?	**Left:** ☐ Y ☒ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☒ N looking Right: ☒ Y ☐ N upstream	**Left:** ☐ Y ☒ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	**Left:** ☐ Y ☒ N Right: ☐ Y ☒ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☒ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☒ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☒ N	**Left:** ☐ Y ☒ N Right: ☐ Y ☒ N
	Structure Span/Diameter	0.5m	0.8m	0.3m	0.3m	0.4m
	Beaver Activity?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☒ **woody debris** smaller wood ☒ leaf litter ☐ sediment ☐ other _____	☐ **woody debris** ☒ leaf litter ☐ sediment ☐ other _____	☐ **woody debris** ☒ leaf litter ☐ sediment ☐ other _____	☒ **woody debris** smaller wood ☒ leaf litter ☐ sediment ☐ other _____	☒ **woody debris** smaller wood ☒ leaf litter ☐ sediment ☐ other _____
	Is this a Beaver Dam?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N
	Alternate Channel Formation/Braiding?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☒ N
BRIDGE/CULVERT	Clearance					
	Bridge Material	☐ **concrete** ☐ steel ☐ timber ☐ other _____	☐ **concrete** ☐ steel ☐ timber ☐ other _____	☐ **concrete** ☐ steel ☐ timber ☐ other _____	☐ **concrete** ☐ steel ☐ timber ☐ other _____	☐ **concrete** ☐ steel ☐ timber ☐ other _____
	Culvert Material Corrugated? ☐ Y ☐ N	☐ **concrete** ☐ steel ☐ plastic ☐ other _____	☐ **concrete** ☐ steel ☐ plastic ☐ other _____	☐ **concrete** ☐ steel ☐ plastic ☐ other _____	☐ **concrete** ☐ steel ☐ plastic ☐ other _____	☐ **concrete** ☐ steel ☐ plastic ☐ other _____
	# of Arches/Culverts					
	Opening Obscured Up/Downstream	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure					
	Armoring?	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N	**Left:** ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure					
	Structure outlet is:	☐ **partially backwatered** ☐ at grade ☐ cascade/free fall	☐ **partially backwatered** ☐ at grade ☐ cascade/free fall	☐ **partially backwatered** ☐ at grade ☐ cascade/free fall	☐ **partially backwatered** ☐ at grade ☐ cascade/free fall	☐ **partially backwatered** ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NASO Fish Survey Date and Time (Start-End): 6/2/14 Investigators: D. Anderson, K. Lamantagne

Stream: NASO-S2 Reach: U Partial Debris Dam Tally for Reach: ___ GPS @ Start Point: □ Y ☒ N Photo #'s: ___

Start of Reach located at: □ Confluence with ___ □ Installation-Specific ___ □ Arbitrary location ___

	Observation Parameters	Barrier Type □ Debris Dam #___ □ Bridge #___ Name of Road___ ☒ Culvert #__1__ Name of Road___ GPS Point? Y / (N)	Barrier Type □ Debris Dam #___ □ Bridge #___ Name of Road___ □ Culvert #___ Name of Road___ GPS Point? Y / N	Barrier Type □ Debris Dam #___ □ Bridge #___ Name of Road___ □ Culvert #___ Name of Road___ GPS Point? Y / N	Barrier Type □ Debris Dam #___ □ Bridge #___ Name of Road___ □ Culvert #___ Name of Road___ GPS Point? Y / N	Barrier Type □ Debris Dam #___ □ Bridge #___ Name of Road___ □ Culvert #___ Name of Road___ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	□ HIGH □ MED □ LOW ☒ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE
	Barrier Height	1.2m diameter				
	Vertical Water Drop	Even				
	Pool Immediately Below?	□ Y Depth___ ☒ N	□ Y Depth___ □ N	□ Y Depth___ □ N	□ Y Depth___ □ N	□ Y Depth___ □ N
	Wetted Channel Width	1.3 m				
	Structure Width (length, for culverts)	10 m				
	Stream Channel	Upstream: ☒ channelized □ natural Downstream: ☒ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural
	Bank Erosion?	Left: □ Y ☒ N Right: □ Y ☒ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Scouring or undercutting of structure?	Left: □ Y ☒ N Right: □ Y ☒ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Structure Span/Diameter	1.3 m				
	Beaver Activity?	□ Y ☒ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
DEBRIS DAMS	Debris Dam Composition	□ woody debris □ leaf litter □ sediment □ other ___	□ woody debris □ leaf litter □ sediment □ other ___	□ woody debris □ leaf litter □ sediment □ other ___	□ woody debris □ leaf litter □ sediment □ other ___	□ woody debris □ leaf litter □ sediment □ other ___
	Is this a Beaver Dam?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Alternate Channel Formation/Braiding?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
BRIDGE/CULVERT	Clearance	~1.3 m				
	Bridge Material	□ concrete □ steel □ timber □ other ___	□ concrete □ steel □ timber □ other ___	□ concrete □ steel □ timber □ other ___	□ concrete □ steel □ timber □ other ___	□ concrete □ steel □ timber □ other ___
	Culvert Material Corrugated? □ Y ☒ N	□ concrete □ steel ☒ plastic □ other ___	□ concrete □ steel □ plastic □ other ___	□ concrete □ steel □ plastic □ other ___	□ concrete □ steel □ plastic □ other ___	□ concrete □ steel □ plastic □ other ___
	# of Arches/Culverts	2				
	Opening Obscured Up/Downstream	□ Y ☒ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Depth Inside Structure	<0.1 m				
	Armoring?	Left: □ Y ☒ N Right: □ Y ☒ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Overflow Pipe?	□ Y ☒ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Substrate inside structure	Plastic, rocks				
	Structure outlet is:	□ partially backwatered ☒ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall
	cross sectional schematic (draw)					

FISH SAMPLING FIELD DATA SHEET (FRONT)

page 1 of 1

STREAM NAME NASO.53	LOCATION OCEANA / DAM NECK		
STATION # _____ RIVERMILE _____	STREAM CLASS		
LAT _____ LONG _____	RIVER BASIN		
STORET #	AGENCY		
GEAR LR-24	INVESTIGATORS Dresser, Cook, Foster		
FORM COMPLETED BY Foster	DATE 6/5/14 TIME 10:40 (AM) PM	REASON FOR SURVEY Fish surveys	

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 233 s **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____% see Habitat form
GENERAL COMMENTS	Stream bed dry, only several pools of standing water totaling 10% of reach. Zero Flow

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*								
		TL	W	TL	W		D	E	F	L	M	S	T	Z
Mud minnow		31	0.3	36	0.5	30/.2								
		31	0.3	34	0.2	48/1.5								
		32	0.1	33	0.2	34/.2								
		37	0.4	35	0.4	29/.3								
		35	0.4	34	0.4	33/.2								
Mud minnow		35	0.4	36	0.2	36/.3								
		35	0.3	28	0.1	34/.4								
		37	0.4	35	0.3									
		36	0.4	25	0.1									
		33	0.1	37	0.5									

FISH SAMPLING FIELD DATA SHEET (FRONT)

page 1 of 1

STREAM NAME NAS0-54	LOCATION NAS Oceana
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS Dresser, Anderson, Lamartosyne, Foster, Cook
FORM COMPLETED BY Cook	DATE 6/4/14 TIME 8:30 (AM) PM — REASON FOR SURVEY NAS0/DNA Fish Survey

SAMPLE COLLECTION	**How were the fish captured?** ☒ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time 8:30am End time _____ Duration 1036 s **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____% See Habitat Form
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Bluegill Sunfish		83	10.4											
		61	4.2											
		66	5.7											
Mosquito fish		43	1.5	42	1.1	56 / 1.9								
		38	0.9	47	1.4	39 / 0.8								
		44	2.0	46	1.0	40 / 0.7								
		44	1.1	50	1.1	48 / 1.3								
		44	1.8	44	0.8	31 / .5								
Redfin Pickerel		103	5.7											
Pumpkinseed		110	24.8											
		108	24.7											
		148	57.9											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Mosquitofish	100	49	1.5	47	1.7	46/.8								
		50	1.4	46	2.0	32/.2								
		25	0.3	46	1.7	46/.8								
		21	0.1	46	0.9	47/1.4								
		28	0.1	45	0.8	31/0.1								
largemouth Bass		42	1.1											
		42	0.7											
		43	1.0											
Yellow Bullhead		228	166											
		77	2.5											
Golden Shiner		85	4.5											
Pirate Perch		91	10.3											
		82	8.1											
Mudminnow		99	13.1											
		85	7.5											
		103	13.3											
		73	4.5											
		90	8.8											
American Eel		280	35											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~EW08~~ NASO-54 DATE: 06/04/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft Ø cm	Ø ft ○ cm	Ø ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0	0	
2	40	0.2	0	
3	80	0.4	0	
4	120	0.5	0	
5	160	0.7	0.01	
6	200	0.7	0.03	
7	240	0.8	0	
8	280	0.8	0	
9	320	0.6	0	
10	360	0.3	0	
11	400	0	0	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

FISH SAMPLING FIELD DATA SHEET (FRONT)

page 1 of 1

STREAM NAME NAS0-55	LOCATION NAS Oceana
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR LR-24	INVESTIGATORS Anderson, Foster, Cook, Dresser, Lamontagne
FORM COMPLETED BY Anderson	DATE 6/4/14 TIME 10:30 (AM) PM / REASON FOR SURVEY NAS0/DNA Fish Survey

SAMPLE COLLECTION	**How were the fish captured?** ☒ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time 10:30 End time _____ Duration 1159 s **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____% See Habitat Form
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W				ANOMALIES* D	E	F	L	M	S	T	Z
mosquitofish	1	50	1.4											
bluespot sunfish	1	59	4.3											
mudminnow	1	55	2.0											
Am eel	1	235	25.8											

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~FW08~~ NAS0-S5 DATE: 06/04/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
⊘ ft ○ cm	○ ft ○ cm	○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0	0	
2	33	0	0	
3	66	0.5	0.01	
4	99	0.5	0.01	
5	132	0.7	0.02	
6	165	0.90	0.02	
7	198	0.9	0.04	
8	231	0.9	0.05	
9	264	0.7	0.03	
10	297	0.6	0.03	
11	330	0.6	0.03	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG [ ]

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASA S6	LOCATION Oreana
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR LR-24	INVESTIGATORS Dresser, Lamartoone, Foster, Cook, Anderson
FORM COMPLETED BY J. Cook	DATE 06/4/14 TIME 12:00 AM (PM) — REASON FOR SURVEY Fish Survey

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 12:00 pm End time _____ Duration 1524s **Stream width (in meters)** Max 5m Mean 5m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☑ Runs 100 % ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

See

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Common Carp		540	7.1kg											
Yellow Bullhead		196	125											
		115	19.1											
Golden Shiner		96	7.5	194	6.9									
		97	8.1	111	12.8									
		103	9.7	98	7.4									
		104	9.8											
		81	4.3											
Redfin pickerel		78	7.9	48	0.5									
		223	82.6											
		99	6.8											
		197	58.8											
		175	12.8											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Largemouth Bass		156	47.8											
		135	32.7											
		139	31.9											
Pirate Perch		78	7.3	99	13.6	89/5.9								
		94	9.2	78	6.7	79/6.5								
		86	8.8	76	6.0	87/9.3								
		82	7.8	79	7.3	75/6.4								
		113	12.5	79	7.2	83/8.3								
Bluegill		56	2.4	58	3.3	141/51								
		68	4.2	95	14.0	48/1.6								
		71	5.4	68	5.0	51/1.8								
		73	5.8	67	4.5	93/13.3								
		61	3.4	67	4.5	60/3.3								
Yellow Perch		124	19.7											
Bluegill		116	31.2	64	4.0									
		78	8.0	116	30.3									
		106	23.4											
		92	12.7											
		54	2.5											
Pumpkinseed		96	17.1	100	19.8	96/15.5								
		93	14.6	101	18.6	79/8.7								
		89	14.6	98	17.5	92/14.8								
		90	17.5	93	15.0	/								
		92	14.9	78	8.1	/								
Warmouth		130	50.7											
		110	27											
Pirate Perch		78	6.9											
		89	11.1											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASD 56		LOCATION Oceana	
STATION # _____ RIVERMILE _____		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY	
GEAR LR-24		INVESTIGATORS	
FORM COMPLETED BY J. Cook	DATE 6/4/14 TIME 12:00 AM (PM)	REASON FOR SURVEY	

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 15245 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Bluegill Sunfish		61	4.3	71	7.5									
		65	6.1	73	7.3									
		61	4.3											
		73	7.8											
		66	5.9											
Blue back Herring		67	1.8											
		64	2.2											
		64	1.9											
		56	1.6											
American Eel		233	19.0											

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: ~~EW08~~ NAS0-S6 DATE: 06/04/2014

530 cm total

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ⊗ cm	⊗ ft ○ cm	⊗ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.7	0.04	
2	53	1.1	0.05	
3	106	1.3	0.05	
4	159	1.2	0.01	
5	212	1.3	0.04	
6	265	1.4	0.07	
7	318	1.4	0.14	
8	371	1.3	0.04	
9	424	1.5	0.02	
10	477	1.3	0.02	
11	430	0.6	0.01	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME NAS0 - S6	LOCATION NAS Oceana/DNA
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT GPS LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS Anderson, Cook	
FORM COMPLETED BY Anderson	DATE 06/04/14 TIME 12:00 AM (PM)
REASON FOR SURVEY Fish survey	

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
____% ☐	%cloud cover	☐ ____%
☒	clear/sunny	☒

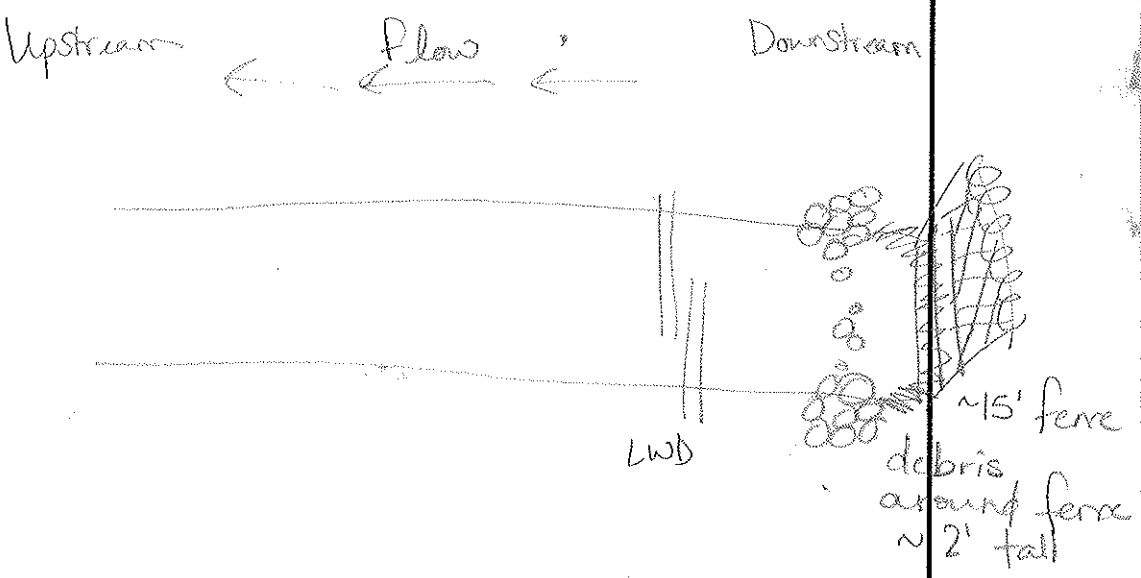
Has there been a heavy rain in the last 7 days? ☒ Yes ☐ No

Air Temperature 85 °F

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Origin
☐ Glacial
☐ Non-glacial montane
☒ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other _____

Stream Type
☐ Coldwater ☒ Warmwater

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

1-866-962-5621
1449557

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other ______ ☐ Residential **Local Watershed NPS Pollution** ☒ No evidence ☐ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☒ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** Red maple, loblolly pine, sweetgum
INSTREAM FEATURES	**Estimated Reach Length** 150 m **Estimated Stream Width** 5 m **Sampling Reach Area** ______ m² **Area in km² (m²x1000)** ______ km² **Estimated Stream Depth** 0.3 m **Surface Velocity (at thalweg)** — m/sec **Canopy Cover** ☐ Partly open ☐ Partly shaded ☒ Shaded **High Water Mark** 0.7 m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle ______% ☒ Run 100 % ☐ Pool ______% **Channelized** ☒ Yes ☐ No **Dam Present** ☐ Yes ☒ No
LARGE WOODY DEBRIS	**LWD** 0.0 m² **Density of LWD** ______ m²/km² (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** ______ **Portion of the reach with aquatic vegetation** 0 %
WATER QUALITY	**Temperature** ______ °C **Specific Conductance** ______ **Dissolved Oxygen** ______ **pH** ______ **Turbidity** ______ **WQ Instrument Used** ______ See H_2O quality sheet **Water Odors** ☒ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ______ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☒ None ☐ Other ______ **Turbidity (if not measured)** ☐ Clear ☒ Slightly turbid ☐ Turbid ☒ Opaque ☐ Stained ☐ Other ______
SEDIMENT/ SUBSTRATE	**Odors** ☒ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ______ **Oils** ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☐ Other ______ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	75%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	75%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	30%	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	20%			
Clay	< 0.004 mm (slick)	50%			

*Bring barrier assessment for next effort

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NASO-S6	LOCATION NAS Oceana / DNA
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT GPS LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS Anderson, Cook	
FORM COMPLETED BY Cook	DATE 06/04/14 TIME 12:00 AM (PM)	REASON FOR SURVEY NASO/DNA Fish Survey

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Only 2 courses within 18m (riparian zone) of zone.

Total Score 85

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NAS0-67	LOCATION NASO Oceana / Dam Neck
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR LR-24	INVESTIGATORS
FORM COMPLETED BY COOK/DRESSER/ANDERSON	DATE 6/14/19 TIME 15:15 AM (PM) / REASON FOR SURVEY Fish Survey

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 15:15 End time _____ Duration 1608 **Stream width (in meters)** Max 6m Mean 6m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☑ Riffles 10 % ☑ Pools 80 % ☑ Runs 10 % ☐ Snags ____ % ☐ Submerged Macrophytes ____ % ☐ Other ( ) ____ %
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Redfin Pickerel		266	71.9											
		211	64.4											
		98	5.4											
Largemouth Bass		155	42.4											
Golden Shiner		125	18.1											
		113	13.7											
Pumpkinseed		98	18.9	95	15.5									
		100	20.3	99	17.2									
		145	71.4	99	18.7									
		107	21.2	140	36.7									
		99	18.1											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) TL	W	TL	W		ANOMALIES* D	E	F	L	M	S	T	Z
Warmouth		107	21.2											
Banded Sunfish		97	19.2	97	18.0	99								
		85	10.6	91	14.1	89 8.1								
		93	14.8	59	5.1	79 7.7								
		89	13.0	91	14.0	107 24.7								
		86	11.9	M63	4.7	68 4.7								
Yellow Perch		179	27.9											
Mosquito Fish		41	1.0											
Yellow Bullhead		141	25.6											
		148	45.7											
		136	32.7											
Pirate Perch		85	8.7											
		84	9.2											
		79	7.1											
		83	7.3											
American Eel		95	36.4											
		245	28.1											
		275	35.4											
		227	19.1											
Mud minnow		96	10.3											
		39	0.8											

* ANOMALY CODES: D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~FW08~~ NASO-57 DATE: 06/04/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ⌀ cm	⌀ ft ○ cm	⌀ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0	0	
2	60	0.4	0.15	
3	120	0.5	0	
4	180	0.3	0.02	
5	240	0.8	0.05	
6	300	0.9	0.08	
7	360	0.9	0.12	
8	420	0.85	0.10	
9	480	0.9	0.08	
10	540	0.8	0.04	
11	600	0	0	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	____.__	____.__	
2	____.__	____.__	
3	____.__	____.__	
4	____.__	____.__	
5	____.__	____.__	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	____.__	____.__	____.__
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME NASO -54	LOCATION NASO OCEANA / DAM NECK
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY FOSTER / LAMONTAGNE	DATE 6/4/14 TIME 3:15 AM PM — REASON FOR SURVEY Fish Survey

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
25 % ☑	%cloud cover	☑ 25 %
☐	clear/sunny	☐

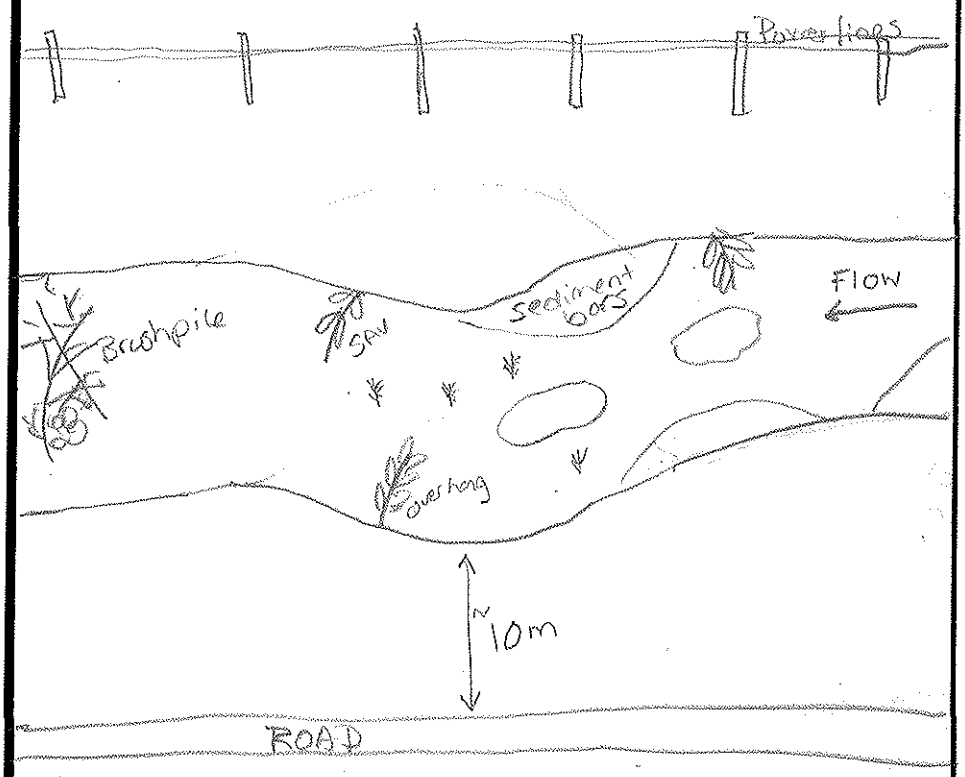
Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No T-STORMS

Air Temperature 85 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☑ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☐ Other _____

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☑ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☐ Agricultural ☐ Other MILITARY
☐ Residential

Local Watershed NPS Pollution
☑ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☑ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Red Maple, Sweetgum, Rayberry, Privet

INSTREAM FEATURES

Estimated Reach Length 150 m

Estimated Stream Width 6 m

Sampling Reach Area _____ m^2

Area in km^2 (m^2x1000) _____ km^2

Estimated Stream Depth 0.2 m

Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☑ Shaded

High Water Mark 0.3 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 10 % ☐ Run 10 %
☑ Pool 80 %

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☑ No

LARGE WOODY DEBRIS

LWD 0 m^2

Density of LWD 0 m^2/km^2 (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present None

Portion of the reach with aquatic vegetation 10 %

WATER QUALITY

See other (WQ) Sheet

Temperature _____ ° C

Specific Conductance _____

Dissolved Oxygen _____

pH _____

Turbidity _____

WQ Instrument Used _____

Water Odors
☐ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☐ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☑ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☒ No NA

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	2%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	2%
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	75%	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	20%			
Clay	< 0.004 mm (slick)	5%			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NASO - S7	LOCATION NASO Oceana / Dam Neck
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT GPS LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS EF & KDL	
FORM COMPLETED BY EF & KDL	DATE 6/4/14 TIME 400 AM (PM)
REASON FOR SURVEY Fish Survey	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0

Total Score 101

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of

STREAM NAME NASO-S1	LOCATION
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE _____ TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ❑ back pack ❑ tote barge ❑ other _____ **Block nets used?** ❑ YES ❑ NO **Sampling Duration** Start time 12:00 End time _____ Duration 1237 **Stream width (in meters)** Max 5.0 m Mean 5.0m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Riffles_____% ❑ Pools_____% ❑ Runs_____% ❑ Snags_____% ❑ Submerged Macrophytes_____% ❑ Other (_____)_____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Largemouth	2	157/38	129/22.6											
Pirate perch	17	69/4.2	65/4.0	69/3.7	88/9.3	85/10								
		66/4.4	64/3.8	68/4.0	55/2.8	90/9.9								
		57/2.9	66/3.0	84/8.0	68/4.6	70/5.1								
		55/2.4	60/3.6											
Blue gill	1	181/31												
Mud minnow	9	35/1.0	61/2.3	70/3.5	38/0.5	60/1.8								
		79/6.0	99/9.1	77/6.1										

Depth	Flow
0.2	0.03
0.8	0.02
0.8	0.01
0.9	0.02
0.7	0.02

Depth	Flow
0.7	0.01
0.7	0.01
0.6	0.03
0.5	0.01
0.3	0.006
0.2	0.10

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
War mouth	1	115/28.5												
Yellow bullhead	2	123/15.9	197/95.1											
Red fin pickerel	2	98/4.6	102/28.8											
Eel	3	175/8.6	170/11.1	180/11.5										

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NASO S2	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR Elect. Fisher	INVESTIGATORS KDL, TG, MG
FORM COMPLETED BY KDL	DATE _____ TIME 856 (AM) PM / REASON FOR SURVEY Fish

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☐ NO **Sampling Duration** Start time _____ End time _____ Duration 1491 **Stream width (in meters)** Max 4.4m Mean 4.4m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☑ Runs 100 % ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other (____)____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Golden Shiner		105/10.0												
Pirate perch	31	48/1.5	48/1.1	46/1.3	51/1.7	29/0.5								
		74/6.3	60/3.6	54/2.2	57/2.0	48/1.7								
Cumulative 1.7g		48/1.3	[illegible]	51/1.8	50/1.7	53/4.6								
		54/2.3	53/1.9	36/0.9	48/1.4	48/1.7								
		53/2.0	39/0.6	92/4.7	55/2.2	93/4.0	53/3.1							
American eel		240/91.4												
		180/8.2												
Mud minnow		45/1.0												
		35/0.3												
		36/0.5												
		55/1.7												

Discharge

Depth	Flow
0.1	0.01
0.60	0.01
0.60	0.02
0.60	0.02
0.9	0.01
0.9	0.02

Depth	Flow
0.80	0.01
0.85	0.02
1.20	0.01
1.30	0.01
1.10	0.02

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NASO S3	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE _____ TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ❑ back pack ❑ tote barge ❑ other _____ **Block nets used?** ❑ YES ❑ NO **Sampling Duration** Start time _____ End time _____ Duration 461 **Stream width (in meters)** Max 2.4m Mean 2.0m
HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Riffles____% ❑ Pools____% ☑ Runs 100 % ❑ Snags____% ❑ Submerged Macrophytes____% ❑ Other (____)____%
GENERAL COMMENTS	Dry or almost dry in various points of stream

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)	ANOMALIES*							
			D	E	F	L	M	S	T	Z
NO FISH										

Discharge

Depth	Flow
0.2	0.01
0.3	0.01
0.5	0.01
0.5	0.01
0.5	0.01

Depth	Flow
0.5	0.02
0.5	0.01
0.5	0.01
0.4	0.01
0.3	0.01
0.1	0.01

3849

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME	LOCATION NC50 - 54
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY TT
GEAR Back Pack	INVESTIGATORS TG MG KL
FORM COMPLETED BY	DATE 8/12/14 TIME 9:34 (AM) PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO ~~Above~~ culvert Barrier **Sampling Duration** Start time 9:40am End time _____ Duration 1200 **Stream width (in meters)** Max 5.5 Mean 4.7
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☑ Runs 80 % ☐ Snags 10 % ☐ Submerged Macrophytes 10 % ☐ Other ( ) ____%
GENERAL COMMENTS	Clay Bottom, low visibility

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Threadfin shad	1	95/9.0												
Mosquitofish	2	52/1.4	42/0.6											
Largemouth Bass	1	70/4.0								✓				
Bluegill	1	75/6.0												

Discharge → width = 4.5 m

Distance	Depth (ft)	Velocity ft/sec
0	.4	0.03
1	.6	0.03
2	1.0	0.01
3	1.2	0.05 in front of
4	1.0	.09 ← center of
5	1.0	.02 culvert
6		
7	1.5	.02
8	1.5	.03
9	.8	.02
10	.3	.01

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Yellow bullfin	1	150/38.9												
Mud minnow	1	90/7.8												

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NASO S5	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR Electro fisher	INVESTIGATORS KOL, TG, MG
FORM COMPLETED BY KOL	DATE 8/6/14 TIME 915 (AM) PM / REASON FOR SURVEY Fish

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO 2040 sec **Sampling Duration** Start time 730 End time 845 Duration ~~1hr 15 min~~ **Stream width (in meters)** Max 5.1 Mean 4.5
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☑ Runs 100 % ☐ Snags ____% ☑ Submerged Macrophytes 25 % ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	W	L	W	L	W	ANOMALIES* D	E	F	L	M	S	T	Z
N. Mosquito		36	0.1	31	0.5	20	0.1								
		46	1.1	28	0.4	26	0.1								
		37	1.0	28	0.1	26	0.2								
		36	1.2	31	0.4	32	0.3								
		31	0.5	21	0.2	35	0.5								
N. Mosquito	39	31	0.4	51	1.7	39	0.6								
Composite weight 5.3 ~~kg~~ g		35	0.5	37	0.6	27	0.3								
		32	0.2	38	0.6	29	0.2								
		31	0.3	28	0.2	24	0.1								
		42	0.1	36	0.5	39	0.7								
Yellow Bullhead	5	36	0.4												
		183	141.8												
		81	7.2												
		84	7.2												
		38	0.9												
Bluegill Sunfish	8	74	8.6	39	1.2										
		71	6.9	38	0.5										
		38	0.9	32	0.9										
		70	6.9												
		40	1.3												

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		L / W					D	E	F	L	M	S	T	Z
Mud minnow	1	51 / 1.5												
LG mouth	1	70 / 3.9												
Pirate Perch	1	48 / 1.4												

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: ~~FW08~~ NASO S5 DATE: 08/12/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
● ft ○ cm	● ft ○ cm	● ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0	0	
2	51	1.1	0.01	
3	102	1.3	0.03	
4	153	1.9	.03	
5	204	2.0	.05	
6	255	1.8	.02	
7	306	1.2	.02	
8	357	1.0	.02	
9	408	0.8	.03	
10	459	0.6	.02	
11	510	0.5	.02	
12				
13				
14				
15				
16				
17				
18				
19				
20	END			

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m	___.___	___.___	___.___
Float Time (s)	___.___	___.___	___.___
Flag			

Cross Sections on Float Reach	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm	___.___	___.___	___.___
Depth 2	___.___	___.___	___.___
Depth 3	___.___	___.___	___.___
Depth 4	___.___	___.___	___.___
Depth 5	___.___	___.___	___.___

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG [ ]

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME SC	LOCATION SC		
STATION # _____ RIVERMILE _____	STREAM CLASS		
LAT _____ LONG _____	RIVER BASIN		
STORET #	AGENCY		
GEAR	INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY	

SAMPLE COLLECTION	**How were the fish captured?** ❑ back pack ❑ tote barge ❑ other _____ **Block nets used?** ❑ YES ❑ NO **Sampling Duration** Start time 11:45 End time 12:30 Duration 1830 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Riffles____% ❑ Pools____% ❑ Runs____% ❑ Snags____% ❑ Submerged Macrophytes____% ❑ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Yellow Bullhead	2	198/69.2		208/24.3										
Pumpkinseed	2	97/17.6	114/20.4											
Blue Spotted Sunfish	2	89/11.0	54/0.7											
Black Crappie	1	78/4.9												

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Golden Shiner	4	60/1.4	63/2.5	39/1.0	41/1.0									
Pirate Perch	12	54/1.8	47/1.6	41/0.9	44/1.3	45/1.2								
		42/1.0	113/21.8	43/1.1	82/9.6	37/1.0								
		40/1.0	48/2.5											
Red fin Pickerel	1	93/4.5												
Eel	4	210/35.8	220/22.5	270/47.4	225/29.8									
Blue Gill	1	38/1.0												
Green Sunfish	1	157/75.8												

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: FW08 NASO 96 DATE: 08/12/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ◉ cm	◉ ft ○ cm	○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	2	0.02	
2	60	2.5	0.03	
3	120	2.6	0.04	
4	180	2.6	0.04	
5	240	2.1	0.02	
6	300	2.1	0.02	
7	360	2.7	0.01	
8	420	2.7	0.02	
9	480	2.7	0.02	
10	540	3.0	0.03	
11	600	2.0	0.03	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1			
2			
3			
4			
5			

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m			
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

14610

TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NaSO- Date and Time (Start-End): 8/12/14 1300 → 2PM Investigators: TG

Stream: NaSO-S6 to S7 Reach: S6-S7 Partial Debris Dam Tally for Reach: GPS @ Start Point: ☐ Y ☒ N Photo #'s:

Start of Reach located at: ☐ Confluence with ☐ Installation-Specific ☐ Arbitrary location

	Observation Parameters	Barrier Type	Barrier Type	Barrier Type	Barrier Type	Barrier Type
		☐ Debris Dam # 1 ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? Y / (N)	☐ Debris Dam # ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? Y / N	☐ Debris Dam # ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? Y / N	☐ Debris Dam # ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? Y / N	☐ Debris Dam # ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	0.3 m				
	Vertical Water Drop	N/A				
	Pool Immediately Below?	☐ Y Depth____ ☒ N	☐ Y Depth____ ☐ N	☐ Y Depth____ ☐ N	☐ Y Depth____ ☐ N	☐ Y Depth____ ☐ N
	Wetted Channel Width	4.0 m				
	Structure Width (length, for culverts)	1.8 m				
	Stream Channel	Upstream: ☒ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter					
	Beaver Activity?	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☒ woody debris ☐ leaf litter ☐ sediment ☐ other	☐ woody debris ☐ leaf litter ☐ sediment ☐ other	☐ woody debris ☐ leaf litter ☐ sediment ☐ other	☐ woody debris ☐ leaf litter ☐ sediment ☐ other	☐ woody debris ☐ leaf litter ☐ sediment ☐ other
	Is this a Beaver Dam?	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance					
	Bridge Material	☐ concrete ☐ steel ☐ timber ☐ other	☐ concrete ☐ steel ☐ timber ☐ other	☐ concrete ☐ steel ☐ timber ☐ other	☐ concrete ☐ steel ☐ timber ☐ other	☐ concrete ☐ steel ☐ timber ☐ other
	Culvert Material Corrugated? ☐ Y ☐ N	☐ concrete ☐ steel ☐ plastic ☐ other	☐ concrete ☐ steel ☐ plastic ☐ other	☐ concrete ☐ steel ☐ plastic ☐ other	☐ concrete ☐ steel ☐ plastic ☐ other	☐ concrete ☐ steel ☐ plastic ☐ other
	# of Arches/Culverts					
	Opening Obscured Up/Downstream	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure					
	Armoring?	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure					
	Structure outlet is:	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NaSo-S7	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
GEAR Back Pack	INVESTIGATORS TG MC KL	
FORM COMPLETED BY TG	DATE 8/12/14 TIME _____ AM PM	REASON FOR SURVEY Baseline

SAMPLE COLLECTION	**How were the fish captured?** ☐ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☒ NO Debris dam **Sampling Duration** Start time 2:15PM End time _____ Duration 1217 sec. **Stream width (in meters)** Max 6.4 Mean 5.3
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☒ Runs 90 % ☒ Snags 10 % ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	murky water, very low flow, clay bottom; bare and undercut banks

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Golden shiner	9	129/17.9	160/44.5	115/13.1	131/19.9	101/9.1								
		127/20.5	143/31.6	112/15.8	106/9.3									
Blue gill	2	53/2.2	70/6.3											
Mosquitofish	1	32/0.5												
Pirate perch	3	45/1.5	42/1.2	52/2.1										

Discharge

Distance	Depth (ft)	Velocity (ft/sec)
0	.7	0.02
1	1.0	0.04
2	1.2	0.05
3	2.6	0.06
4	2.8	0.03
5	2.8	0.03
6	2.9	0.06
7	2.1	0.10
8	2.0	0.08
9	1.9	0.04
10	0.9	0.02

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Blue spot	1	70/6.8												
yellow bullhead	10	91/7.7	149/33.4	127/23.4	137/27.1	240/217.6				1				
		140/33.7	149/32.8	167/56.8		163/57.4								
	L→	108/13.7												
Eel	3	270/37.6		270/40.5	285/50.8									
Pumpkinseed	1	89/13.2												
Brown bullhead	2	182/73.8		128/23.9										

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

NASO-P1

Oceana

~~Vasquez~~ Pond

Location:	**Gear** Boat e-fishing	**Button Time (sec):** 4225	(424 V) ~ 6 Amps	
Date: 6/2/14	Gill net	**Effort:**	**Deployed (time):**	**Retrieved (time)**
Time: 1520	Seine	**Net Dimensions:**	**Length (m)**	**Height (m)**
Personnel: CM, PTS	Minnow trap	**Effort:**	**Deployed (time):**	**Retrieved (time)**

Species	**Length (max. 25 specimens)**		~~**Tally**~~ Dead	**Total**
Largemouth Bass	331 (388), 275 (244), 163 (56), 105 (16), 114 (17)			
Bluegill	67, 103, 62, 69, 53, 60, 56, 72, 71, 57, 46, 42, 90, 58, 76, 130, 72, 99, 40, 106, 119, 58, 55, 72,		~~𝍸~~ 11	
American Eel	Less than 150	150-300 𝍸 𝍸 𝍸 𝍸 11		
	300-450	450+		

NASO-P1
06-02-2014

Species	Length (max. 25 specimens)	~~Tally~~ Dead	Total
Yellow Perch	132, 124		
Warmouth	68, 100, 87, 150, 185		
Redear Sunfish	164, 78	1 (retained)	
Pumpkinseed	129, 118, 85, 76, 96	1 (retained) IIII	
Black Crappie	115		

NASO PL

Vacapes

Location: ~~Ocean~~	**Gear** Boat e-fishing	**Button Time (sec):** 3306	(495 V) ~ 5 amps	
Date: 6/3/2014	Gill net	**Effort:**	**Deployed (time):**	**Retrieved (time)**
Time: 0830	Seine	**Net Dimensions:**	**Length (m)**	**Height (m)**
Personnel: CM, PTS	Minnow trap	**Effort:**	**Deployed (time):**	**Retrieved (time)**

Species	Length (max. 25 specimens)	~~Tally~~ Dead	Total
Largemouth Bass	359(538), 235(159), 319(371), 357(487), 267(225), 339(365), 340(450), 346(446) 122(21), 273(295), 341(412), 308(325), 240(168), 31, 26, 23		
Bluegill	108, 56, 45, 52, 81, 66, 72, 56, 80, 52, 67, 64, 58, 62, 61, 67, 65, 78, 57, 79, 51, 78, 69, 91, 52, 64, 54, 57 51, 47, 60, 80, 87, 44, 58, 58, 76, 50, 84, 60, 55, 43, 38, 58, 56, 56, 58, 55, 52, 45, 58, 58, 61, 46, 74, 56, 67, 47	~~|||| |||| |||| |||| |||| |||| |||| |||~~	
	64, 54, 58, 81, 60, 53, 55, 78, 58, 47, 72, 58, 47, 57, 71, 78, 52, 70, 58, 65, 57, 52, 57, 57, 50, 71, 65, 48, 83, 69, 60, 62, 64, 58, 81, 58, 57, 52, 57, 55, 70, 42, 54, 42, 52, 41, 82, 58, 53, 43, 44, 56.		
~~Eastern~~ PTS 6/3/14 ~~Mosquitofish~~			

FISH SAMPLING FIELD DATA SHEET (FRONT)

page of

STREAM NAME NASD S1	LOCATION Vacant
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR Electrofishing	INVESTIGATORS KOL, BKD, JV, EF
FORM COMPLETED BY KOL	DATE 9/26/14 TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☐ NO **Sampling Duration** Start time _____ End time _____ Duration 1497 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	potential ~~[illegible]~~ Ludwigia (3C)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Bluegill	39	99/13.2	99/13.6	89/9.4	86/8.0	62/3.5								
++++ ++++		88/9.8	80/7.8	56/6.4	71/10.8	77/6.5								
		63/3.5	90/11.2	65/4.2	106/14.9	93/11.2								
		84/8.1	81/9.3	114/25.8	105/13.3	96/6.8								
		59/2.3	57/2.2	81/7.9	57/2.5	49/1.2								
Pinfish	33	63/3.5	66/3.7	81/9.4	62/3.1	68/4.6								
|||	91/10.9	68/3.9	70/4.3	36/0.5	39/0.7								
		92/5.1	84/8.5	62/3.7	68/4.7	81/9.8								
		59/3.8	91/4.4	64/3.7	87/8.8	39/0.9								
		64/3.6	82/8.2	63/3.4	60/3.2	54/1.8								
Bullseye		75/6.8												
		88/11.0												
Mullet		52/0.7	59/2.3	45/0.7										
		84/6.6	102/10.0	54/1.5										
		58/1.9	79/3.9	63/2.5										
		69/3.4	54/1.4	70/3.6										
		65/2.9	66/2.6											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Redfin pickerel		179/91.9	162/32.1											
		111/6.7	204/65.6											
		113/8.1												
		203/55.1												
		155/22.7												
Warmouth		125/36.3												
Am. eel		290 / 41.8												
		225 / 20.3												
		185 / 12.7												
		165 / 12.3												
		215 / 19.8												
Yellow bullhead		165/74.9												

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASO 52	LOCATION
STATION #________ RIVERMILE________	STREAM CLASS
LAT ____________ LONG ____________	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY Emily Foster	DATE 9/30/14 TIME ______ AM PM — REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other ____________ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time ________ End time ________ Duration 1758 **Stream width (in meters)** Max________ Mean________
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L(mm)	W	L(mm)	W	L(mm)/W	ANOMALIES* D	E	F	L	M	S	T	Z
Golden Shiner		146	30.4	84	4.3									
		136	21.4											
		70	2.6											
		78	3.0											
		74	2.7											
Pumpkinseed		123	38.9											
		111	25.8											
		97	18.1											
		81	9.0											
Blue Gill		125	32.7	100	18.4									
		145	53.4	99	17.1									
		155	70.0	121?	[illegible]									
		115	26.8											
Green? →		162	87.5											
Pirate Perch		59	3.8	49	1.6	49 / 1.4								
卌 卌 卌 卌 卌 ||||		58	3.7	62	3.3	57 / 2.9								
		44	1.6	59	3.0	40 / 0.6								
		58	3.2	57	2.2	36 / 0.6								
		57	2.5	55	2.2	59 / 2.7								

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		L	W	L	W	L/W	D	E	F	L	M	S	T	Z
Largmouth Bass		145	42.4											
		165	57.5											
Pirate Perch II		59	2.5	57	1.9	71/4.8								
		64	3.4	54	1.8	38/0.8								
		67	3.8	60	3.0	36/0.8								
		55	2.2	56	2.4	54/2.4								
		57	2.1	61	3.2	52/1.9								
Green Sunfish		121	32											
mud minnow		58	1.7											
		89	6.5											
		58	1.8											
		49	1.1											
American Eel		253	29.5											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page of

STREAM NAME NASO - 53	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
GEAR	INVESTIGATORS	
FORM COMPLETED BY Emily Foster	DATE 9/30/14 TIME _____ AM PM	REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 801 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L(mm) W					ANOMALIES* D	E	F	L	M	S	T	Z
Mud minnow		52	0.8											
Mosquito fish		25	0.1											
		26	0.1											

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASO 54	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
GEAR	INVESTIGATORS	
FORM COMPLETED BY EF	DATE 10/1 TIME 9:20 (AM) PM	REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 1845 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	W	L	W	L/W	ANOMALIES* D	E	F	L	M	S	T	Z
Golden Shiner		127	19.0	123	17.5					1				
		154	33.9	147	30.1									
		140	27.3	121	15.5									
small mouth on gill →		131	19.8	124	16.5									
		149	32.3	136	26									
Eastern Silvery		34	4.3											
Bluegill		109	21.8	58	2.8	59 2.4								
		99	14.7	104	17.6	118 27.5								
		68	4.4	83	8.9	62 3.7								
		56	2.2	43	1.0	61 3.9								
		103	17.3	63	4.4	63 4.1								
Pumpkinseed		107	20.9	116	29.4	109 24.2								
		107	21.7	113	26.8									
		73	6.5	126	38.8									
		115	28.3	120	32.2									
		112	25.9	110	25.0									

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		L	W				D	E	F	L	M	S	T	Z
Bowfin		300	?											
got away ☹														
Banded Sunfish		80	8.8	56	3.9	52/2.3								
		59	4.1	51	2.4	49/2.1								
		62	4.3	57	3.5	48/1.9								
		81	11.2	61	4.3	56/2.9								
		53	1.9	59	3.7	38/1.0								
Banded Sunfish		58	3.6	49	2.4									
		46	1.9	45	1.8		卌 卌 卌 卌 卌							
		54	3.2	55	3.1		卌 ||||							
		72	8.3	59	3.6									
		56	3.5	57	3.9									
Yellow Bullhead		90	7.3	138	34.5									
		192	73.5											
		129	29.2											
		96	10.0											
		169	51.1											
Largemouth Bass		134	30.8											
		128	26.2											
		101	12.1											
		112	16.8											
		116	19.8											
Green Sunfish		59	3.3	65	5.0									
		45	1.5	73	7.6									
		123	37.3											
		45	1.4											
		64	4.9											
Mosquito fish		56	2.0	48	1.0	35/0.5								
		34	0.4	37	0.5	39/0.5								
		33	0.4	38	0.5									
		36	0.5	33	0.5									
		40	0.5	35	0.4									
Black Crappy		93	8.2											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASO 54 (cont'd)	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE _____ TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ❑ back pack ❑ tote barge ❑ other _____ **Block nets used?** ❑ YES ❑ NO **Sampling Duration** Start time _____ End time _____ Duration _____ **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Riffles_____% ❑ Pools_____% ❑ Runs_____% ❑ Snags_____% ❑ Submerged Macrophytes_____% ❑ Other (_____)_____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Golden Shiner		133	24.2	146	28.8									
		113	11.3											
		119	14.0											
		72	2.9											
		72	2.8											
RedFin Pickerel		169	36.3											
		153	24.2											
		143	18.5											
		187	41.9											
Pirate Perch		59	3.1	73	6.7									
		78	5.4											
		70	5.1											
		56	2.0											
		59	2.3											
Black Bullhead		155	43.6											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Mud Minnow		72	4.4											
		108	16.1											
		109	15.5											
Bluegill		62	4.6											
		118	28.7											
		69	5.3											
		58	2.5											
		64	4.6											
American Eel		290	63											
		150	10.6											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page 1 of

STREAM NAME NASO-55	LOCATION NAS OCEANA		
STATION # _____ RIVERMILE _____	STREAM CLASS		
LAT _____ LONG _____	RIVER BASIN		
STORET #	AGENCY		
GEAR LR 24	INVESTIGATORS DRESSER, LAMONTAGNE, COOK		
FORM COMPLETED BY DRESSER	DATE 10/1/2014 TIME 1020 AM PM	REASON FOR SURVEY	

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 1030 End time 1105 Duration 966 **Stream width (in meters)** Max 4 Mean 4
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☑ Runs 100 % ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
BLUEGILL		102/15.5	71/5.8	79/7.0	97/14.9	81/7.8								
		61/3.1	72/6.5	68/5.2	64/4.2	92/11.9								
		77/7.1	64/4.3	66/4.1	43/1.8	64/3.6								
		96/14.5	73/6.8	97/13.5	72/5.7	77/7.5								
		86/10.5	68/5.8	68/4.8	67/4.7									
PUMPKINSEED		93/12.6	105/19.8	108/23.9										
WARMOUTH		88/11.2	119/29.8											
MOSQUITO FISH		45/1.0	31/0.5	29/0.3	29/0.2	30/0.4								
		34/0.4	41/0.9	36/0.5	42/1.0									

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
BANDED SUNFISH		53/2.7	49/2.2	53/2.6										
LMB		161/49.2	122/21.4	140/35.2	82/7.5	97/11.7								
		177/77.6												
R.F. PICKEREL		171/28.2	84/43.8											
GOLDEN SHINER		111/13.2	115/11.8											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NA50 SC	LOCATION NA50
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE 9/30/19 TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☐ NO **Sampling Duration** Start time _____ End time _____ Duration 1632 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other (_____)____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Gizzard Shad	✓	119/12.5												
Fant Shiner	31	103/3.8	66/2.2	73/2.6	57/1.2	61/1.6								
~~HHH~~		65/1.6	69/1.9	66/1.8	64/1.9	46/0.6	70/3.6							
		96/3.2	79/6.9	89/6.1	66/2.1	58/1.4								
		88/5.1	61/1.4	67/2.0	69/1.6	67/1.9								
		69/2.0	67/2.2	58/1.4	68/2.0	60/1.6								
Blacktail	40	113/19	49/1.6	71/5.5	49/1.8	48/1.5								
~~HHH~~ ~~HHH~~ ~~HHH~~		95/9.0	78/7.7	66/4.9	107/15.7	55/2.7								
		65/4.4	95/13.5	89/4.6	54/2.3	65/5.1								
		62/3.5	92/5.9	93/12.3	96/12.7	92/6.3								
		89/6.1	55/2.7	69/5.3	62/3.9	69/5.5								
Banded Sculpin	①	89/9.5	56/3.0											
		75/3.7	52/2.4											
	④	49/2.1												
		59/3.6												
		61/3.5												

① Reference picture (BSO)

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES* D	E	F	L	M	S	T	Z
Green Sunfish		73/6.5												
RF Pickrel		100/5.9												
Pumkin seed		125/40.2												
⑧		115/66.1												
		125/38.?												
Pirate Perch		63/3.2	62/3.5	62/2.2										
		52/1.9	56/2.6	36/6.6										
		55/2.1	89/9.9											
		66/3.8	59/2.7											
		45/1.2	89/4.0											
Yellow bullhead		195/60.9												

*ANOMALY CODES: D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

⑧ Deformed lower jaw

Location: Vacapes NASO - P2	**Gear** ~~Boat e-fishing~~	**Button Time (sec):** 2387 @ 424 v.hz DC		
Date: 08-12-24	Gill net	**Effort:**	**Deployed (time):**	**Retrieved (time)**
Time: 1345	Seine	**Net Dimensions:**	**Length (m)**	**Height (m)**
Personnel: CB, PS	Minnow trap	**Effort:**	**Deployed (time):**	**Retrieved (time)**

Species	Length (max. 25 specimens)	~~Tally~~ Dead or Taken as Voucher	Total
Largemouth Bass	33(456), 25(186), 36(546), 32(440), 39(595), 17(78), 4.5, 5, 4.5, 7.5, 5, 4, 16(43), 4, 11(18), 5, 5.5, 15(40), 14.5(41)	IIII	
Bluegill	4, 3, 3.5, 5.5, 5.5, 6, 3.5, 7.5, 5, 3, 8, 7, 7, 6, 3, 7.5, 5, 6.5, 5, 4.5, 5.5, 9.5, 6, 3.5, 3, 4, 6, 2, 3.5, 6.5, 7.5, 6, 6, 4, 3, 3, 7, 5, 6.5, 3, 3.5, 7, 10, 4, 6, 8, 5.5, 8, 6, 5, 8, 6, 4, 5.5, 3.5, 5, 3, 7, 6, 3, 6, 3, 4, 2, 3, 4, 6, 5, 7, 3.5, 6, 7, 7.5	~~IIII IIII IIII~~	
Black crappie			
Bluegill (continued)	7, 6, 6, 6, 7, 7, 6, 6, 5, 4, 3, 8, 7.5, 6.5, 6.5, 6.5, 7, 5, 5.5, 6, 7, 5.5, 7, 6, 6.5, 5, 5.5, 6.5, 6.5, 3.5, 6, 7, 8, 7.5, 7, 9, 6.5, 5.5, 5.5, 5.5, 7, 7, 6, 17, 4.5, 2, 3, 5.5, 2	~~IIII~~	
Unknown QC = BLUEGILL	20.5, (SEE PHOTO)		

Location: NASO-P1	Gear (Boat e-fishing)	Button Time (sec): 2819 CB 5818 s		
Date: 08-12-14	Gill net	Effort: 424 DC	Deployed (time):	Retrieved (time)
Time: 0800	Seine	Net Dimensions:	Length (m)	Height (m)
Personnel: CB, PS	Minnow trap	Effort:	Deployed (time):	Retrieved (time)

Species	Length (max. 25 specimens)	~~Tally~~ (Dead) or Taken as Voucher	Total
Bluegill	8, 11, 7, 9, 9, 7, 8, 11, 10, 6.5, 3, 8.5, 11, 6.5, 6, 3.5, 7.5, 8, 6.5, 6, 6.5, 7, 8.5, 10.5, 11, 9, 7, 4, 11, 10, 7.5, 7, 12.5, 9, 3, 8.5, 8, 4, 7, 12.5, 6, 3, 5.5, 8, 8.5, 4, 2, 8, 6	1111	
Largemouth Bass	4.5, 8.5, 5.5, 5.5, 5, 5.5, 5, 7, 5, 6, 6, 5, 5, 8.5 accidentally released before weighing: 8.5( ), 11( ) 9( ) 5( ) 5( ), 9.5( ) 58(740), 25.5(238) Escaped: 10 in (~5 lb), 30 in (~15 lb)	~~||||~~ ~~||||~~ 11	
Pumpkinseed	24, 16, 11, 11, 10.5, 22.5, 23, 23, 10.5, 23.5, 18.5, 12, 12, 24, 13, 13, 10, 10.5, 11, 22, 21	111	
Bowfin QC=EASTERN MUDMINNOW	7, 8	11	
Black crappie	7, 6, 6, 6, 6, 6, 6.5, 6.5, 5.5, 5.5, 6, 6.5	~~||||~~ 1	
Yellow Perch	7.5, 12.5, 14, 8, 8, 8	11	

NASO-PI 08-12-14
0800

Species	Length (max. 25 specimens)	~~Tally~~ (Dead or Taken as Voucher)	Total
Warmouth	12, 9 5, 12.5, 11	11	
American Eel	0-50cm ++++ ++++ ++++ ++++ 1 180-150cm 1 (escaped) 50-100cm 1 150cm ++		
Unknown Sunfish Photos 1, 2, 3 OC: WARMOUTH	1		

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASO S7	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY EF	DATE 10/1 TIME 1:11 AM (PM) / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 1322 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	W	L	W		ANOMALIES* D	E	F	L	M	S	T	Z
Pumpkinseed		127	44	155	77.2	119/21.2								
		130	46.9	101	18.9	141/64.9								
		117	32.9	134	46.7	133/32.9								
		138	55.8	129	45.8	133/20.1								
		142	58.7	137	59.1	188/51.8								
Golden Shiner		152	31.5											
		133	19.3											
		147	33.1											
		160	39.5											
		144	28.1											
Blue Gill		92	14	69	5.3	66/4.7								
		63	3.8	71	6.1	59/3.3								
		63	4.2	72	6.1	65/4.3								
		67	4.7	69	5.2	69/5.8								
		101	15.2	63	4.0	57/3.7								
Largemouth Bass		236	172.6											
		106	14.5											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Yellow Bullhead		172	63.6											
		215	126.1											
		131	26.6											
		161	43.2											
		168	53.5											
Warmouth		131	43.4											
Redear Pickerel		179	36.3											
Black catfish		141	33.2											
Banded Sunfish		73	8.0											
		70	7.2											
		51	2.5											
		50	2.6											
Pirate Perch		62	3.2											
		71	4.5											
		72	5.0											
		94	12.3											
		53	2.4											
Juvenile Sunfish sp.		31	0.3											
~~Black~~ Green Sunfish		67	5.1											

*

ANOMALY CODES: D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NASO S7 (end)	LOCATION		
STATION # _____ RIVERMILE _____	STREAM CLASS		
LAT _____ LONG _____	RIVER BASIN		
STORET #	AGENCY		
GEAR	INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY	

SAMPLE COLLECTION	**How were the fish captured?** ❑ back pack ❑ tote barge ❑ other _____ **Block nets used?** ❑ YES ❑ NO **Sampling Duration** Start time _____ End time _____ Duration _____ **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Riffles _____% ❑ Pools _____% ❑ Runs _____% ❑ Snags _____% ❑ Submerged Macrophytes _____% ❑ Other ( ) _____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Brown bullhead		273	36.1											
		283	45.8											
		267	32.8											
		301	57.1											
Pumpkinseed		134	50.5	135	53.6									
		137	55.8	142	53.7		HHT | | |							
		128	45.8	130	48.5									
		135	44.8	143	60.2									
		124	36.1	114	29.6									
Bluegill		131	37.7	88	10.0		1							
Deformed / missing part of caudal fin →		136	50.1	81	9.2		HHT | | |							
		55	2.2	64	4.1									
		78	7.5	58	2.9									
		66	4.8	61	3.7									
mosquito fish		38	0.6											

TETRA TECH

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Project: NASO - DNA - Fish and Habitat

Site: NASO-P1 **Date and Time (Start-End):** 8/14/14 8:30am

Investigators: TG KL

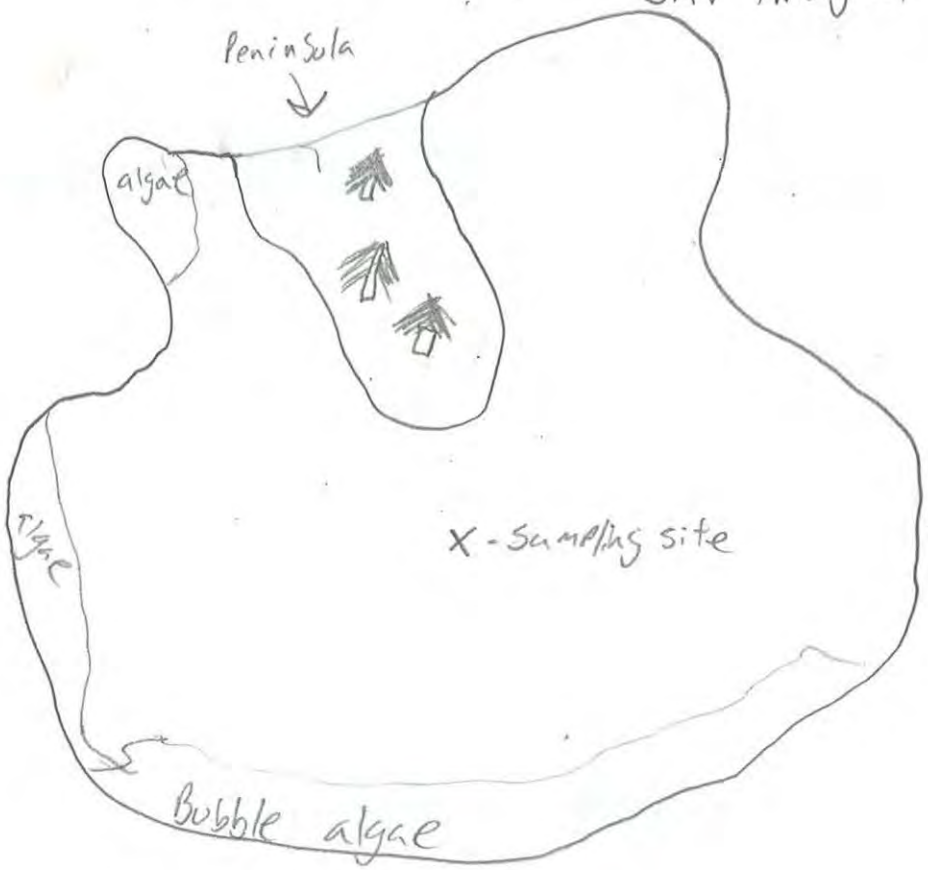
Weather Conditions (current and past 24 hrs): Sunny, 70°F, No rain in Past 24 hrs

Pond Surface Conditions: Bubble algae around shoreline

Index GPS Coordinates: LAT: LONG:

Observed Approx. Depth Range: 3m, 2m, surface - sampling Profile

SITE LOCATION MAP (Include locations sampled by gear type, water quality index location, inlet/outlet streams, cover, vegetation, and high water mark): - completely forested shoreline
- SAV throughout Pond



TETRA TECH

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Water Quality (*Recorded at Index Location*)	In-situ Measurements				Grab Samples			
Depth = 3.1 m	pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Conductivity (µS/cm)	Temperature (C°)	Total Nitrogen (TN)	Total Phosphorus & ortho-Phosphate (SRP)	Total Suspended Solids (TSS)
Upper (Surface)	8.41				27.22	□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Middle	8.39		–	–	27.15	□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Lower	7.91	–	–	–	26.83	□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Remarks: YSI Probe malfunction								

Shoreline Characteristics				
	Rare (<5%)	Sparse (5 to 25%)	Moderate (26 to 75%)	Extensive (76 to 100%)
Forest				X
Grass		X		
Shrub		X		
Wetland				
Bare Ground				
Agriculture				
Shoreline Modifications (concrete, rip rap, etc.)				
Development (residential/industrial)				
Shoreline Qualitative Macrophyte Survey				
Emergent/Floating		Bubble algae		
Submergent			X	
Macrophyte Density (circle one)	Absent	Sparse	(Moderate)	High
Shoreline Stability (%)			Stable % 90	Eroding % 10

Bare ground
But no erosion lines observed during visit

TETRA TECH NASO-P1

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Littoral Bottom Substrate (*shoreline out to 10 m*)	Absent (0%)	Sparse (<10%)	Moderate (11-40%)	Heavy (41 to 70%)	Very Heavy (71 to 100%)
Bedrock	X				
Boulder	X				
Cobble		X			
Gravel			X		
Sand			X		
Silt, Clay, Muck					
Woody Debris		X			
Organic (leaf pack, detritus)			X		
Vegetation or other			X		
Substrate Odor/Color: Muck at Shoreline, mix of light and dark brown					
Remarks:					

Littoral Fish Cover (*shoreline out to 10 m*)					
Aquatic and Inundated Herbaceous Vegetation			X		
Woody Debris/Snags		X			
Inundated Live trees	X				
Overhanging Vegetation		X			
Sharp Ledges or Dropoffs	X				
Boulders	X				
Human Structures (docks, barges, tires, car bodies, etc.)		X			
Species Observed: Sunfish SP.					
Remarks: SAV is most prolific habitat					

Fish Sampling: ☒ yes ☐ no **Gear Used:** ☒ electrofishing ☐ exp. gill net ☐ seine ☐ minnow trap ☐ hook & line

Trophic State: ☐ Oligotrophic ☐ Mesotrophic ☒ Eutrophic ☐ Hypereutrophic

TETRA TECH

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Emergent/Submerged Vegetation Observed: elodia sp., cattail

Invasive Species Observed:

Wildlife Observed: Blue heron

Additional Notes: shoreline was covered with floating bubble algae. banks were mostly stable, only a few bare spots (>2%).

TETRA TECH

Project: NASO/ONA fish and habitat **Freshwater Pond Habitat Assessment,** Sheet ___ of ___

Site: NASO P1 **Date and Time (Start-End):** 8/14/14 9:45am

Investigators: TG KL

Weather Conditions (current and past 24 hrs): Sunny ~75°F, no rain in past 24hrs

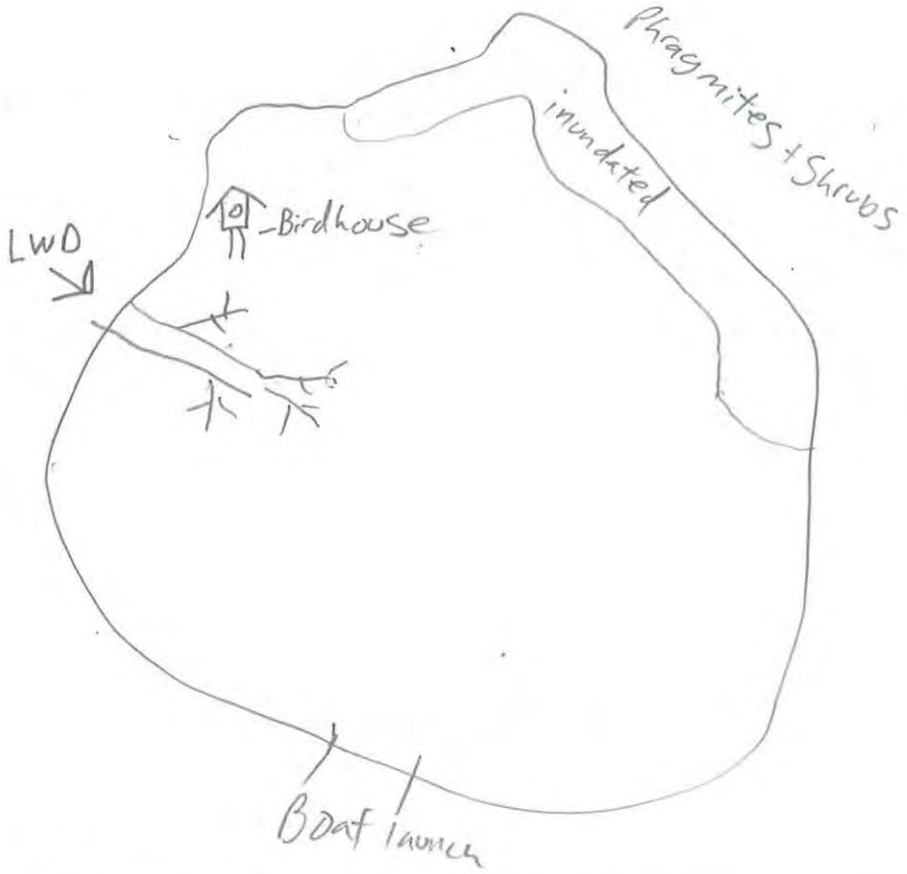
Pond Surface Conditions: flat, calm

Index GPS Coordinates: LAT: LONG:

Observed Approx. Depth Range:

SITE LOCATION MAP (Include locations sampled by gear type, water quality index location, inlet/outlet streams, cover, vegetation, and high water mark):

Riparian area consists of softwoods (Pine)



Shoreline contains numerous overhanging trees

TETRA TECH

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Water Quality (*Recorded at Index Location*)	In-situ Measurements				Grab Samples			
Depth = 2.03 m	pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Conductivity (µS/cm)	Temperature (C°)	Total Nitrogen (TN)	Total Phosphorus & ortho-Phosphate (SRP)	Total Suspended Solids (TSS)
Upper (Surface)						□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Middle						□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Lower						□ bottle(s) filled	□ bottle(s) filled	□ bottle(s) filled
Remarks: YSI malfunction - No WQ recorded								

Shoreline Characteristics				
	Rare (<5%)	Sparse (5 to 25%)	Moderate (26 to 75%)	Extensive (76 to 100%)
Forest			X	
Grass			X	
Shrub		X		
Wetland			X	
Bare Ground	absent			
Agriculture	absent			
Shoreline Modifications (concrete, rip rap, etc.)	absent			
Development (residential/industrial)	absent			
Shoreline Qualitative Macrophyte Survey				
Emergent/Floating			X	
Submergent			X	
Macrophyte Density (circle one)	Absent	Sparse	Moderate	High
Shoreline Stability (%)			Stable % 100	Eroding %

TETRA TECH

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Littoral Bottom Substrate (*shoreline out to 10 m*)	Absent (0%)	Sparse (<10%)	Moderate (11-40%)	Heavy (41 to 70%)	Very Heavy (71 to 100%)
Bedrock	X				
Boulder	X				
Cobble	X				
Gravel			X	X	
Sand			X		
Silt, Clay, Muck		X			
Woody Debris			X		
Organic (leaf pack, detritus)					
Vegetation or other					

Substrate Odor/Color: No odor, light Brown

Remarks:

Littoral Fish Cover (*shoreline out to 10 m*)					
Aquatic and Inundated Herbaceous Vegetation				X	
Woody Debris/Snags			X		
Inundated Live trees			X		
Overhanging Vegetation			X		
Sharp Ledges or Dropoffs	X				
Boulders	X				
Human Structures (docks, barges, tires, car bodies, etc.)	X				

Species Observed: Sunfish sp.

Remarks:

Fish Sampling: ☒ yes ☐ no **Gear Used:** ☒ electrofishing ☐ exp. gill net ☐ seine ☐ minnow trap ☐ hook & line

Trophic State: ☐ Oligotrophic ☒ Mesotrophic ☐ Eutrophic ☐ Hypereutrophic

TETRA TECH

NASO-P2

Freshwater Pond Habitat Assessment, Sheet ___ of ___

Emergent/Submerged Vegetation Observed: elodia, emergent shrubs over ~20% of shoreline

Invasive Species Observed: Phrag mites (~30% of shoreline)

Wildlife Observed: none, one birdhouse is present along shoreline, No birds observed @ time of visit

Additional Notes: Clarity of water was good with slight green tint. ~50% of shoreline is inundated with Phrag and shrubs present.

Location: NASO-P2	**Gear** Boat e-fishing	**Button Time (sec):** 3034 & 3554 volts DC		
Date: 10-07-14	Gill-net	**Effort:**	**Deployed (time):**	**Retrieved (time)**
Time: 1530	Seine	**Net Dimensions:**	**Length (m)**	**Height (m)**
Personnel: CB. PS	Minnow trap	**Effort:**	**Deployed (time):**	**Retrieved (time)**

Species	Length (max. 25 specimens) mm	Tally Voucher / Dead Tally(Wt)	Total
Largemouth bass	~~220~~ (~~250~~), 280 (~~300~~ 300), 320 (390), 110 (65), 235 (170), 390 (563) 330 (392), 320 (350), 270 (215), 65, 65, 65, 60, 67½	1 (190 mm), 1 (65) Voucher Dead 2 lost over 250 mm	
Bluegill	65, 80, 55, 30, 70, 35, 65, 75, 40, 65, 45, 60, 30, 45, 40, 50, 35, 65, 40, 45, 35, 50, 55, 50, 45, 45, 50, 20, 20, 25, 30, 30, 40, 30, 45, 40, 60, 30, 35, 50, 50, 30, 30, 30, 32, 43, 32, 30, 50, 38, 66, 35, 36, 32, 41, 54, 50, 40, 45, 38, 64, 35, 55, 37, 62, 52	11 (both 65) Voucher 1 (25) voucher – unsure if bluegill Dead ++++ 11	
Eastern Mudminnow	38, 30, 20, 34, 32, 30, 20, 35, 28, 32, 29, 27, 24, 30, 32, 20	Voucher 1 (38) 1 (30) Dead ++++	
Bluegill (continued)	33, 52, 37, 45, 30, 65, 22, 44, 46, 35, 29, 32, 45, 34, 27, 58, 31, 22, 40, 42, 30, 48, 37, 35, 35, 47, 52, 46, 25, 22, 44, 44, 62, 37, 42, 44		

Temp ~~23~~ 20.2 °C
DO 5.21 mg/L
cond 85.1 MS/cm
pH 6.97
DO % 56.0

WQ @ 1800

Location: NASO IP1	Gear: E-Fishing	Button Time (sec): 5749s @ 354 VDC
Date: 10/9/14		
Time: 0930		
Personnel: CB DB		

Species	Length mm	Dead or Vouchered Tally (+)	Total
LM BASS	481 (1845), 68, 81, 80, 112, 96, 72, 102, 84, 70, 77, 125, 72, 74, 175 (54), 75, 127 (52), 96, 80, 74, 75, 80,	Vouchered 1(81), 1(68) Dead 11	
Yellow Perch	140, 138, 138, 90, 120, 42, 142, 90, 126, 97, 129, 138, 97, 85, 85	Vouchered 1(139) 1(90) Dead	
Bluegill	74, 139, 95, 111, 45, 70, 46, 67, 98, 125, 76, 144, 69, 80, 72, 62, 51, 35, 77, 75, 74, 68, 46, 56, 85, 85, 54, 45, 55, 78, 134, 81, 55, 98, 58, 60, 91, 75, 52, 48, 82, 90, 87, 40, 71, 77, 70, 70, 72, 57, 32, 90, 72, 69, 76, 56, 79, 85, 81, 73, 53	Vouchered 1(95), 1(94) Dead +++	
Warmouth	45, 153, 135, 141, 38, 84, 88, 42, 74, 46, 120, 92, 101, 42,	Vouchered 1(45) (135) Dead 1	
Pumpkinseed	96, 55, 53, 87, 45, 54, 47, 56, 61, 155, 56, 97, 46, 128, 56, 50, 63, 57, 41, 53, 47, 122, 57, 52, 56, 54, 64, 54, 155, 48, 100, 54, 63, 36, 55, 61, 57, 113, 102, 80, 95, 55, 46, 90, 55, 37, 83, 65, 125, 126, 115, 87, 114, 164, 102, 90, 110, 52, 113, 57, 129, 121, 43, 181, 101,	Vouchered 1(96) 1(47)	

Temp 20.9°C
DO % 123.5
DO 10.57 mg/L
SP Cond 132.9
" 122.6

meter not calibrated

VQ @ 1000

Location: NASO P1	Gear: Electrofishing	Button Time (sec):
Date: 1/24/24		
Time: 0930		
Personnel: CB PT		

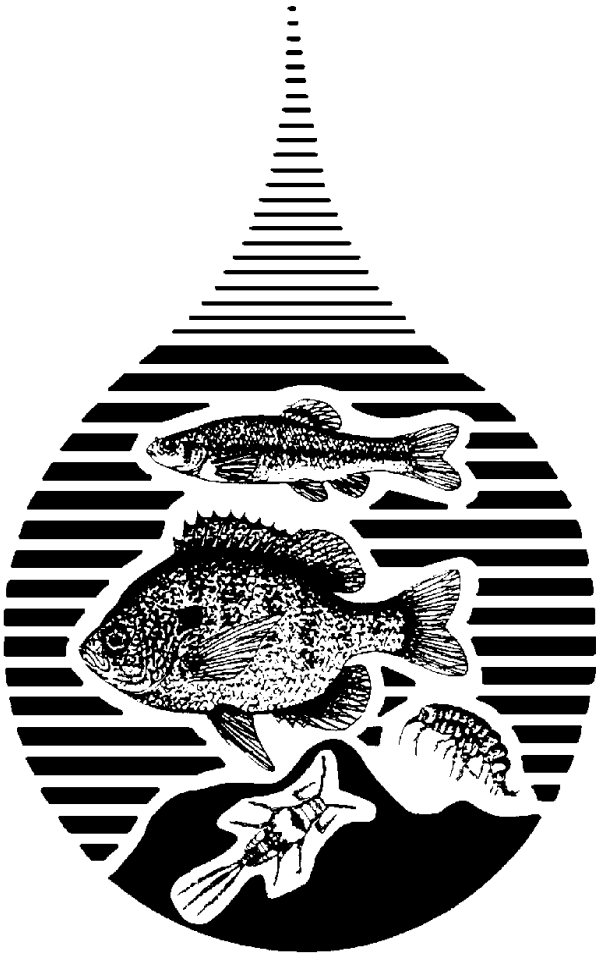
Species	Length	Dead or Vouchered	Total
Unknown sunfish (potentially pumpkinseed)	44	Vouchered 1 (44)	
Black crappie	74, 72, 76, 72, 65, 64, 75, 65, 76	Vouchered 1 (74), 1 (72)	
Bluegill Continued	73, 75, 35, 125, 55, 80, 88, 96, 67, 77, 80, 85, 102, 85, 70, 83, 78, 80, 94, 99, 82, 75, 82, 118, 73, 65, 74, 55, 83, 72, 78, 74, 49, 75, 72, 82, 74, 68, 125, 77, 55, 72, 82, 82, 48, 48, 112, 92, 89, 77, 109, 110, 79, 115, 55, 78, 68, 102, 80, 83, 140, 98, 73, 128, 91, 85, 108, 102, 115, 74		
American Eel	0-50mm | 50-100mm 100-150mm | 150+mm I | III	Vouchered 1 (100-150mm)	
Eastern Mudminnow	62,	Vouchered 1 (62)	

9 APPENDIX D - THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S (EPA) RAPID BIOASSESSMENT PROTOCOLS (RBP)

EPA 841-B-99-002

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers:

Periphyton, Benthic Macroinvertebrates, and Fish
Second Edition



http://www.epa.gov/OWOW/monitoring/techmon.html

By:

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5 HABITAT ASSESSMENT AND PHYSICOCHEMICAL PARAMETERS

An evaluation of habitat quality is critical to any assessment of ecological integrity and should be performed at each site at the time of the biological sampling. In general, habitat and biological diversity in rivers are closely linked (Raven et al. 1998). In the truest sense, "habitat" incorporates all aspects of physical and chemical constituents along with the biotic interactions. In these protocols, the definition of "habitat" is narrowed to the quality of the instream and riparian habitat that influences the structure and function of the aquatic community in a stream. The presence of an altered habitat structure is considered one of the major stressors of aquatic systems (Karr et al. 1986). The presence of a degraded habitat can sometimes obscure investigations on the effects of toxicity and/or pollution. The assessments performed by many water resource agencies include a general description of the site, a physical characterization and water quality assessment, and a visual assessment of instream and riparian habitat quality. Some states (e.g., Idaho DEQ and Illinois EPA) include quantitative measurements of physical parameters in their habitat assessment. Together these data provide an integrated picture of several of the factors influencing the biological condition of a stream system. These assessments are not as comprehensive as needed to adequately identify all causes of impact. However, additional investigation into hydrological modification of water courses and drainage patterns can be conducted, once impairment is noted.

The habitat quality evaluation can be accomplished by characterizing selected physicochemical parameters in conjunction with a systematic assessment of physical structure. Through this approach, key features can be rated or scored to provide a useful assessment of habitat quality.

5.1 PHYSICAL CHARACTERISTICS AND WATER QUALITY

Both physical characteristics and water quality parameters are pertinent to characterization of the stream habitat. An example of the data sheet used to characterize the physical characteristics and water quality of a site is shown in Appendix A. The information required includes measurements of physical characterization and water quality made routinely to supplement biological surveys.

Physical characterization includes documentation of general land use, description of the stream origin and type, summary of the riparian vegetation features, and measurements of instream parameters such as width, depth, flow, and substrate. The water quality discussed in these protocols are *in situ* measurements of standard parameters that can be taken with a water quality instrument. These are generally instantaneous measurements taken at the time of the survey. Measurements of certain parameters, such as temperature, dissolved oxygen, and turbidity, can be taken over a diurnal cycle and will require instrumentation that can be left in place for extended periods or collects water samples at periodic intervals for measurement. In addition, water samples may be desired to be collected for selected chemical analysis. These chemical samples are transported to an analytical laboratory for processing. The combination of this information (physical characterization and water quality) will provide insight as to the ability of the stream to support a healthy aquatic community, and to the presence of chemical and non-chemical stressors to the stream ecosystem. Information requested in this section (Appendix A-1, Form 1) is standard

to many aquatic studies and allows for some comparison among sites. Additionally, conditions that may significantly affect aquatic biota are documented.

5.1.1 Header Information (Station Identifier)

The header information is identical on all data sheets and requires sufficient information to identify the station and location where the survey was conducted, date and time of survey, and the investigators responsible for the quality and integrity of the data. The stream name and river basin identify the watershed and tributary; the location of the station is described in the narrative to help identify access to the station for repeat visits. The rivermile (if applicable) and latitude/longitude are specific locational data for the station. The station number is a code assigned by the agency that will associate the sample and survey data with the station. The STORET number is assigned to each datapoint for inclusion in USEPA's STORET system. The stream class is a designation of the grouping of homogeneous characteristics from which assessments will be made. For instance, Ohio EPA uses ecoregions and size of stream, Florida DEP uses bioregions (aggregations of subecoregions), and Arizona DEQ uses elevation as a means to identify stream classes. Listing the agency and investigators assigns responsibility to the data collected from the station at a specific date and time. The reason for the survey is sometimes useful to an agency that conducts surveys for various programs and purposes.

5.1.2 Weather Conditions

Note the present weather conditions on the day of the survey and those immediately preceding the day of the survey. This information is important to interpret the effects of storm events on the sampling effort.

5.1.3 Site Location/Map

To complete this phase of the bioassessment, a photograph may be helpful in identifying station location and documenting habitat conditions. Any observations or data not requested but deemed important by the field observer should be recorded. A hand-drawn map is useful to illustrate major landmarks or features of the channel morphology or orientation, vegetative zones, buildings, etc. that might be used to aid in data interpretation.

5.1.4 Stream Characterization

Stream Subsystem: In regions where the perennial nature of streams is important, or where the tidal influence of streams will alter the structure and function of communities, this parameter should be noted.

Stream Type: Communities inhabiting coldwater streams are markedly different from those in warmwater streams, many states have established temperature criteria that differentiate these 2 stream types.

Stream Origin: Note the origination of the stream under study, if it is known. Examples are glacial, montane, swamp, and bog. As the size of the stream or river increases, a mixture of origins of tributaries is likely.

5.1.5 Watershed Features

Collecting this information usually requires some effort initially for a station. However, subsequent surveys will most likely not require an in-depth research of this information.

Predominant Surrounding Land Use Type: Document the prevalent land-use type in the catchment of the station (noting any other land uses in the area which, although not predominant, may potentially affect water quality). Land use maps should be consulted to accurately document this information.

Local Watershed Nonpoint Source Pollution: This item refers to problems and potential problems in the watershed. Nonpoint source pollution is defined as diffuse agricultural and urban runoff. Other compromising factors in a watershed that may affect water quality include feedlots, constructed wetlands, septic systems, dams and impoundments, mine seepage, etc.

Local Watershed Erosion: The existing or potential detachment of soil within the local watershed (the portion of the watershed or catchment that directly affects the stream reach or station under study) and its movement into the stream is noted. Erosion can be rated through visual observation of watershed and stream characteristics (note any turbidity observed during water quality assessment below).

5.1.6 Riparian Vegetation

An acceptable riparian zone includes a buffer strip of a minimum of 18 m (Barton et al. 1985) from the stream on either side. The acceptable width of the riparian zone may also be variable depending on the size of the stream. Streams over 4 m in width may require larger riparian zones. The vegetation within the riparian zone is documented here as the dominant type and species, if known.

5.1.7 Instream Features

Instream features are measured or evaluated in the sampling reach and catchment as appropriate.

Estimated Reach Length: Measure or estimate the length of the sampling reach. This information is important if reaches of variable length are surveyed and assessed.

Estimated Stream Width (in meters, m): Estimate the distance from bank to bank at a transect representative of the stream width in the reach. If variable widths, use an average to find that which is representative for the given reach.

Sampling Reach Area (m^2): Multiply the sampling reach length by the stream width to obtain a calculated surface area.

Estimated Stream Depth (m): Estimate the vertical distance from water surface to stream bottom at a representative depth (use instream habitat feature that is most common in reach) to obtain average depth.

Velocity: Measure the surface velocity in the thalweg of a representative run area. If measurement is not done, estimate the velocity as slow, moderate, or fast.

Canopy Cover: Note the general proportion of open to shaded area which best describes the amount of cover at the sampling reach or station. A densiometer may be used in place of visual estimation.

High Water Mark (m): Estimate the vertical distance from the bankfull margin of the stream bank to the peak overflow level, as indicated by debris hanging in riparian or floodplain vegetation, and deposition of silt or soil. In instances where bank overflow is rare, a high water mark may not be evident.

Proportion of Reach Represented by Stream Morphological Types: The proportion represented by riffles, runs, and pools should be noted to describe the morphological heterogeneity of the reach.

Channelized: Indicate whether or not the area around the sampling reach or station is channelized (e.g., straightening of stream, bridge abutments and road crossings, diversions, etc.).

Dam Present: Indicate the presence or absence of a dam upstream in the catchment or downstream of the sampling reach or station. If a dam is present, include specific information relating to alteration of flow.

5.1.8 Large Woody Debris

Large Woody Debris (LWD) density, defined and measured as described below, has been used in regional surveys (Shields et al. 1995) and intensive studies of degraded and restored streams (Shields et al. 1998). The method was developed for sand or sand-and-gravel bed streams in the Southeastern U.S. that are wadeable at baseflow, with water widths between 1 and 30 m (Cooper and Testa 1999).

Cooper and Testa's (1999) procedure involves measurements based on visual estimates taken by a wading observer. Only woody debris actually in contact with stream water is counted. Each woody debris formation with a surface area in the plane of the water surface >0.25 m^2 is recorded. The estimated length and width of each formation is recorded on a form or marked directly onto a stream reach drawing. Estimates are made to the nearest 0.5 m , and formations with length or width less than 0.5 m are not counted. Recorded length is maximum width in the direction perpendicular to the length. Maximum actual length and width of a limb, log, or accumulation are not considered.

If only a portion of the log/limb is in contact with the water, only that portion in contact is measured. Root wads and logs/limbs in the water margin are counted if they contact the water, and are arbitrarily given a width of 0.5 m Lone individual limbs and logs are included in the determination if their diameter is 10 cm or larger (Keller and Swanson 1979, Ward and Aumen 1986). Accumulations of smaller limbs and logs are included if the formation total length or width is 0.5 m or larger. Standing trees and stumps within the stream are also recorded if their length and width exceed 0.5 m.

The length and width of each LWD formation are then multiplied, and the resulting products are summed to give the aquatic habitat area directly influenced. This area is then divided by the water

surface area (km^2) within the sampled reach (obtained by multiplying the average water surface width by reach length) to obtain LWD density. Density values of 10^3 to 10^4 m^2/km^2 have been reported for channelized and incised streams and on the order of 10^5 m^2/km^2 for non-incised streams (Shields et al. 1995 and 1998). This density is not an expression of the volume of LWD, but rather a measure of LWD influence on velocity, depth, and cover.

5.1.9 Aquatic Vegetation

The general type and relative dominance of aquatic plants are documented in this section. Only an estimation of the extent of aquatic vegetation is made. Besides being an ecological assemblage that responds to perturbation, aquatic vegetation provides refugia and food for aquatic fauna. List the species of aquatic vegetation, if known.

5.1.10 Water Quality

Temperature (°C), Conductivity or "Specific Conductance" (µohms), Dissolved Oxygen (µg/L), pH, Turbidity: Measure and record values for each of the water quality parameters indicated, using the appropriate calibrated water quality instrument(s). Note the type of instrument and unit number used.

Water Odors: Note those odors described (or include any other odors not listed) that are associated with the water in the sampling area.

Water Surface Oils: Note the term that best describes the relative amount of any oils present on the water surface.

Turbidity: If turbidity is not measured directly, note the term which, based upon visual observation, best describes the amount of material suspended in the water column.

5.1.11 Sediment/Substrate

Sediment Odors: Disturb sediment in pool or other depositional areas and note any odors described (or include any other odors not listed) which are associated with sediment in the sampling reach.

Sediment Oils: Note the term which best describes the relative amount of any sediment oils observed in the sampling area.

Sediment Deposits: Note those deposits described (or include any other deposits not listed) that are present in the sampling reach. Also indicate whether the undersides of rocks not deeply embedded are black (which generally indicates low dissolved oxygen or anaerobic conditions).

Inorganic Substrate Components: Visually estimate the relative proportion of each of the 7 substrate/particle types listed that are present over the sampling reach.

Organic Substrate Components: Indicate relative abundance of each of the 3 substrate types listed.

5.2 A VISUAL-BASED HABITAT ASSESSMENT

Biological potential is limited by the quality of the physical habitat, forming the template within which biological communities develop (Southwood 1977). Thus, habitat assessment is defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour et al. 1996a). For streams, an encompassing approach to assessing structure of the habitat includes an evaluation of the variety and quality of the substrate, channel morphology, bank structure, and riparian vegetation. Habitat parameters pertinent to the assessment of habitat quality include those that characterize the stream "micro scale" habitat (e.g., estimation of embeddeddness), the "macro scale" features (e.g., channel morphology), and the riparian and bank structure features that are most often influential in affecting the other parameters.

EQUIPMENT/SUPPLIES NEEDED FOR HABITAT ASSESSMENT AND PHYSICAL/WATER QUALITY CHARACTERIZATION

- Physical Characterization and Water Quality Field Data Sheet*
- Habitat Assessment Field Data Sheet*
- clipboard
- pencils or waterproof pens
- 35 mm camera (may be digital)
- video camera (optional)
- upstream/downstream “arrows” or signs for photographing and documenting sampling reaches
- Flow or velocity meter
- *In situ* water quality meters
- Global Positioning System (GPS) Unit

* It is helpful to copy field sheets onto water-resistant paper for use in wet weather conditions

Rosgen (1985, 1994) presented a stream and river classification system that is founded on the premise that dynamically-stable stream channels have a morphology that provides appropriate distribution of flow energy during storm events. Further, he identifies 8 major variables that affect the stability of channel morphology, but are not mutually independent: channel width, channel depth, flow velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment particle size distribution. When streams have one of these characteristics altered, some of their capability to dissipate energy properly is lost (Leopold et al. 1964, Rosgen 1985) and will result in accelerated rates of channel erosion. Some of the habitat structural components that function to dissipate flow energy are:

- sinuosity
- roughness of bed and bank materials
- presence of point bars (slope is an important characteristic)
- vegetative conditions of stream banks and the riparian zone
- condition of the floodplain (accessibility from bank, overflow, and size are important characteristics).

Measurement of these parameters or characteristics serve to stratify and place streams into distinct classifications. However, none of these habitat classification techniques attempt to differentiate the quality of the habitat and the ability of the habitat to support the optimal biological condition of the

region. Much of our understanding of habitat relationships in streams has emerged from comparative studies that describe statistical relationships between habitat variables and abundance of biota (Hawkins et al. 1993). However, in response to the need to incorporate broader scale habitat assessments in water resource programs, 2 types of approaches for evaluating habitat structure have been developed. In the first, the Environmental Monitoring and Assessment Program (EMAP) of the USEPA and the National Water-Quality Assessment Program (NAWQA) of the USGS developed techniques that incorporate measurements of various features of the instream, channel, and bank morphology (Meader et al. 1993, Klemm and Lazorchak 1994). These techniques provide a relatively comprehensive characterization of the physical structure of the stream sampling reach and its surrounding floodplain. The second type was a more rapid and qualitative habitat assessment approach that was developed to describe the overall quality of the physical habitat (Ball 1982, Ohio EPA 1987, Plafkin et al. 1989, Barbour and Stribling 1991, 1994, Rankin 1991, 1995). In this document, the more rapid visual-based approach is described. A cursory overview of the more quantitative approaches to characterizing the physical structure of the habitat is provided.

The habitat assessment matrix developed for the Rapid Bioassessment Protocols (RBPs) in Plafkin et al. (1989) were originally based on the Stream Classification Guidelines for Wisconsin developed by Ball (1982) and "*Methods of Evaluating Stream, Riparian, and Biotic Conditions*" developed by Platts et al. (1983). Barbour and Stribling (1991, 1994) modified the habitat assessment approach originally developed for the RBPs to include additional assessment parameters for high gradient streams and a more appropriate parameter set for low gradient streams (Appendix A-1, Forms 2,3). All parameters are evaluated and rated on a numerical scale of 0 to 20 (highest) for each sampling reach. The ratings are then totaled and compared to a reference condition to provide a final habitat ranking. Scores increase as habitat quality increases. To ensure consistency in the evaluation procedure, descriptions of the physical parameters and relative criteria are included in the rating form.

The Environmental Agency of Great Britain (Environment Agency of England and Wales, Scottish Environment Protection Agency, and Environment and Heritage Service of Northern Ireland) have developed a River Habitat Survey (RHS) for characterizing the quality of their streams and rivers (Raven et al. 1998). The approach used in Great Britain is similar to the visual-based habitat assessment used in the US in that scores are assigned to ranges of conditions of various habitat parameters.

A biologist who is well versed in the ecology and zoogeography of the region can generally recognize optimal habitat structure as it relates to the biological community. The ability to accurately assess the quality of the physical habitat structure using a visual-based approach depends on several factors:

- the parameters selected to represent the various features of habitat structure need to be relevant and clearly defined
- a continuum of conditions for each parameter must exist that can be characterized from the optimum for the region or stream type under study to the poorest situation reflecting substantial alteration due to anthropogenic activities

- the judgement criteria for the attributes of each parameter should minimize subjectivity through either quantitative measurements or specific categorical choices

- the investigators are experienced in or adequately trained for stream assessments in the region under study (Hannaford et al. 1997)

- adequate documentation and ongoing training is maintained to evaluate and correct errors resulting in outliers and aberrant assessments.

Habitat evaluations are first made on instream habitat, followed by channel morphology, bank structural features, and riparian vegetation. Generally, a single, comprehensive assessment is made that incorporates features of the entire sampling reach as well as selected features of the catchment. Additional assessments may be made on neighboring reaches to provide a broader evaluation of habitat quality for the stream ecosystem. The actual habitat assessment process involves rating the 10 parameters as optimal, suboptimal, marginal, or poor based on the criteria included on the Habitat Assessment Field Data Sheets (Appendix A-1, Forms 2,3). Some state programs, such as Florida Department of Environmental Protection (DEP) (1996) and Mid-Atlantic Coastal Streams Workgroup (MACS) (1996) have adapted this approach using somewhat fewer and different parameters.

Reference conditions are used to scale the assessment to the "best attainable" situation. This approach is critical to the assessment because stream characteristics will vary dramatically across different regions (Barbour and Stribling 1991). The ratio between the score for the test station and the score for the reference condition provides a percent comparability measure for each station. The station of interest is then classified on the basis of its similarity to expected conditions (reference condition), and its apparent potential to support an acceptable level of biological health. Use of a percent comparability evaluation allows for regional and stream-size differences which affect flow or velocity, substrate, and channel morphology. Some regions are characterized by streams having a low channel gradient, such as coastal plains or prairie regions.

Other habitat assessment approaches or a more rigorously quantitative approach to measuring the habitat parameters may be used (See Klemm and Lazorchak 1994, Kaufmann and Robison 1997, Meader et al. 1993). However, holistic and rapid assessment of a wide variety of habitat attributes along with other types of data is critical if physical measurements are to be used to best advantage in interpreting biological data. A more detailed discussion of the relationship between habitat quality and biological condition is presented in Chapter 10.

A generic habitat assessment approach based on visual observation can be separated into 2 basic approaches—one designed for high-gradient streams and one designed for low-gradient streams. High-gradient or riffle/run prevalent streams are those in moderate to high gradient landscapes. Natural high-gradient streams have substrates primarily composed of coarse sediment particles (i.e., gravel or larger) or frequent coarse particulate aggregations along stream reaches. Low-gradient or glide/pool prevalent streams are those in low to moderate gradient landscapes. Natural low-gradient streams have substrates of fine sediment or infrequent aggregations of more coarse (gravel or larger) sediment particles along stream reaches. The entire sampling reach is evaluated for each parameter. Descriptions of each parameter and its relevance to instream biota are presented in the following discussion. Parameters that are used only for high-gradient prevalent streams are marked with an “a”; those for low-gradient dominant streams, a “b”. If a parameter is used for both stream types, it is not marked with a letter. A brief set of decision criteria is given

for each parameter corresponding to each of the 4 categories reflecting a continuum of conditions on the field sheet (optimal, suboptimal, marginal, and poor). Refer to Appendix A-1, Forms 2 and 3, for a complete field assessment guide.

PROCEDURE FOR PERFORMING HABITAT ASSESSMENT

1. Select the reach to be assessed. The habitat assessment is performed on the same 100 m reach (or other reach designation [e.g., 40 x stream wetted width]) from which the biological sampling is conducted. Some parameters require an observation of a broader section of the catchment than just the sampling reach.

2. Complete the station identification section of each field data sheet and habitat assessment form.

3. It is best for the investigators to obtain a close look at the habitat features to make an adequate assessment. If the physical and water quality characterization and habitat assessment are done before the biological sampling, care must be taken to avoid disturbing the sampling habitat.

4. Complete the **Physical Characterization and Water Quality Field Data Sheet**. Sketch a map of the sampling reach on the back of this form.

5. Complete the **Habitat Assessment Field Data Sheet**, in a team of 2 or more biologists, if possible, to come to a consensus on determination of quality. Those parameters to be evaluated on a scale greater than a sampling reach require traversing the stream corridor to the extent deemed necessary to assess the habitat feature. As a general rule-of-thumb, use 2 lengths of the sampling reach to assess these parameters.

QUALITY ASSURANCE PROCEDURES

1. Each biologist is to be trained in the visual-based habitat assessment technique for the applicable region or state.

2. The judgment criteria for each habitat parameter are calibrated for the stream classes under study. Some text modifications may be needed on a regional basis.

3. Periodic checks of assessment results are completed using pictures of the sampling reach and discussions among the biologists in the agency.

Parameters to be evaluated in sampling reach:

1 EPIFAUNAL SUBSTRATE/AVAILABLE COVER

high and low gradient streams

Includes the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding, or sites for spawning and nursery functions of aquatic macrofauna. A wide variety and/or abundance of submerged structures in the stream provides macroinvertebrates and fish with a large number of niches, thus increasing habitat diversity. As variety and abundance of cover decreases, habitat structure becomes monotonous, diversity decreases, and the potential for recovery following disturbance decreases. Riffles and runs are critical for maintaining a variety and abundance of insects in most high-gradient streams and serving as spawning and feeding refugia for certain fish. The extent and quality of the riffle is an important factor in the support of a healthy biological condition in high-gradient streams. Riffles and runs offer a diversity of habitat through variety of particle size, and, in many small high-gradient streams, will provide the most stable habitat. Snags and submerged logs are among the most productive habitat structure for macroinvertebrate colonization and fish refugia in low-gradient streams. However, "new fall" will not yet be suitable for colonization.

Selected References

Wesche et al. 1985, Pearsons et al. 1992, Gorman 1988, Rankin 1991, Barbour and Stribling 1991, Plafkin et al. 1989, Platts et al. 1983, Osborne et al. 1991, Benke et al. 1984, Wallace et al. 1996, Ball 1982, MacDonald et al. 1991, Reice 1980, Clements 1987, Hawkins et al. 1982, Beechie and Sibley 1997.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover **(high and low gradient)**	Greater than 70% (50% for low gradient streams) of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% (30-50% for low gradient streams) mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% (10-30% for low gradient streams) mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% (10% for low gradient streams) stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

1a. Epifaunal Substrate/Available Cover—High Gradient

Optimal Range

Poor Range

1b. Epifaunal Substrate/Available Cover—Low Gradient

Optimal Range (*Mary Kay Corazalla, U. of Minn.*)

Poor Range

2a EMBEDDEDNESS

high gradient streams

Refers to the extent to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish (shelter, spawning, and egg incubation) is decreased. Embeddedness is a result of large-scale sediment movement and deposition, and is a parameter evaluated in the riffles and runs of high-gradient streams. The rating of this parameter may be variable depending on where the observations are taken. To avoid confusion with sediment deposition (another habitat parameter), observations of embeddedness should be taken in the upstream and central portions of riffles and cobble substrate areas.

Selected References

Ball 1982, Osborne et al. 1991, Barbour and Stribling 1991, Platts et al. 1983, MacDonald et al. 1991, Rankin 1991, Reice 1980, Clements 1987, Benke et al. 1984, Hawkins et al. 1982, Burton and Harvey 1990.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
2.a Embeddedness (high gradient)	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

2a. Embeddedness—High Gradient

Optimal Range *(William Taft, MI DNR)*

Poor Range *(William Taft, MI DNR)*

2b POOL SUBSTRATE CHARACTERIZATION

low gradient streams

Evaluates the type and condition of bottom substrates found in pools. Firmer sediment types (e.g., gravel, sand) and rooted aquatic plants support a wider variety of organisms than a pool substrate dominated by mud or bedrock and no plants. In addition, a stream that has a uniform substrate in its pools will support far fewer types of organisms than a stream that has a variety of substrate types.

Selected References

Beschta and Platts 1986, U.S. EPA 1983.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
2b. Pool Substrate Characterization (low gradient)	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or submerged vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

2b. Pool Substrate Characterization—Low Gradient

Optimal Range
(Mary Kay Corazalla, U. of Minn.)

Poor Range

3a VELOCITY/DEPTH COMBINATIONS

high gradient streams

Patterns of velocity and depth are included for high-gradient streams under this parameter as an important feature of habitat diversity. The best streams in most high-gradient regions will have all 4 patterns present: (1) slow-deep, (2) slow-shallow, (3) fast-deep, and (4) fast-shallow. The general guidelines are 0.5 m depth to separate shallow from deep, and 0.3 m/sec to separate fast from slow. The occurrence of these 4 patterns relates to the stream's ability to provide and maintain a stable aquatic environment.

Selected References

Ball 1982, Brown and Brussock 1991, Gore and Judy 1981, Oswood and Barber 1982.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
3a. Velocity/ Depth Regimes **(high gradient)**	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (slow is <0.3 m/s, deep is >0.5 m)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

3a. Velocity/Depth Regimes—High Gradient

Optimal Range *(Mary Kay Corazalla, U. of Minn.)*
(arrows emphasize different velocity/depth regimes)

Poor Range *(William Taft, MI DNR)*

3b POOL VARIABILITY

low gradient streams

Rates the overall mixture of pool types found in streams, according to size and depth. The 4 basic types of pools are large-shallow, large-deep, small-shallow, and small-deep. A stream with many pool types will support a wide variety of aquatic species. Rivers with low sinuosity (few bends) and monotonous pool characteristics do not have sufficient quantities and types of habitat to support a diverse aquatic community. General guidelines are any pool dimension (i.e., length, width, oblique) greater than half the cross-section of the stream for separating large from small and 1 m depth separating shallow and deep.

Selected References

Beschta and Platts 1986, USEPA 1983.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
3b. Pool Variability (low gradient)	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

3b. Pool Variability—Low Gradient

Optimal Range *(Peggy Morgan, FL DEP)*

Poor Range *(William Taft, MI DNR)*

4 SEDIMENT DEPOSITION

high and low gradient streams

Measures the amount of sediment that has accumulated in pools and the changes that have occurred to the stream bottom as a result of deposition. Deposition occurs from large-scale movement of sediment. Sediment deposition may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increase in size as the channel is diverted toward the outer bank) or shoals, or result in the filling of runs and pools. Usually deposition is evident in areas that are obstructed by natural or manmade debris and areas where the stream flow decreases, such as bends. High levels of sediment deposition are symptoms of an unstable and continually changing environment that becomes unsuitable for many organisms.

Selected References

MacDonald et al. 1991, Platts et al. 1983, Ball 1982, Armour et al. 1991, Barbour and Stribling 1991, Rosgen 1985.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
4. Sediment Deposition **(high and low gradient)**	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

4a. Sediment Deposition—High Gradient

Optimal Range

Poor Range
(arrow pointing to sediment deposition)

4b. Sediment Deposition—Low Gradient

Optimal Range

Poor Range
(arrows pointing to sediment deposition)

5 CHANNEL FLOW STATUS

high and low gradient streams

The degree to which the channel is filled with water. The flow status will change as the channel enlarges (e.g., aggrading stream beds with actively widening channels) or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the amount of suitable substrate for aquatic organisms is limited. In high-gradient streams, riffles and cobble substrate are exposed; in low-gradient streams, the decrease in water level exposes logs and snags, thereby reducing the areas of good habitat. Channel flow is especially useful for interpreting biological condition under abnormal or lowered flow conditions. This parameter becomes important when more than one biological index period is used for surveys or the timing of sampling is inconsistent among sites or annual periodicity.

Selected References

Rankin 1991, Rosgen 1985, Hupp and Simon 1986, MacDonald et al. 1991, Ball 1982, Hicks et al. 1991.

Habitat Parameter	Condition Category																					
	Optimal					Suboptimal					Marginal					Poor					
5. Channel Flow Status **(high and low gradient)**	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

5a. Channel Flow Status—High Gradient

Optimal Range

Poor Range
(arrow showing that water is not reaching both banks; leaving much of channel uncovered)

5b. Channel Flow Status—Low Gradient

Optimal Range

Poor Range *(James Stahl, IN DEM)*

Parameters to be evaluated broader than sampling reach:

6 CHANNEL ALTERATION

high and low gradient streams

Is a measure of large-scale changes in the shape of the stream channel. Many streams in urban and agricultural areas have been straightened, deepened, or diverted into concrete channels, often for flood control or irrigation purposes. Such streams have far fewer natural habitats for fish, macroinvertebrates, and plants than do naturally meandering streams. Channel alteration is present when artificial embankments, riprap, and other forms of artificial bank stabilization or structures are present; when the stream is very straight for significant distances; when dams and bridges are present; and when other such changes have occurred. Scouring is often associated with channel alteration.

Selected References

Barbour and Stribling 1991, Simon 1989a, b, Simon and Hupp 1987, Hupp and Simon 1986, Hupp 1992, Rosgen 1985, Rankin 1991, MacDonald et al. 1991.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration **(high and low gradient)**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

6a. Channel Alteration—High Gradient

Optimal Range

Poor Range
(arrows emphasizing large-scale channel alterations)

6b. Channel Alteration—Low Gradient

Optimal Range

Poor Range *(John Maxted, DE DNREC)*

7a FREQUENCY OF RIFFLES (OR BENDS)

high gradient streams

Is a way to measure the sequence of riffles and thus the heterogeneity occurring in a stream. Riffles are a source of high-quality habitat and diverse fauna, therefore, an increased frequency of occurrence greatly enhances the diversity of the stream community. For high gradient streams where distinct riffles are uncommon, a run/bend ratio can be used as a measure of meandering or sinuosity (see 7b). A high degree of sinuosity provides for diverse habitat and fauna, and the stream is better able to handle surges when the stream fluctuates as a result of storms. The absorption of this energy by bends protects the stream from excessive erosion and flooding and provides refugia for benthic invertebrates and fish during storm events. To gain an appreciation of this parameter in some streams, a longer segment or reach than that designated for sampling should be incorporated into the evaluation. In some situations, this parameter may be rated from viewing accurate topographical maps. The "sequencing" pattern of the stream morphology is important in rating this parameter. In headwaters, riffles are usually continuous and the presence of cascades or boulders provides a form of sinuosity and enhances the structure of the stream. A stable channel is one that does not exhibit progressive changes in slope, shape, or dimensions, although short-term variations may occur during floods (Gordon et al. 1992).

Selected References

Hupp and Simon 1991, Brussock and Brown 1991, Platts et al. 1983, Rankin 1991, Rosgen 1985, 1994, 1996, Osborne and Hendricks 1983, Hughes and Omernik 1983, Cushman 1985, Bain and Boltz 1989, Gislason 1985, Hawkins et al. 1982, Statzner et al. 1988.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
7a. Frequency of Riffles (or bends) **(high gradient)**	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

7a. Frequency of Riffles (or bends)—High Gradient

Optimal Range
(arrows showing frequency of riffles and bends)

Poor Range

7b

CHANNEL SINUOSITY

low gradient streams

Evaluates the meandering or sinuosity of the stream. A high degree of sinuosity provides for diverse habitat and fauna, and the stream is better able to handle surges when the stream fluctuates as a result of storms. The absorption of this energy by bends protects the stream from excessive erosion and flooding and provides refugia for benthic invertebrates and fish during storm events. To gain an appreciation of this parameter in low gradient streams, a longer segment or reach than that designated for sampling may be incorporated into the evaluation. In some situations, this parameter may be rated from viewing accurate topographical maps. The "sequencing" pattern of the stream morphology is important in rating this parameter. In "oxbow" streams of coastal areas and deltas, meanders are highly exaggerated and transient. Natural conditions in these streams are shifting channels and bends, and alteration is usually in the form of flow regulation and diversion. A stable channel is one that does not exhibit progressive changes in slope, shape, or dimensions, although short-term variations may occur during floods (Gordon et al. 1992).

Selected References

Hupp and Simon 1991, Brussock and Brown 1991, Platts et al. 1983, Rankin 1991, Rosgen 1985, 1994, 1996, Osborne and Hendricks 1983, Hughes and Omernik 1983, Cushman 1985, Bain and Boltz 1989, Gislason 1985, Hawkins et al. 1982, Statzner et al. 1988.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
7b. Channel Sinuosity **(low gradient)**	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

7b. Channel Sinuosity—Low Gradient

Optimal Range

Poor Range

8 BANK STABILITY (condition of banks)

high and low gradient streams

Measures whether the stream banks are eroded (or have the potential for erosion). Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks, and are therefore considered to be unstable. Signs of erosion include crumbling, unvegetated banks, exposed tree roots, and exposed soil. Eroded banks indicate a problem of sediment movement and deposition, and suggest a scarcity of cover and organic input to streams. Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.

Selected References

Ball 1982, MacDonald et al. 1991, Armour et al. 1991, Barbour and Stribling 1991, Hupp and Simon 1986, 1991, Simon 1989a, Hupp 1992, Hicks et al. 1991, Osborne et al. 1991, Rosgen 1994, 1996.

Habitat Parameter	Condition Category											
	Optimal			Suboptimal			Marginal			Poor		
8. Bank Stability (score each bank) **Note: determine left or right side by facing downstream** **(high and low gradient)**	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.			Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.			Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.			Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE ___ (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0
SCORE ___ (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	0

8a. Bank Stability (condition of banks)—High Gradient

Optimal Range
(arrow pointing to stable streambanks)

Poor Range *(MD Save Our Streams)*
(arrow highlighting unstable streambanks)

8b. Bank Stability (condition of banks)—Low Gradient

Optimal Range *(Peggy Morgan, FL DEP)*

Poor Range
(arrow highlighting unstable streambanks)

9 BANK VEGETATIVE PROTECTION

high and low gradient streams

Measures the amount of vegetative protection afforded to the stream bank and the near-stream portion of the riparian zone. The root systems of plants growing on stream banks help hold soil in place, thereby reducing the amount of erosion that is likely to occur. This parameter supplies information on the ability of the bank to resist erosion as well as some additional information on the uptake of nutrients by the plants, the control of instream scouring, and stream shading. Banks that have full, natural plant growth are better for fish and macroinvertebrates than are banks without vegetative protection or those shored up with concrete or riprap. This parameter is made more effective by defining the native vegetation for the region and stream type (i.e., shrubs, trees, etc.). In some regions, the introduction of exotics has virtually replaced all native vegetation. The value of exotic vegetation to the quality of the habitat structure and contribution to the stream ecosystem must be considered in this parameter. In areas of high grazing pressure from livestock or where residential and urban development activities disrupt the riparian zone, the growth of a natural plant community is impeded and can extend to the bank vegetative protection zone. Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.

Selected References

Platts et al. 1983, Hupp and Simon 1986, 1991, Simon and Hupp 1987, Ball 1982, Osborne et al. 1991, Rankin 1991, Barbour and Stribling 1991, MacDonald et al. 1991, Armour et al. 1991, Myers and Swanson 1991, Bauer and Burton 1993.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
9. Vegetative Protection (score each bank) **Note: determine left or right side by facing downstream.** **(high and low gradient)**	More than 90% of the streambank surfaces and immediate riparian zones covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

9a. Bank Vegetative Protection—High Gradient

Optimal Range
(arrow pointing to streambank with high level of vegetative cover)

Poor Range
(arrow pointing to streambank with almost no vegetative cover)

9b. Bank Vegetative Protection—Low Gradient

Optimal Range *(Peggy Morgan, FL DEP)*

Poor Range *(MD Save Our Streams)*
(arrow pointing to channelized streambank with no vegetative cover)

10 RIPARIAN VEGETATIVE ZONE WIDTH

high and low gradient streams

Measures the width of natural vegetation from the edge of the stream bank out through the riparian zone. The vegetative zone serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream. A relatively undisturbed riparian zone supports a robust stream system; narrow riparian zones occur when roads, parking lots, fields, lawns, bare soil, rocks, or buildings are near the stream bank. Residential developments, urban centers, golf courses, and rangeland are the common causes of anthropogenic degradation of the riparian zone. Conversely, the presence of "old field" (i.e., a previously developed field not currently in use), paths, and walkways in an otherwise undisturbed riparian zone may be judged to be inconsequential to altering the riparian zone and may be given relatively high scores. For variable size streams, the specified width of a desirable riparian zone may also be variable and may be best determined by some multiple of stream width (e.g., 4 x wetted stream width). Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.

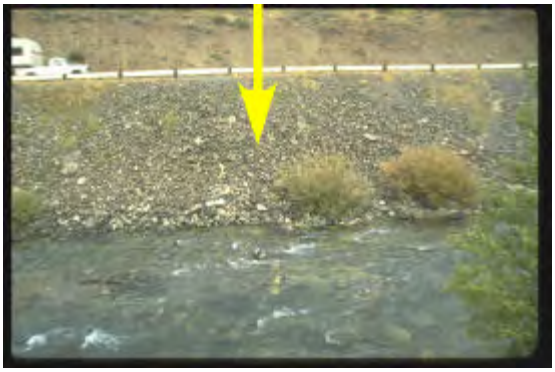
Selected References

Barton et al. 1985, Naiman et al. 1993, Hupp 1992, Gregory et al. 1991, Platts et al. 1983, Rankin 1991, Barbour and Stribling 1991, Bauer and Burton 1993.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
10. Riparian Vegetative Zone Width (score each bank riparian zone) **(high and low gradient)**	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

10a. Riparian Vegetative Zone Width—High Gradient

Optimal Range
(arrow pointing out an undisturbed riparian zone)



Poor Range
(arrow pointing out lack of riparian zone)

10b. Riparian Vegetative Zone Width—Low Gradient

Optimal Range
(arrow emphasizing an undisturbed riparian zone)

Poor Range *(MD Save Our Streams)*
(arrow emphasizing lack of riparian zone)

5.3 ADDITIONS OF QUANTITATIVE MEASURES TO THE HABITAT ASSESSMENT

Kaufmann (1993) identified 7 general physical habitat attributes important in influencing stream ecology. These include:

- channel dimensions
- channel gradient
- channel substrate size and type
- habitat complexity and cover
- riparian vegetation cover and structure
- anthropogenic alterations
- channel-riparian interaction.

All of these attributes vary naturally, as do biological characteristics; thus expectations differ even in the absence of anthropogenic disturbances. Within a given physiographic-climatic region, stream drainage area and overall stream gradient are likely to be strong natural determinants of many aspects of stream habitat, because of their influence on discharge, flood stage, and stream power (the product of discharge times gradient). In addition, all of these attributes may be directly or indirectly altered by anthropogenic activities.

In Section 5.2, an approach is described whereby habitat quality is interpreted directly in the field by biologists while sampling the stream reach. This Level 1 approach is observational and requires only one person (although a team approach is recommended) and takes about 15 to 20 minutes per stream reach. This approach more quickly yields a habitat quality assessment. However, it depends upon the knowledge and experience of the field biologist to make the proper interpretation of observed of both the natural expectations (potentials) and the biological consequences (quality) that can be attributed to the observed physical attributes. Hannaford et al. (1997) found that training in habitat assessment was necessary to reduce the subjectivity in a visual-based approach. The authors also stated that training on different types of streams may be necessary to adequately prepare investigators.

The second conceptual approach described here confines observations to habitat characteristics themselves (whether they are quantitative or qualitative), then later ascribing quality scoring to these measurements as part of the data analysis process. Typically, this second type of habitat assessment approach employs more quantitative data collection, as exemplified by field methods described by Kaufmann and Robison (1997) for EMAP, Simonson et al. (1994), Meador et al. (1993) for NAWQA, and others cited by Gurtz and Muir (1994). These field approaches typically define a reach length proportional to stream width and employ transect measurements that are systematically spaced (Simonson et al. 1994, Kaufmann and Robison 1997) or spaced by judgement to be representative (Meador et al. 1993). They usually include measurement of substrate, channel and bank dimensions, riparian canopy cover, discharge, gradient, sinuosity, in-channel cover features, and counts of large woody debris and riparian human disturbances. They may employ systematic visual estimates of substrate embeddedness, fish cover features, habitat

types, and riparian vegetation structure. The time commitment in the field to these more quantitative habitat assessment methods is usually 1.5 to 3 hours with a crew of two people. Because of the greater amount of data collected, they also require more time for data summarization, analysis, and interpretation. On the other hand, the more quantitative methods and less ambiguous field parameters result in considerably greater precision. The USEPA applied both quantitative and visual-based (RBPs) methods in a stream survey undertaken over 4 years in the mid-Atlantic region of the Appalachian Mountains. An earlier version of the RBP techniques were applied on 301 streams with repeat visits to 29 streams; signal-to-noise ratios varied from 0.1 to 3.0 for the twelve RBP metrics and averaged (1.1 for the RBP total habitat quality score). The quantitative methods produced a higher level of precision; signal-to-noise ratios were typically between 10 and 50, and sometimes in excess of 100 for quantitative measurements of channel morphology, substrate, and canopy densiometer measurements made on a random subset of 186 streams with 27 repeat visits in the same survey. Similarly, semi-quantitative estimates of fish cover and riparian human disturbance estimates obtained from multiple, systematic visual observations of otherwise measurable features had signal:noise ratios from 5 to 50. Many riparian vegetation cover and structure metrics were moderately precise (signal:noise ranging from 2 to 30). Commonly used flow dependent measures (e.g., riffle/pool and width/depth ratios), and some visual riparian cover estimates were less precise, with signal:noise ratios more in the range of those observed for metrics of the EPA's RBP habitat score (<2).

The USEPA's EMAP habitat assessment field methods are presented as an option for a second level (II) of habitat assessment. These methods have been applied in numerous streams throughout the Mid-Atlantic region, the Midwest, Colorado, California, and the Pacific Northwest. Table 5-1 is a summary of these field methods; more detail is presented in the field manual by Kaufmann and Robison (1997).

Table 5-1. Components of EMAP physical habitat protocol.

Component	Description
1. Thalweg Profile	Measure maximum depth, classify habitat, determine presence of soft/small sediment at 10-15 equally spaced intervals between each of 11 channel cross-sections (100-150 along entire reach). Measure wetted width at 11 channel cross-sections and mid-way between cross-sections (21 measurements).
2. Woody Debris	Between each of the channel cross sections, tally large woody debris numbers within and above the bankfull channel according to size classes.
3. Channel and Riparian Cross-Sections	At 11 cross-section stations placed at equal intervals along reach length: • **Measure**: channel cross section dimensions, bank height, undercut, angle (with rod and clinometer); gradient (clinometer), sinuosity (compass backsite), riparian canopy cover (densiometer). • **Visually Estimate***: substrate size class and embeddedness; areal cover class and type (e.g., woody) of riparian vegetation in Canopy, Mid-Layer and Ground Cover; areal cover class of fish concealment features, aquatic macrophytes and filamentous algae. • **Observe & Record***: human disturbances and their proximity to the channel.
4. Discharge	In medium and large streams (defines later) measure water depth and velocity @ 0.6 depth (with electromagnetic or impeller-type flow meter) at 15 to 20 equally spaced intervals across one carefully chosen channel cross-section. In very small streams, measure discharge with a portable weir or time the filling of a bucket.

* Substrate size class and embeddedness are estimated, and depth is measured for 55 particles taken at 5 equally-spaced points on each of 11 cross-sections. The cross-section is defined by laying the surveyor's rod or tape to span the wetted channel. Woody

debris is tallied over the distance between each cross-section and the next cross-section upstream. Riparian vegetation and human disturbances are observed 5 m upstream and 5 m downstream from the cross section station. They extend shoreward 10 m from left and right banks. Fish cover types, aquatic macrophytes, and algae are observed within channel 5 m upstream and 5 m downstream from the cross section stations. These boundaries for visual observations are estimated by eye.

Table 5-2 lists the physical habitat metrics that can be derived from applying these field methods. Once these habitat metrics are calculated from the available physical habitat data, an assessment would be obtained from comparing these metric values to those of known reference sites. A strong deviation from the reference expectations would indicate a habitat alteration of the particular parameter. The close connectivity of the various attributes would most likely result in an impact on multiple metrics if habitat alteration was occurring. The actual process for interpreting a habitat assessment using this approach is still under development.

Table 5-2. Example of habitat metrics that can be calculated from the EMAP physical habitat data.

Channel mean width and depth
Channel volume and Residual Pool volume
Mean channel slope and sinuosity
Channel incision, bankfull dimensions, and bank characteristics
Substrate mean diameter, % fines, % embeddedness
Substrate stability
Fish concealment features (areal cover of various types, e.g., undercut banks, brush)
Large woody debris (volume and number of pieces per 100 m)
Channel habitat types (e.g., % of reach composed of pools, riffles, etc.)
Canopy cover
Riparian vegetation structure and complexity
Riparian disturbance measure (proximity-weighted tally of human disturbances)

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8 FISH PROTOCOLS

Monitoring of the fish assemblage is an integral component of many water quality management programs, and its importance is reflected in the aquatic life use-support designations of many states. Narrative expressions such as “maintaining coldwater fisheries”, “fishable” or “fish propagation” are prevalent in state standards. Assessments of the fish assemblage must measure the overall structure and function of the ichthyofaunal community to adequately evaluate biological integrity and protect surface water resource quality. Fish bioassessment data quality and comparability are assured through the utilization of qualified fisheries professionals and consistent methods.

The Rapid Bioassessment Protocol (RBP) for fish presented in this document, is directly comparable to RBP V in Plafkin et al. (1989). The principal evaluation mechanism utilizes the technical framework of the Index of Biotic Integrity (IBI) — a fish assemblage assessment approach developed by Karr (1981). The IBI incorporates the zoogeographic, ecosystem, community and population aspects of the fish assemblage into a single ecologically-based index. Calculation and interpretation of the IBI involves a sequence of activities including: fish sample collection; data tabulation; and regional modification and calibration of metrics and expectation values. This concept has provided the overall multimetric index framework for rapid bioassessment in this document. A more detailed description of this approach for fish is presented in Karr et al. (1986) and Ohio EPA (1987). Regional modification and applications are described in Leonard and Orth (1986), Moyle et al. (1986), Hughes and Gammon (1987), Wade and Stalcup (1987), Miller et al. (1988), Steedman (1988), Simon (1991), Lyons (1992a), Simon and Lyons (1995), Lyons et al. (1996), and Simon (1999).

The RBP for fish involves careful, standardized field collection, species identification and enumeration, and analyses using aggregated biological attributes or quantification of the numbers (and in some cases biomass, see Section 8.3.3, Metric 13) of key species. The role of experienced fisheries scientists in the adaptation and application of the RBP and the taxonomic identification of fishes cannot be overemphasized. The fish RBP survey yields an objective discrete measure of the condition of the fish assemblage. Although the fish survey can usually be completed in the field by qualified fish biologists, difficult species identifications will require laboratory confirmation. Data provided by the fish RBP can serve to assess use attainment, develop biological criteria, prioritize sites for further evaluation, provide a reproducible impact assessment, and evaluate status and trends of the fish assemblage.

Fish collection procedures must focus on a multihabitat approach — sampling habitats in relative proportion to their local representation (as determined during site reconnaissance). Each sample reach should contain riffle, run and pool habitat, when available. Whenever possible, the reach should be sampled sufficiently upstream of any bridge or road crossing to minimize the hydrological effects on overall habitat quality. Wadeability and accessability may ultimately govern the exact placement of the sample reach. A habitat assessment is performed and physical/chemical parameters measured concurrently with fish sampling to document and characterize available habitat specifics within the sample reach (see Chapter 5: Habitat Assessment and Physicochemical Characterization).

8.1 FISH COLLECTION PROCEDURES: ELECTROFISHING

All fish sampling gear types are generally considered selective to some degree; however, electrofishing has proven to be the most comprehensive and effective *single* method for collecting stream fishes. Pulsed DC (direct current) electrofishing is the method of choice to obtain a representative sample of the fish assemblage at each sampling station. However, electrofishing in any form has been banned from certain salmonid spawning streams in the northwest. As with any fish sampling method, the proper scientific collection permit(s) must be obtained before commencement of any electrofishing activities. The accurate identification of each fish collected is essential, and species-level identification is required (including hybrids in some cases, see Section 8.3.3, Metric 11). Field identifications are acceptable; however, voucher specimens must be retained for laboratory verification, particularly if there is any doubt about the correct identity of the specimen (see Section 8.2). Because the collection methods used are not consistently effective for young-of-the-year fish and because their inclusion may seasonally skew bioassessment results, fish less than 20 millimeters total length will not be identified or included in standard samples.

ELECTROFISHING CONFIGURATION AND FIELD TEAM ORGANIZATION

All field team members must be trained in electrofishing safety precautions and unit operation procedures identified by the electrofishing unit manufacturer. Each team member must be insulated from the water and the electrodes; therefore, chest waders and rubber gloves are required. Electrode and dip net handles must be constructed of insulating materials (e.g., woods, fiberglass). Electrofishers/electrodes must be equipped with functional safety switches (as installed by virtually all electrofisher manufacturers). Field team members must not reach into the water unless the electrodes have been removed from the water or the electrofisher has been disengaged.

It is recommended that at least 2 fish collection team members be certified in CPR (cardiopulmonary resuscitation). *Many* options exist for electrofisher configuration and field team organization; however, procedures will always involve pulsed DC electrofishing and a minimum 2-person team for sampling streams and wadeable rivers. Examples include:

- Backpack electrofisher with 2 hand-held electrodes mounted on fiberglass poles, one positive (anode) and one negative (cathode). One crew member, identified as the electrofisher unit operator, carries the backpack unit and manipulates both the anode and cathode poles. The anode may be fitted with a net ring (and shallow net) to allow the unit operator to net specimens. The remaining 1 or 2 team members net fish with dip nets and are responsible for specimen transport and care in buckets or livewells.

- Backpack electrofisher with 1 hand-held anode pole and a trailing or floating cathode. The electrofisher unit operator manipulates the anode with one hand, and has a second hand free for use of a dip net. The remaining 1 or 2 team members also aid in the netting of specimens, and in addition are responsible for specimen transport in buckets or livewells.

- Tote barge (pramunit) electrofisher with 2 hand-held anode poles and a trailing/floating cathode (recommended for large streams and wadeable rivers). Two team members are each equipped with an anode pole and a dip net. Each is responsible for electrofishing and the netting of specimens. The remaining team member will follow, pushing or pulling the barge through the sample reach. A livewell is maintained within the barge and/or within the sampling reach but outside the area of electric current.

The safety of all personnel and the quality of the data is assured through the adequate education, training, and experience of all members of the fish collection team. At least 1 biologist with training and experience in electrofishing techniques and fish taxonomy *must* be involved in each sampling event. Laboratory analyses are conducted and/or supervised by a fisheries professional trained in fish taxonomy. Quality assurance and quality control must be a continuous process in fisheries monitoring and assessment, and must include all program aspects (i.e., field sampling, habitat measurement, laboratory processing, and data recording).

Tote barge (pram unit) Electrofishing

Backpack Electrofishing

FIELD EQUIPMENT/SUPPLIES NEEDED FOR FISH SAMPLING—ELECTROFISHING

- appropriate scientific collection permit(s)
- backpack or tote barge-mounted electrofisher
- dip nets
- block nets (i.e., seines)
- elbow-length insulated waterproof gloves
- chest waders (equipped with wading cleats, when necessary)
- polarized sunglasses
- buckets/livewells
- jars for voucher/reference specimens
- waterproof jar labels
- 10% buffered formalin (formaldehyde solution)
- measuring board (500 mm minimum, with 1 mm increments)[a]
- balance (gram scale)[b]
- tape measure (100 m minimum)
- fish Sampling Field Data Sheet[c]
- applicable topographic maps
- copies of field protocols
- pencils, clipboard
- first aid kit
- Global Positioning System (GPS) Unit

[a] Needed only if program/study requires length frequency information

[b] Needed only if total biomass and/or the Index of Well-Being are included in the assessment process (see Section 8.3.3, Metric 13).

[c] It is helpful to copy fieldsheets onto water-resistant paper for use in wet weather conditions.

8.1.1 Field Sampling Procedures

1. A representative stream reach (see Alternatives for Stream Reach Designation, next page) is selected and measured such that primary physical habitat characteristics of the stream are included within the reach (e.g., riffle, run and pool habitats, when available). The sample reach should be located away from the influences of major tributaries and

bridge/road crossings (e.g., sufficiently upstream to decrease influences on overall habitat quality). The exact location (i.e., latitude and longitude) of the downstream limit of the reach must be recorded on each field data sheet. (If a Global Positioning System unit is used to provide location information, the accuracy or design confidence of the unit should be noted.) A habitat assessment and physical/chemical characterization of water quality should be performed within the same sampling reach (see Chapter 5: Habitat Assessment and Physicochemical Characterization).

2. Collection via electrofishing begins at a shallow riffle, or other physical barrier at the downstream limit of the sample reach, and terminates at a similar barrier at the upstream end of the reach. In the absence of physical barriers, block nets should be set at the upstream and downstream ends of the reach prior to the initiation of any sampling activities.

ALTERNATIVES FOR STREAM REACH DESIGNATION

The collection of a representative sample of the fish assemblage is essential, and the appropriate sampling station length for obtaining that sample is best determined by conducting pilot studies (Lyons 1992b, Simonson et al. 1994, Simonson and Lyons 1995). Alternatives for the designation of stream sampling reaches include:

- **Fixed-distance designation**—A standard length of stream, e.g., a 150-200-meter reach (Ohio EPA 1987), 100-meter reach (Massachusetts DEP 1995) may be used to obtain a representative sample. Conceptually, this approach should provide a mixture of habitats in the reach and provide, at a minimum, duplicate physical and structural elements such as riffle/pool sequences.

- **Proportional-distance designation**— A standard number of stream channel "widths" may be used to measure the stream study reach, e.g., 40 times the stream width is defined by Environmental Monitoring & Assessment Program (EMAP) for sampling (Klemm and Lazorchak 1995). This approach allows variation in the length of the reach based on the size of the stream. Application of the proportional-distance approach in large streams or wadeable rivers may require the establishment of sampling program time and/or distance maxima (e.g., no more than 3 hours of electrofishing or 500-meter reach per sampling site, [Klemm et al. 1993]).

3. Fish collection procedures commence at the downstream barrier. A minimum 2-person fisheries crew proceeds to electrofish in an upstream direction using a side-to-side or bank-to-bank sweeping technique to maximize area coverage. All wadeable habitats within the reach are sampled via a single pass, which terminates at the upstream barrier. Fish are held in livewells (or buckets) for subsequent identification and enumeration.

4. Sampling efficiency is dependent, at least in part, on water clarity and the field team's ability to see and net the stunned fish. Therefore, each team member should wear polarized sunglasses, and sampling is conducted only during periods of optimal water clarity and flow.

5. All fish (greater than 20 millimeters total length) collected within the sample reach must be identified to species (or subspecies). Specimens that cannot be identified with certainty in the field are preserved in a 10% formalin solution and stored in labeled jars for subsequent laboratory identification (see Section 8.2). A representative voucher collection must be retained for unidentified specimens, very small specimens, new locality records, and/or a particular region. In addition to the unidentified specimen jar, a voucher collection of a

subsample of each species identified in the field should be preserved and labeled for subsequent laboratory verification, if necessary. Obviously, species of special concern (e.g., threatened, endangered) should be noted and released *immediately* on site. Labels should contain (at a minimum) location data (verbal description and coordinates), date, collectors' names, and sample identification code and/or station numbers for the particular sampling site. Young-of-the-year fish less than 20 millimeters (total length) are not identified or included in the sample, and are released on site. Specimens that can be identified in the field are counted, examined for external anomalies (i.e., deformities, eroded fins, lesions, and tumors), and recorded on field data sheets. An example of a "Fish Sampling Field Data Sheet" is provided in Appendix A-4, Form 1. Space is available for optional fish length and weight measurements, should a particular program/study require length frequency or biomass data. However, these data *are not required* for the standard multimetric assessment. Space is allotted on the field data sheets for the *optional* inclusion of measurements (nearest millimeter total length) and weights (nearest gram) for a subsample (to a maximum 25 specimens) of each species. Although fish length and weight measurements are optional, recording a range of lengths for species encountered may be a useful routine measure. Following the data recording phase of the procedure, specimens that have been identified and processed in the field are released on site to minimize mortality.

6. The data collection phase includes the completion of the top portion of the "Fish Sampling Field Data Sheet" (Appendix A-4, Form 1),

QUALITY CONTROL (QC) IN THE FIELD

1. Quality control must be a continuous process in fish bioassessment and should include all program aspects, from field collection and preservation to habitat assessment, sample processing, and data recording. Field validation should be conduced at selected sites and will involve the collection of a duplicate sample taken from an adjacent reach upstream of the initial sampling site. The adjacent reach should be similar to the initial site with respect to habitat and stressors. Sampling QC data should be evaluated following the first year of sampling in order to determine a level of acceptable variability and the appropriate duplication frequency.

2. Field identifications of fish *must* be conducted by qualified/trained fish taxonomists, familiar with local and regional ichthyofauna. Questionable records are prevented by: (a) requiring the presence of at least one experienced/trained fish taxonomist on every field effort, and (b) preserving selected specimens (e.g., Klemm and Lazorchak 1995 recommend a subsample of a maximum 25 voucher specimens of each species) and those that cannot by readily identified in the field for laboratory verification and/or examination by a second qualified fish taxonomist (see Section 8.2). Specimens must be properly preserved and labeled (refer to Section 8.1.1, number 5). When needed, chain-of-custody forms must be initiated following sample preservation, and must include the same information as the sample container labels.

3. All field equipment must be in good operating condition, and a plan for routine inspection, maintenance, and/or calibration must be developed to ensure consistency and quality of field data. Field data must be complete and legible, and should be entered on standardized field data forms and/or digital recorders. While in the field, the field team should possess sufficient copies of standardized field data forms and chains-of-custody for all anticipated sampling sites, as well as copies of all applicable Standard Operating Procedures (SOPs).

which duplicates selected information from the physical/chemical field sheet. Information regarding the sample collection procedures must also be recorded. This includes method of fish capture, start time, ending time, duration of sampling, maximum and mean stream widths. The percentage of each habitat type in the reach is estimated and documented on the data sheet. Comments should include sampling conditions, e.g., visibility, flow, difficult access to stream, or anything that may prove to be valuable information to consider for future sampling events or by personnel unfamiliar with the site.

8.2 LABORATORY IDENTIFICATION AND VERIFICATION

Fish records of questionable quality are prevented by preserving specimens (that cannot be readily identified in the field) for laboratory examination and/or a voucher collection for laboratory verification. Specimens must be properly preserved (e.g., 10% formalin for tissue fixing and 70% ethanol for long-term storage) and labeled (using museum-grade archival labels/paper, and formalin/alcohol-proof pen or pencil). Labels should contain (at a minimum) site location data (i.e., verbal description and site coordinates), collection date, collector's names, species identification (for fishes identified in the field), species totals, and sample identification code and/or station number. All samples received in the laboratory should be tracked using a sample log-in procedure (Appendix A-4, Form 2). Laboratory fisheries professionals *must* be capable of identifying fish to the lowest possible taxonomic level (i.e., species or subspecies) and should have access to suitable regional taxonomic references (see Section 8.4) to aid in the identification process. Laboratories that do not typically identify fish, or trained fisheries professionals that have difficulty identifying a particular specimen or group of fish, should contact a taxonomic specialist (i.e., a recognized authority for that particular taxonomic group). Taxonomic nomenclature *must* be kept consistent and current. Common and scientific names of fishes from the United States and Canada are listed in Robins et al. (1991).

QUALITY CONTROL (QC) FOR TAXONOMY

1. A representative voucher collection must be retained for unidentified specimens, small specimens, and new locality records. In addition, a second voucher jar should be retained for a subsample of each species identified in the field (e.g., Klemm and Lazorchak 1995 recommend a subsample of 25 voucher specimens of each species). The vouchers must be properly preserved, labeled, and stored in the laboratory for future reference (see Section 8.2).

2. Voucher collections should be verified by a second qualified fish taxonomist, i.e., a professional other than the taxonomist responsible for the original field identifications. The word "validated" and the name of the taxonomist that validated the identification should be added to each voucher label. Specimens sent from the laboratory to taxonomic specialists should be recorded in a "Taxonomy Validation Notebook" (see Chapter 7), noting the label information and date sent. Upon return of the specimens, the date received and findings should also be recorded in the notebook (and the voucher label), along with the name of the person who performed the validation.

3. Information on samples completed (through the identification/validation process) will be tracked in a "Sample Log" notebook, to track the progress of each sample (Appendix A-4, Form 2). Sample log entries will be updated as each step is completed (e.g., receipt, identification, validation, archive).

4. A library of taxonomic literature is essential for the aid and support of identification/verification activities, and must be maintained (and updated as needed) in the laboratory. A list of selected taxonomic references is provided in Section 8.4.

8.3 DESCRIPTION OF FISH METRICS

Through the IBI, Karr et al. (1986) provided a consistent theoretical framework for analyzing fish assemblage data. The IBI is an aggregation of 12 biological metrics that are based on the fish assemblage's taxonomic and trophic composition and the abundance and condition of fish. Such multiple-parameter indices are necessary for making objective evaluations of complex systems. The IBI was designed to evaluate the quality of small Midwestern warmwater streams but has been modified for use in many regions (e.g., eastern and western United States, Canada, France) and in different ecosystems (e.g., rivers, impoundments, lakes, and estuaries).

The metrics attempt to quantify a biologist's best professional judgment (BPJ) of the quality of the fish assemblage. The IBI utilizes professional judgment, but in a prescribed manner, and it includes quantitative standards for discriminating the condition of the fish assemblage (Figure 8-1). BPJ is involved in choosing both the most appropriate population or assemblage element that is representative of each metric and in setting the scoring criteria. This process can be easily and clearly modified, as opposed to judgments that occur after results are calculated. Each metric is scored against criteria based on expectations developed from appropriate regional reference sites. Metric values

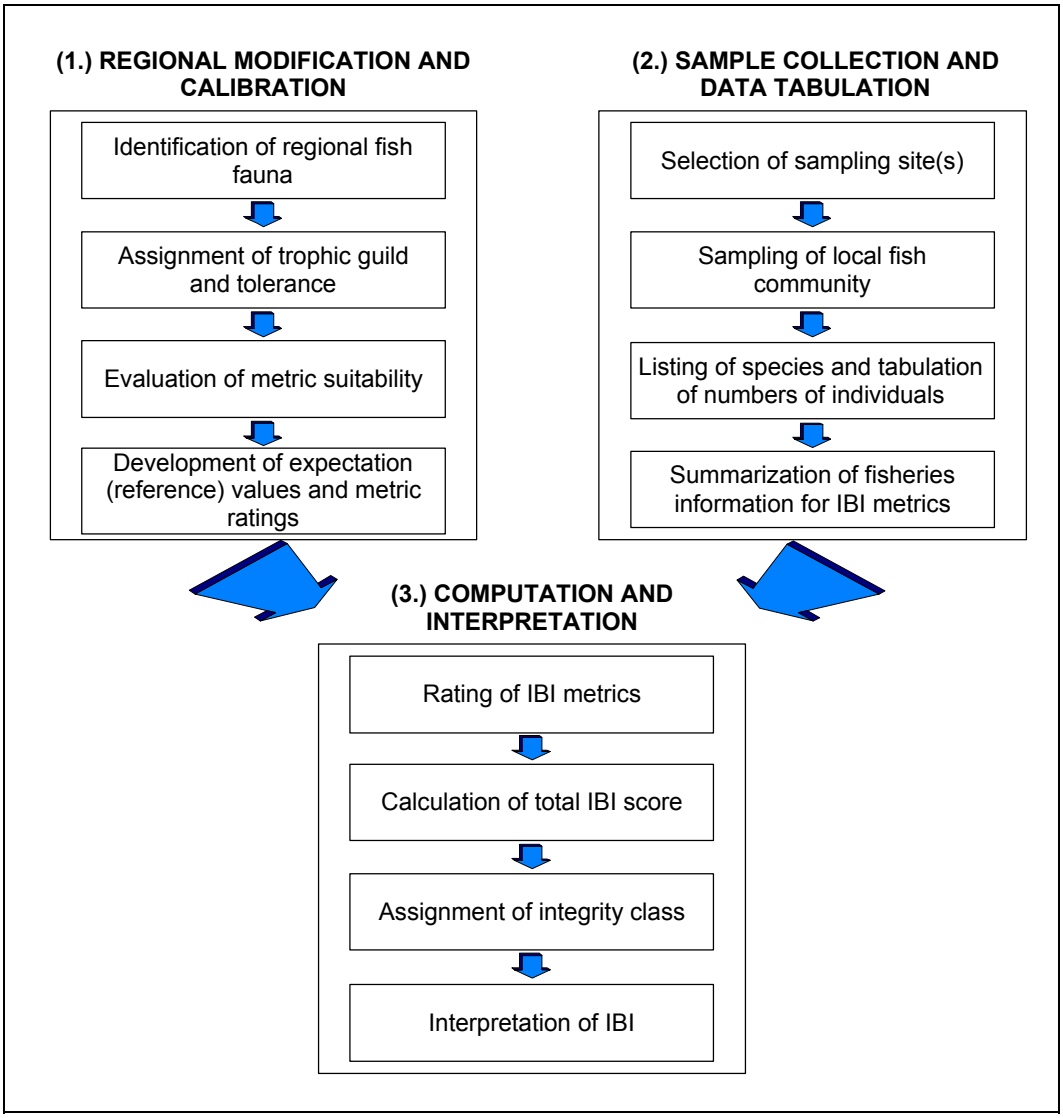

Figure 8-1. Sequence of activities involved in calculating and interpreting the Index of Biotic Integrity (adapted from Karr et al. 1986).

approximating, deviating slightly from, or deviating greatly from values occurring at the reference sites are scored as 5, 3, or 1, respectively. The scores of the 12 metrics are added for each station to give an IBI ranging from a maximum of 60 (excellent) to a minimum of 12 (very poor). Trophic and tolerance classifications of selected fish species are listed in Appendix C. Additional classifications can be derived from information in State and regional fish texts, by objectively assessing a large statewide database, or by contacting authors/originators of regional IBI programs or pilot studies. Use of the IBI by water resource agencies may result in further modifications. Many modifications have occurred (Miller et al. 1988) without changing the IBI's basic theoretical foundations.

The IBI serves as an integrated analysis because individual metrics may differ in their relative sensitivity to various levels of biological condition. A description and brief rationale for each of the 12 IBI metrics is outlined below. The original metrics described by Karr (1981) for Illinois streams are followed by substitutes used in or proposed for different geographic regions and stream sizes. Because of zoogeographic differences, different families or species are evaluated in different regions, with regional substitutes occupying the same general habitat or niche. The source for each substitute is footnoted below. Table 8-1 presents an overview of the IBI metric alternatives and their sources for various areas of the United States and Canada.

EXAMPLES OF SOURCES FOR METRIC ALTERNATIVES

Karr et al. (1986)
Leonard and Orth (1986)
Moyle et al. (1986)
Fausch and Schrader (1987)
Hughes and Gammon (1987)
Ohio EPA (1987)
Miller et al. (1988)
Steedman (1988)
Simon (1991)
Lyons (1992a)
Barbour et al. (1995)
Simon and Lyons (1995)
Hall et al. (1996)
Lyons et al. (1996)
Roth et al. (1997)
Simon (1999)

8.3.1 Species Richness and Composition Metrics

These metrics assess the species richness component of diversity and the health of resident taxonomic groupings and habitat guilds of fishes. Two of the metrics assess assemblage composition in terms of tolerant or intolerant species.

Metric 1. Total number of fish species Substitutes (Table 8-1): Total number of resident native fish species and salmonid age classes.

This number decreases with increased degradation; hybrids and introduced species are not included. In coldwater streams supporting few fish species, the age classes of the species found represent the suitability of the system for spawning and rearing. The number of species is strongly affected by stream size at most small warmwater stream sites, but not at large river sites (Karr et al. 1986, Ohio EPA 1987).

Metric 2. Number and identity of darter species Substitutes (Table 8-1): Number and identity of sculpin species, benthic insectivore species, salmonid juveniles (individuals); number of sculpins (individuals); percent round-bodied suckers, sculpin and darter species.

These species are sensitive to degradation resulting from siltation and benthic oxygen depletion because they feed and reproduce in benthic habitats (Kuehne and Barbour 1983, Ohio EPA 1987). Many smaller species live within the rubble interstices, are weak swimmers, and spend their entire lives in an area of 100-400 m^2 (Matthews 1986, Hill and Grossman 1987). Darters are appropriate in most

Mississippi Basin streams; sculpins and yearling trout occupy the same niche in western streams. Benthic insectivores and sculpins or darters are used in small Atlantic slope streams that have few sculpins or darters, and round-bodied suckers are suitable in large midwestern rivers.

Metric 3. Number and identity of sunfish species. Substitutes (Table 8-1): Number and identity of cyprinid species, water column species, salmonid species, headwater species, and sunfish and trout species.

Table 8-1. Fish IBI metrics used in various regions of North America.[a]

Alternative IBI Metrics	Midwestern United States	Central Appalachians	Sacramento-San Joaquin	Colorado Front Range	Western Oregon Ohio	Ohio Headwater Sites	Northeastern United States	Ontario	Central Corn Belt Plain	Wisconsin-Warmwater	Wisconsin-Coldwater	Maryland Coastal Plain	Maryland Non-Tidal
1. Total Number of Species	X	X	X	X				X		X		X	X
#native fish species					X	X	X		X		X		
# salmonid age classes[b]				X	X								
2. Number of Darter Species	X	X		X		X				X	X		
# sculpin species					X								
# benthic insectivore species								X					
# darter and sculpin species							X						
# darter, sculpin, and madtom species										X			
# salmonid juveniles (individuals)[b]			X		X			X					
% round-bodied suckers						X[c]							
# sculpins (individuals)			X										
# benthic species												X	X
3. Number of Sunfish Species	X			X		X				X	X		
# cyprinid species					X								
# water column species								X					
# sunfish and trout species									X				
# salmonid species			X							X			
# headwater species							X						
% headwater species							X			X			
4. Number of Sucker Species	X				X	X		X		X	X		
# adult trout species[b]			X		X								
# minnow species				X			X			X			
# sucker and catfish species									X				
5. Number of Intolerant Species	X			X	X	X		X			X	X	X	X
# sensitive species							X			X			
# amphibian species			X										
presence of brook trout									X				
% stenothermal cool and cold water species											X		
% of salmonid ind. as brook trout											X		
6. % Green Sunfish	X												
% common carp					X								
% white sucker				X				X					
% tolerant species						X	X			X	X	X	X	X
% creek chub		X											
% dace species									X				
% eastern mudminnow												X	

Table 8-1. Fish IBI metrics used in various regions of North America.[a]

Alternative IBI Metrics	Midwestern United States	Central Appalachians	Sacramento-San Joaquin	Colorado Front Range	Western Oregon Ohio	Ohio Headwater Sites	Northeastern United States	Ontario	Central Corn Belt Plain	Wisconsin-Warmwater	Wisconsin-Coldwater	Maryland Coastal Plain	Maryland Non-Tidal
7. % Omnivores	X			X		X	X	X	X	X	X		
% generalist feeders		X											
% generalists, omnivores, and invertivores													X
8. % Insectivorous Cyprinids	X											X	
% insectivores					X			X		X	X	X	X[e]
% specialized insectivores		X		X									
# juvenile trout			X										
% insectivorous species						X	X						
9. % Top Carnivores	X					X		X	X	X	X		
% catchable salmonids					X								
% catchable trout			X										
% pioneering species							X			X		X	
Density catchable wild trout			X										
10. Number of Individuals (or catch per effort)	X	X	X	X	X	X[d]	X[d]		X	X	X[d]	X	
Density of individuals								X					X
% abundance of dominant species												X	X
Biomass (per m^2)													X[f]
11. % Hybrids	X							X					
% introduced species				X	X								
% simple lithophills						X				X	X		X
# simple lithophills species							X						
% native species			X										
% native wild individuals			X										
% silt-intolerant spawners												X	
12. % Diseased Individuals (deformities, eroded fins, lesions, and tumors)	X	X		X	X	X	X	X	X	X	X	X	X

Note: X = metric used in region. Many of these variations are applicable elsewhere.

a Taken from Karr et al. (1986), Leonard and Orth (1986), Moyle et al. (1986), Fausch and Schrader (1987), Hughes and Gammon (1987), Ohio EPA (1987), Miller et al. (1988), Steedman (1988), Simon (1991), Lyons (1992a), Barbour et al. (1995), Simon and Lyons (1995), Hall et al. (1996), Lyons et al. (1996), Roth et al. (1997).

b Metric suggested by Moyle et al. (1986) or Hughes and Gammon (1987) as a provisional replacement metric in small western salmonid streams.

c Boat sampling methods only (i.e., larger streams/rivers).

d Excluding individuals of tolerant species.

e Non-coastal Plain streams only.

f Coastal Plain streams only.

These pool species decrease with increased degradation of pools and instream cover (Gammon et al. 1981, Angermeier 1987, Platts et al. 1983). Most of these fishes feed on drifting and surface invertebrates and are active swimmers. The sunfishes and salmonids are important sport species. The sunfish metric works for most Mississippi Basin streams, but where sunfish are absent or rare, other

groups are used. Cyprinid species are used in coolwater western streams; water column species occupy the same niche in northeastern streams; salmonids are suitable in coldwater streams; headwater species serve for midwestern headwater streams; and trout and sunfish species are used in southern Ontario streams. Karr et al. (1986) and Ohio EPA (1987) found the number of sunfish species to be dependent on stream size in small streams, but Ohio EPA (1987) found no relationship between stream size and sunfish species in medium to large streams, nor between stream size and headwater species in small streams.

Metric 4. Number and identity of sucker species. Substitutes (Table 8-1): Number of adult trout species, number of minnow species, and number of suckers and catfish.

These species are sensitive to physical and chemical habitat degradation and commonly comprise most of the fish biomass in streams. All but the minnows are longlived species and provide a multiyear integration of physicochemical conditions. Suckers are common in medium and large streams; minnows dominate small streams in the Mississippi Basin; and trout occupy the same niche in coldwater streams. The richness of these species is a function of stream size in small and medium sized streams, but not in large (e.g., non-wadeable) rivers.

Metric 5. Number and identity of intolerant species. Substitutes (Table 8-1): Number and identity of sensitive species, amphibian species, and presence of brook trout.

This metric distinguishes high and moderate quality sites using species that are intolerant of various chemical and physical perturbations. Intolerant species are typically the first species to disappear following a disturbance. Species classified as intolerant or sensitive should only represent the 5-10 percent most susceptible species, otherwise this becomes a less discriminating metric. Candidate species are determined by examining regional ichthyological books for species that were once widespread but have become restricted to only the highest quality streams. Ohio EPA (1987) uses number of sensitive species (which includes highly intolerant and moderately intolerant species) for headwater sites because highly intolerant species are generally not expected in such habitats. Moyle (1976) suggested using amphibians in northern California streams because of their sensitivity to silvicultural impacts. This also may be a promising metric in Appalachian streams which may naturally support few fish species. Steedman (1988) found that the presence of brook trout had the greatest correlation with IBI score in Ontario streams. The number of sensitive and intolerant species increases with stream size in small and medium sized streams but is unaffected by size of large (e.g., non-wadeable) rivers.

Metric 6. Proportion of individuals as green sunfish. Substitutes (Table 8-1): Proportion of individuals as common carp, white sucker, tolerant species, creek chub, and dace.

This metric is the reverse of Metric 5. It distinguishes low from moderate quality waters. These species show increased distribution or abundance despite the historical degradation of surface waters, and they shift from incidental to dominant in disturbed sites. Green sunfish are appropriate in small midwestern streams; creek chubs were suggested for central Appalachian streams; common carp were suitable for a coolwater Oregon river; white suckers were selected in the northeast and Colorado where green sunfish are rare to absent; and dace (*Rhinichthys* species) were used in southern Ontario. To avoid weighting the metric on a single species, Karr et al. (1986) and Ohio EPA (1987) suggest using a small number of highly tolerant species (e.g., alternative Metric 6— percent abundance of tolerant species).

8.3.2 Trophic Composition Metrics

These three metrics assess the quality of the energy base and trophic dynamics of the fish assemblage. Traditional process studies, such as community production and respiration, are time consuming to conduct and the results are equivocal; distinctly different situations can yield similar results. The trophic composition metrics offer a means to evaluate the shift toward more generalized foraging that typically occurs with increased degradation of the physicochemical habitat.

Metric 7. Proportion of individuals as omnivores. Substitutes (Table 8-1): Proportion of individuals as generalist feeders.

The percent of omnivores in the community increases as the physical and chemical habitat deteriorates. Omnivores are defined as species that consistently feed on substantial proportions of plant and animal material. Ohio EPA (1987) excludes sensitive filter feeding species such as paddlefish and lamprey ammocoetes and opportunistic feeders like channel catfish. In areas where few species fit the true definition of omnivore, the proportion of generalized feeders may be substituted (Leonard and Orth 1986).

Metric 8. Proportion of individuals as insectivorous cyprinids. Substitutes (Table 8-1): Proportion of individuals as insectivores, specialized insectivores, insectivorous species, and number of juvenile trout.

Invertivores, primarily insectivores, are the dominant trophic guild of most North American surface waters. As the invertebrate food source decreases in abundance and diversity due to habitat degradation (e.g., anthropogenic stressors), there is a shift from insectivorous to omnivorous fish species. Generalized insectivores and opportunistic species, such as blacknose dace and creek chub were excluded from this metric by Ohio EPA (1987). This metric evaluates the midrange of biological condition, i.e., low to moderate condition.

Metric 9. Proportion of individuals as top carnivores. Substitutes (Table 8-1): Proportion of individuals as catchable salmonids, catchable wild trout, and pioneering species.

The top carnivore metric discriminates between systems with high and moderate integrity. Top carnivores are species that feed, as adults, predominantly on fish, other vertebrates, or crayfish. Occasional piscivores, such as creek chub and channel catfish, are not included. In trout streams, where true piscivores are uncommon, the percent of large salmonids is substituted for percent piscivores. These species often represent popular sport fish such as bass, pike, walleye, and trout. Pioneering species are used by Ohio EPA (1987) in headwater streams typically lacking piscivores. Pioneering species predominate in unstable environments that have been affected by temporal desiccation or anthropogenic stressors, and are the first to reinvade sections of headwater streams following periods of desiccation.

8.3.3 Fish Abundance and Condition Metrics

The last 3 metrics indirectly evaluate population recruitment, mortality, condition, and abundance. Typically, these parameters vary continuously and are time consuming to estimate accurately. Instead of such detailed population attributes or estimates, general population parameters are evaluated. Indirect estimation is less variable and much more rapidly determined.

Metric 10. Number of individuals in sample. Substitutes (Table 8-1): Density of individuals.

This metric evaluates population abundance and varies with region and stream size for small streams. It is expressed as catch per unit effort, either by area, distance, or time sampled. Generally sites with lower integrity support fewer individuals, but in some nutrient poor regions, enrichment increases the number of individuals. Steedman (1988) addressed this situation by scoring catch per minute of sampling greater than 25 as a 3, and less than 4 as a 1. Unusually low numbers generally indicate toxicity, making this metric most useful at the low end of the biological integrity scale. Hughes and Gammon (1987) suggest that in larger streams, where sizes of fish may vary in orders of magnitude, total fish biomass may be an appropriate substitute or additional metric.

Metric 11. Proportion of individuals as hybrids. Substitutes (Table 8-1): Proportion of individuals as introduced species, simple lithophils, and number of simple lithophilic species.

This metric is an estimate of reproductive isolation or the suitability of the habitat for reproduction. Generally as environmental degradation increases the percent of hybrids and introduced species also increases, but the proportion of simple lithophils decreases. However, minnow hybrids are found in some high quality streams, hybrids are often absent from highly impacted sites, and hybridization is rare and difficult to detect. Thus, Ohio EPA (1987) substitutes simple lithophils for hybrids. Simple lithophils spawn where their eggs can develop in the interstices of sand, gravel, and cobble substrates without parental care. Hughes and Gammon (1987) and Miller et al. (1988) propose using percent introduced individuals. This metric is a direct measure of the loss of species segregation between midwestern and western fishes that existed before the introduction of midwestern species to western rivers.

THE INDEX OF WELL-BEING (IWB)

The Iwb (Gammon 1976, 1980, Hughes and Gammon 1987) incorporates two abundance and two diversity measures in an approximately equal fashion, thereby representing fish assemblage quality more realistically than a single diversity or abundance measure. The Iwb is calculated using the formula:

$$Iwb = 0.51nN + 0.5\ 1nB + \bar{H}_N + \bar{H}_B$$

where

N = number of individuals caught per unit distance sampled
B = biomass of individuals caught per unit distance
$\bar{H}$ = Shannon diversity index, calculated as:

$$\bar{H} = -\Sigma \frac{n_i}{N}\ 1n\ (\frac{n_i}{N})$$

where

n_i = relative number or weight of the ith species
N = total number or weight of the sample

THE MODIFIED INDEX OF WELL-BEING (MIWB)

The MIwb (Ohio EPA 1987) retains the same formula as the Iwb; however, highly tolerant species, hybrids, and exotic species are eliminated from the abundance (i.e., number and biomass) components of the formula. This modification increases the sensitivity of the index to a wider array of environmental disturbances.

Metric 12. Proportion of individuals with disease, tumors, fin damage, and skeletal anomalies

This metric depicts the health and condition of individual fish. These conditions occur infrequently or are absent from minimally impacted reference sites but occur frequently below point sources and in

areas where toxic chemicals are concentrated. They are excellent measures of the subacute effects of chemical pollution and the aesthetic value of game and nongame fish.

Metric 13. Total fish biomass (optional).

Hughes and Gammon (1987) suggest that in larger (e.g., non-wadeable) rivers where sizes of fish may vary in orders of magnitude this additional metric may be appropriate. Gammon (1976, 1980) and Ohio EPA (1987) developed an Index of Well-Being (Iwb) and Modified Index of Well-Being (MIwb), respectively, based upon both fish abundance and biomass measures. The combination of diversity and biomass measures is a useful tool for assessing fish assemblages in larger rivers (Yoder and Rankin 1995b). Ohio EPA (1987) found that the additional collection of biomass data (i.e., in addition to abundance information needed for the IBI) required to calculate the MIwb does not represent a significant expenditure of time, providing that subsampling techniques are applied (see Field Sampling Procedures 8.1.1).

Because the IBI is an adaptable index, the choice of metrics and scoring criteria is best developed on a regional basis through use of available publications (Karr et al. 1986, Ohio EPA 1987, Miller et al. 1988, Steedman 1988; Simon 1991, Lyons 1992a, Simon and Lyons 1995, Hall et al. 1996, Lyons et al. 1996, Roth et al. 1997, Simon 1999). Several steps are common to all regions. The fish species must be listed and assigned to trophic and tolerance guilds. Scoring criteria are developed through use of high quality historical data and data from minimally-impaired regional reference sites. This has been done for much of the country, but continued refinements are expected as more ecological data become available for the fish community.

8.4 TAXONOMIC REFERENCES FOR FISH

The following references are provided as a list of taxonomic references currently being used around the United States for identification of fish. Any of these references cited in the text of this document will also be found in Chapter 11 (Literature Cited).

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10 APPENDIX E - OWL'S CREEK ESTUARY WATER QUALITY DATA

Table E-1: Owl's Creek Annual Mean Water Quality Data Summary 1998-2010

Year	ORP	Dissolved Oxygen		Temp.	pH	Alkalinity	Salinity	Ammonium (NH_3-N)	Nitrite (NO_2-N)	Nitrate (NO_3-N)	Orthophosphate (PO_4-P)	Bromate (Br [II])	Turbidity	Color	Fecal Coliform	Non-Fecal Coliform
	mV	% sat	mg/L	°C		mg/L	PSU	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	Pt-Co	col/100mL	col/100mL
SURFACE																
1998	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	103.9	56.0	34.63	19.4	7.76	98	25	0.062	0.006	0.05	0.036	--	13	81	--	--
2000	220.5	103.9	12.73	14.9	7.61	89	24	0.102	0.005	0.06	0.055	0.23008	11	70	0	--
2001	0.0	73.3	6.50	18.7	7.54	87	25	0.068	0.006	0.06	0.082	0.11400	11	63	0	87
2002	0.0	94.1	7.67	13.0	7.76	87	26	0.093	0.004	0.03	0.139	0.09550	15	27	--	174
2003	128.4	86.2	7.47	20.8	7.60	85	21	0.076	0.004	0.04	0.019	0.06176	13	79	97	54
2004	135.6	82.4	7.44	18.5	7.65	85	21	0.060	0.005	0.07	0.034	0.06146	11	90	66	56
2005	75.0	82.2	7.36	17.3	7.73	86	21	0.067	0.004	0.05	0.039	0.04688	9	64	45	6
2006	84.2	73.6	6.28	18.7	7.67	87	24	0.087	0.004	0.91	0.032	0.04407	10	65	31	18
2007	174.1	69.8	6.21	18.1	7.75	88	24	0.089	0.004	0.09	0.032	0.03633	9	57	30	19
2008	176.3	79.3	7.16	16.1	7.69	87	25	0.096	0.005	0.07	0.028	0.05727	9	59	50	21
2009	171.7	86.1	7.84	15.6	7.60	86	24	0.094	0.004	0.08	0.040	0.05030	9	61	44	51
2010	165.7	78.9	7.36	16.9	7.81	95	26	0.126	0.007	0.05	0.071	0.04000	7	43	11	24
5 ft. Depth																
1998	160.4	104.5	9.85	10.1	7.93	82	22	0.183	0.005	0.06	0.001	--	53	10	12	3
1999	82.0	48.5	31.13	19.7	7.78	98	27	0.062	0.005	0.03	0.030	--	63	11	116	434
2000	211.8	95.9	8.55	13.3	7.56	86	25	0.094	0.005	0.02	0.037	0.06316	10	248	185	141
2001	--	71.0	6.02	19.8	7.63	88	26	0.073	0.003	0.02	0.079	0.05174	11	56	0	21
2002	--	93.7	7.78	15.0	7.46	86	25	0.108	0.005	0.02	0.117	0.08315	7	54	0	53
2003	99.4	77.8	6.59	19.1	7.61	88	22	0.086	0.004	0.02	0.038	0.06000	12	67	55	45
2004	120.6	78.0	7.02	16.2	7.70	87	23	0.060	0.005	0.03	0.032	0.05188	10	59	45	31
2005	64.1	79.6	7.16	16.5	7.75	88	23	0.047	0.005	0.02	0.039	0.05063	9	58	29	12
2006	72.4	72.6	6.30	18.2	7.73	88	25	0.062	0.003	0.05	0.029	0.04889	9	53	23	35
2007	168.4	68.6	6.06	17.6	7.78	90	25	0.067	0.004	0.04	0.029	0.04004	9	55	35	23
2008	172.9	80.2	7.21	17.4	7.74	88	26	0.068	0.004	0.04	0.024	0.05705	9	55	39	18
2009	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10 ft. Depth																
1998	160.7	85.0	7.95	9.8	7.71	92	25	0.260	0.006	0.04	0.016	--	43	8	29	8
1999	52.6	55.1	4.26	18.4	7.69	104	28	0.148	0.007	0.04	0.073	--	85	18	103	1658
2000	202.2	79.8	7.23	11.9	7.52	94	27	0.127	0.005	0.02	0.046	0.04789	9	54	0	0
2001	--	64.5	5.46	19.9	7.50	92	27	0.112	0.004	0.02	0.088	0.03791	10	52	0	12
2002	--	86.3	5.71	11.5	7.43	90	26	0.141	0.003	0.02	0.077	0.04100	6	48	0	44
2003	20.5	49.0	5.12	18.2	7.42	97	25	0.218	0.005	0.03	0.071	0.05543	10	60	14	17
2004	83.1	60.4	5.44	15.6	7.52	95	26	0.156	0.005	0.02	0.076	0.04542	10	54	18	16
2005	37.4	61.0	5.58	14.6	7.60	95	25	0.095	0.004	0.03	0.057	0.04455	8	48	12	8

Year	ORP	Dissolved Oxygen		Temp.	pH	Alkalinity	Salinity	Ammonium (NH_3-N)	Nitrite (NO_2-N)	Nitrate (NO_3-N)	Orthophosphate (PO_4-P)	Bromate (Br [II])	Turbidity	Color	Fecal Coliform	Non-Fecal Coliform
	mV	% sat	mg/L	°C		mg/L	PSU	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	Pt-Co	col/100mL	col/100mL
2006	39.9	64.7	8.20	17.1	7.66	93	27	0.089	0.004	0.05	0.040	0.04185	9	53	15	14
2007	164.2	60.9	5.52	16.9	7.71	95	26	0.103	0.008	0.04	0.040	0.04063	8	50	14	8
2008	171.5	72.4	27.44	15.5	7.68	93	27	0.087	0.003	0.04	0.030	0.05250	8	48	14	16
2009	167.2	72.5	6.71	14.7	7.58	91	26	0.118	0.002	0.04	0.057	0.04697	8	49	16	26
2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BOTTOM																
1998	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999	-66.4	28.5	2.17	18.4	7.50	110	29	0.449	0.023	0.32	0.217	--	--	883	383	--
2000	48.5	49.6	4.72	10.9	7.32	102	29	0.330	0.004	0.02	0.195	0.05789	--	88	285	--
2001	--	44.2	2.15	17.1	7.39	109	28	0.483	0.003	0.02	0.336	0.05609	--	156	445	4
2002	--	25.6	3.57	11.1	7.30	107	28	0.212	0.004	0.03	0.077	0.04350	--	82	175	88
2003	-182.3	20.5	2.24	16.2	7.38	130	27	1.584	0.006	0.04	0.393	0.55914	--	382	1893	5
2004	-39.4	31.1	2.99	15.0	7.40	112	28	0.903	0.004	0.03	0.254	0.09625	--	664	1884	23
2005	-103.1	30.7	3.12	14.0	7.44	112	28	0.662	0.005	0.03	0.243	0.78273	--	1021	1757	4
2006	-194.6	20.8	2.34	16.2	7.40	114	28	0.585	0.004	0.06	0.258	0.12074	--	1476	2707	19
2007	145.1	48.5	4.37	17.2	7.64	97	27	0.235	0.004	0.03	0.068	0.04796	--	71	259	7
2008	152.5	60.9	5.46	16.1	7.51	95	28	0.261	0.004	0.03	0.068	0.05171	--	22	298	5
2009	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2010	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTE: Full data set is included as Appendix E, Excel files on the project DVD inset.

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Naval Air Station Oceana – Aeropines Golf Course Pond Assessment

December 2014

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Introduction

This report summarizes the survey results of a wildlife (amphibians, reptiles, birds, and fish), vegetation and water quality assessment at the Aeropines Golf Course ponds located on Naval Air Station (NAS) Oceana. The study was conducted by natural resource specialists Chris Petersen, Paul Block, and Scott Chappell of Naval Facilities Engineering Command Atlantic (NAVFAC Atlantic) with assistance from Lawrence McGrogan (Navy Game Warden) and Chad Boyce (Virginia Department of Game and Inland Fisheries). The study occurred from February to August 2013.

The overall objective of the surveys was to collect baseline data regarding the use of the ponds by wildlife and collect data on the water quality and vegetation of the ponds. Data collected from the this investigation will provide baseline data for the Integrated Natural Resource Management Plan (INRMP) and be used for environmental planning, natural resource management, and conservation in support of the military missions of the installation.

Project Location

NAS Oceana encompasses approximately 5,700 acres and is located in the City of Virginia Beach in Princess Ann County, Virginia. It currently serves as the Navy's East Coast Master Jet Base, home to the F/A-18 Hornets and Super Hornets. The primary mission of the Naval Air Station Oceana is as a Shore-Based Readiness Integrator, providing the facilities, equipment and personnel to support shored-based readiness, total force readiness and maintain operational access of Oceana-based forces.

The Aeropines Golf Course was built in 1985 and is located on the southeastern side of the installation (Figure 1). Aeropines Golf Course has two 18-hole courses: the Hornet Course and the Tomcat Course. It also has a practice facility that includes a driving range featuring a 60,000-square-foot hitting area, two putting greens, chipping green and a practice bunker area. The golf course contains eight manmade ponds ranging in size from 0.67 acres (pond 7) to 3.16 acres (pond 1). The ponds were once likely barrow pits for soil to construct the course. Scattered areas of forested habitat (mostly pine trees) separate the various courses.

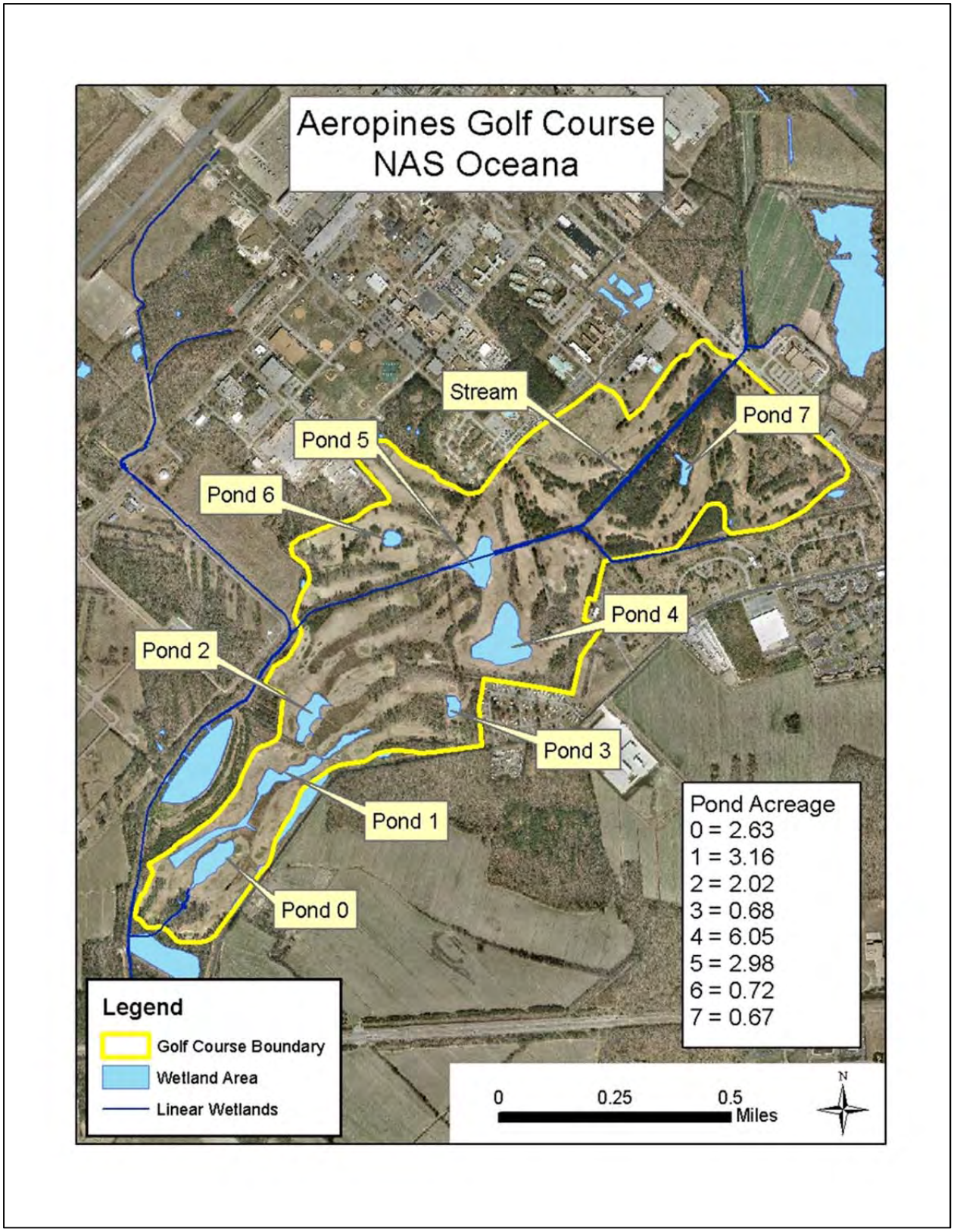


Figure 1. Aeropines Golf Course Ponds

Survey Dates

The following table 1 summarizes the dates and primary purpose of each field survey. However, Incidental field observations of wildlife were recorded during every field visit.

Table 1. Purpose and date of field surveys at Aeropines golf course.

Purpose of Field Visit	Date
Bird Survey	2/6/2013
Spring Amphibian Breeding Survey	3/12/2013
Fish Shocking/Water Quality Sampling	4/9/2013
Amphibian, Reptile and Bird Survey/Water Quality Sampling/Invertebrates	5/9/2013
Turtle Trapping/ Fish Seine/Vegetation/Wildlife Observations	6/20/2013
Water Quality Sampling	8/6/2013

Aquatic Organisms (Fish, Invertebrates and Vegetation)

Fish sampling was conducted in seven ponds and two stream locations on Aeropines Golf Course on 9 April and 20 Jun, 2013 (Figure 1). The Golf Course is located in the highly developed headwaters of the West Neck Creek watershed in southeastern Virginia (Figure 2). The ponds are connected to more perennial waters of the West Neck Creek watershed through ditches or channelized headwater streams. Numerous culverts and other obstructions downstream of the ponds limit

immigration from downstream fish populations. Either by human introductions or immigration events, the ponds do have assemblages of fish. The species of fish and incidental aquatic invertebrates encountered in the streams and ponds are listed in Table 2.

Table 2. Fish and invertebrate species collected in Aeropines Golf Course during stream and pond sampling on April 9 and June 9, 2013. Note: "12x" means dozens were collected, "?" means collection may be counted in unidentified species (spp.) rows, and "S" refers to stream samples.

Common Name	***Scientific Name***	**Pond Collections (numbers)**								
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**S**
FISH										
American eel	*Anguilla rostrata*	6	1	4	0	7	1	0	0	0
Black crappie	*Pomoxis nigromaculatus*	?	51	1	0	0	0	0	0	0
Bluegill	*Lepomis macrochirus*	21	42	63	43	10	15	0	0	3
Brown bullhead	*Ameiurus nebulosus*	1	0	0	0	0	0	0	0	?
Bluespotted sunfish	*Enneacanthus gloriosus*	0	0	0	0	0	0	0	0	5
Bullhead spp.	*Ameiurus spp.*	0	0	0	0	0	0	0	0	4
Chain pickerel	*Esox niger*	0	0	0	0	1	0	0	0	0
Common carp	*Cyprinus carpio*	7	0	5	1	32	29	0	0	0
Crappie spp.	*Pomoxis spp.*	4	0	0	158	0	1	0	0	0
Mosquitofish	*Gambusia affinis*	0	7	0	0	0	0	12x	0	12x
Golden shiner	*Notemigonus crysoleucas*	0	2	3	16	0	8	0	0	1
Green sunfish	*Lepomis cyanellus*	0	0	0	0	1	1	0	0	0
Gizzard shad	*Dorosoma cepedianum*	13	19	1	0	2	55	0	0	0
Largemouth bass	*Macropterus salmoides*	23	1	68	4	5	7	1	0	6
Pumpkinseed	*Lepomis gibbosus*	41	2	9	0	1	2	0	0	17
Redear sunfish	*Lepomis microlophus*	0	0	1	0	2	3	0	0	?
Sunfish spp.	*Lepomis spp.*	0	0	0	0	0	0	0	0	2
Warmouth	*Lepomis gulosus*	0	0	1	0	0	2	0	0	1
White perch	*Morone americana*	22	1	0	0	14	0	0	0	0
TOTAL fish species		**9**	**9**	**10**	**5**	**10**	**11**	**2**	**0**	**9**
INVERTEBRATES										
Crayfish spp.	*Procambarus* spp.					X				X
Grass shrimp	*Palaemonetes* spp.						X			X
Mussel spp.	Unionid spp.			X						
Clam spp.	*Corbicula* or *Pisidium* spp.									X
Dragonfly larvae	Suborder Anisoptera spp.			X						

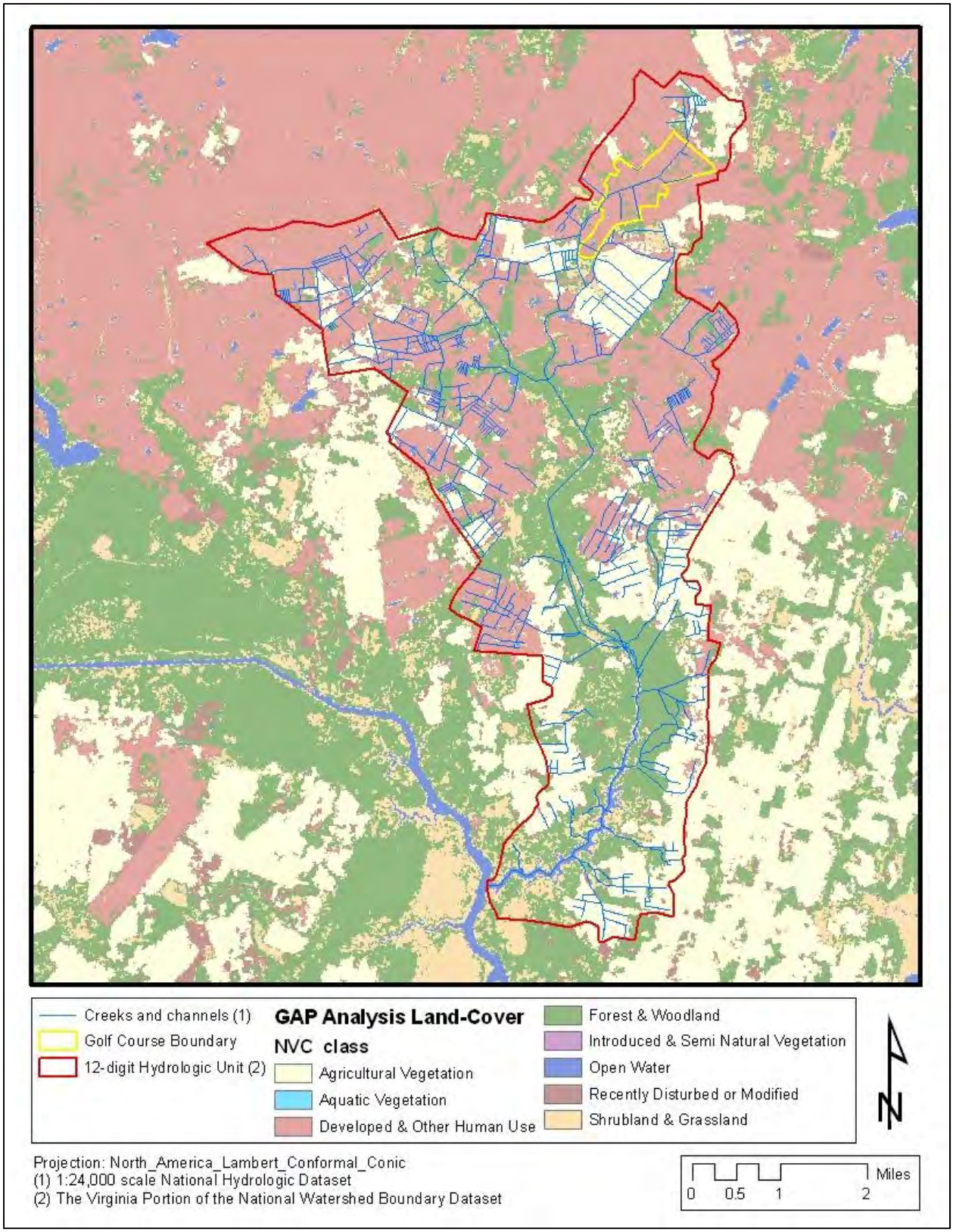


Figure 2. Hydrology and land-cover (Southeast Gap Analysis Project 2001) in and around the West Neck Creek watershed

There were no state or federally threatened or endangered fish species collected during surveys of the golf course water bodies. The only species collected with candidate ESA status was the American eel (*Anguilla rostrata*). Another likely candidate, the anadromous river herrings (*Alosa* spp.) are possible but unlikely to occur this far upstream in the West Neck Creek watershed (Jenkins and Burkhead 1994); North Carolina and Virginia-identified anadromous fish spawning areas do not include West Neck Creek (Kohler and Hubert 1993). The presence of river herring (*Alosa pseudoharengus*) in the Oceana watershed was documented by an installation fish and stream assessment in 2014 (Wright 2014). The species was found in the stream below the Aeropines Mitigation Site. However, the presence of river herring in the Aeropines Golf Course ponds is highly unlikely given the presence of a riprap dam just downstream from Pond 5 (Figure 1). And, a stream draining Pond 0 intersects the stream below the mitigation site. However, the culvert at the south end of Pond 0 would be a barrier to herring migration and other obstructions in the streambed such as vegetation debris (e.g. leaves, branches, etc.) could also disrupt potential migration pathways. The relative abundance of river herring in the Oceana watershed is likely very low given that current VDGIF-identified anadromous fish spawning areas (VDGIF 2014) and state fish collection records (Jenkins and Burkhead 1994) do not suggest their presence this far up in the West Neck Creek watershed.

The species present are typical of freshwater creeks and ponds in developed watersheds of coastal Virginia (e.g., largemouth bass, sunfish, crappie, bullheads, carp). As such, the ponds have numerous undesirable species that discourage a productive fishery for bass and bluegill (NCDMF 2013). In artificial ponds, the number of species is more a reflection of fishery degradation than ecosystem resilience with diversity. The streams had a subset of species collected in ponds, except for the presence of blue-spotted sunfish which did not occur in ponds. In total, there were 16 fish species collected on the Aeropines Golf Course during two sampling days in late spring and early summer.

Not accounting for differences in sampling effort, pond 5 had the highest number of species (11) followed by pond 2 (10). Pond 5 intersects the primary conduit of water on the Golf Course, and may explain the relatively high number of species. The number of species in pond 2 is unexplained by obvious water connections, though the pond is lower in the watershed than most other ponds on the Golf Course. The low number of species in ponds 3 (5) could be explained by the relative upstream position. Pond 6 had no water connection to account for the presence of largemouth bass (one of only 2 species collected). No fish sampling was conducted in pond 7 because it was covered with duckweed and registered nearly 0 mg/l of dissolved oxygen. The following subsections describe each of the ponds sampled in terms of size, average depth, water source/drainage, shoreline habitat, relative abundance of species size classes, and fishery potential.

PONDS

Pond 0

1.1.1. Description

Pond 0 is 2.63 acres in size, and drains via a linear wetland on the southern end. The pond may receive inflow from upstream via linear wetland drainage along the northwestern shore (Figure 3). The linear wetland connects upstream ponds 1 with downstream pond 0. A narrow margin of vegetation typically occupies the banks of the pond but herbicide application has removed the vegetation in an approximately three foot border around the entire pond (Figure 2A). Many areas of the pond shoreline are eroding with sections of the shoreline collapsing into the pond. This erosion is likely caused or expedited by the herbicide application removing the vegetation at the pond shoreline. The brushy banks

are bordered by patches of alligator weed (*Alternanthera philoxeroides*) in the shallow margins of the pond.

Vegetation control border at pond 0 and associated erosion.

Figure 3. Aeropines Golf Course Pond 0.
(Source: Services.arcgisonline.com/arcgis/services/)

1.1.2. Water Quality

Water quality measurements were acquired on 9 April, 9 May, and 7 August 2013. Oxygen concentrations ranged from 6.5 - 12.76 mg/l in water temperatures ranging from 19.8 - 28°C (daytime measurements). The pH of the water was 6.5-7.0, which is neutral. Though not measured, water clarity was estimated at less than 1 ft. of visibility. The water quality measurements are documented in Table 3.

Table 3. Water quality measurements in pond 0

Date	Parameter	Measurement
4/9/2013	Water Temperature (°C)	19.8
	Dissolved O^2 (mg/l)	12.76
	Specific Conductivity (µS)	1002
5/9/2013	Water Temperature (C)	20.0
	Dissolved O^2 (mg/l)	8.2
	Ammonia Nitrogen (ppm)	0.4
	pH	6.5
8/7/2013	Water Temperature (°C)	28
	Dissolved O^2 (mg/l)	6.5
	Ammonia Nitrogen (ppm)	0.2
	pH	7.0

1.1.3. Fish

Fish sampling was conducted in conjunction with water quality measurements on 9 April 2013. The method used was an electrofishing boat owned and operated by the Virginia Department of Game and Inland Fisheries (VDGIF; Chad Boyce). The boat surveyed the shoreline for 735 seconds of effort and collected 9 species (Table 4). Based on electrofishing results, the top predatory gamefish in pond 0 is the largemouth bass (up to 19 inches) followed by a small number of large white perch (up to 13 inches). The primary panfish and forage species for largemouth bass in this pond are pumpkinseed and bluegill. The sunfish ranged from 2 to 7 inches, which includes some quality sizes. However, due to competition from pelagic, mud-sucking planktivores (gizzard shad) and large mud-sucking omnivores (common carp), sunfish populations are not as abundance as they could be. The bass population is also affected because the shad and carp get too large, too quickly, for most bass consumption. These species may also stir up fine bottom sediments and reduce water clarity for the visual feeding bass. White perch tend to overpopulate and stunt in small ponds and may serve only to compete with smaller size classes of bass.

Table 4. Electrofishing results from 9 April 2013 in pond 0 (effort = 735 sec). Note: Captured most fish except eels

Species	Number	Avg. Length (mm)	Min. Length (mm)	Max. Length (mm)
American eel	6	272	230	330
Bluegill	7	79	50	125
Brown bullhead	1	297	297	297
Common carp	7	596	552	684
Gizzard shad	3	334	299	367
Largemouth bass	16	356	82	492
Pumpkinseed	41	121	76	175
White perch	9	154	96	336

Considering an electrofishing method is biased toward collected larger fish, a second method (seine haul) was employed on 20 June 2013 in pond 0. No water quality measurements were taken in conjunction with the seine haul sampling. Two hauls of a 20ft seine collected 5 species in the smaller size classes (Table 5). The results suggest spawning of bluegill, gizzard shad, largemouth bass, and white perch. There must also be some larger crappie in the pond to produce the 4 small crappie collected in the seine hauls. This species is yet another undesirable species for small pond because they tend to overpopulate and stunt; providing only competition for smaller size classes of bass.

Table 5. Seine haul results from 20 June 2013 in pond 0 (effort = 2 hauls).

	Size classes (inches)						
Species	**1**	**2**	**2.5**	**3**	**4**	**7.5**	**Total**
Black crappie	4	0	0	0	0	0	4
Bluegill	2	5	1	4	1	1	14
Gizzard shad	0	1	2	7	0	0	10
Largemouth bass	0	7	0	0	0	0	7
White perch	0	13	0	0	0	0	13
Total	**6**	**26**	**3**	**11**	**1**	**1**	**48**

Relative to the other ponds sampled, pond 0 was the closest to achieving a desirable pond fishery. However, non-fishery species degrade the sportfishing potential of the pond like so many other ponds on the golf course.

Pond 1

1.1.4. Description

Pond 1 is 3.16 acres in size, and drains via a linear wetland on the southern end. The pond may receive inflow from upstream via linear wetland drainage along the northeastern shore (Figure 4). A narrow margin of brush occupies the banks of the pond along over half of the shoreline.

Figure 4. Aeropines Golf Course Pond 1
(Source: Services.arcgisonline.com/arcgis/services/)

1.1.5. Water Quality

Water quality measurements were acquired on 9 April (Table 6). The oxygen concentration ranged from 4.8 to 7.0 mg/l in a water temperature of 21 to 26°C (daytime measurements). The pH of the water was 6.0 - 6.5, which is at the acidic end of the neutral range. Though not measured, water clarity was estimated at less than 1 foot of visibility. The ammonia concentration in this pond was measured at 0.4 – 1.0 mg/l.

Table 6. Water quality measurements in pond 1.

Date	Parameter	Measurement
4/9/2013	Water Temperature (°C)	21
	Dissolved O^2 (mg/l)	7.0
	Ammonia Nitrogen (ppm)	0.4
	pH	6.0
8/7/2013	Water Temperature (°C)	26
	Dissolved O^2 (mg/l)	4.8
	Ammonia Nitrogen (ppm)	1.0
	pH	6.5

1.1.6. Fish

Though electrofishing was not conducted on this pond, a turtle trap night and a couple of seine hauls were made on 20 June 2013. No water quality measurements were taken in conjunction with the seine haul sampling. Two hauls of a 20ft seine collected 8 species in the smaller size classes (Table 7). The results suggest spawning of black crappie, bluegill, Mosquitofish, golden shiner, gizzard shad, largemouth bass, pumpkinseed, and white perch. The turtle trap captured an adult American eel (24 inches) and three bluegills (5-6 inches). Though not captured by seining or turtle trap, common carp are likely present in this pond like so many others on the Golf Course; they can easily avoid small seine nets.

Table 7. Seine haul results from 20 June 2013 in pond 1 (effort = 2 hauls).

	Size Classes (inches)												
Species	**1**	**2**	**2**	**3**	**3**	**3.5**	**4**	**4.5**	**5**	**5.5**	**6**	**6.5**	**Total**
Black crappie	47	0	0	0	0	0	0	0	1	0	2	1	51
Bluegill	0	1	8	6	9	3	4	1	3	1	2	1	39
Mosquitofish	7	0	0	0	0	0	0	0	0	0	0	0	7
Golden shiner	2	0	0	0	0	0	0	0	0	0	0	0	2
Gizzard shad	8	1	7	1	2	0	0	0	0	0	0	0	19
Largemouth bass	1	0	0	0	0	0	0	0	0	0	0	0	1
Pumpkinseed	0	0	0	0	0	1	1	0	0	0	0	0	2
White perch	0	0	0	0	0	0	0	0	1	0	0	0	1
Grand Total	**56**	**2**	**15**	**7**	**11**	**4**	**5**	**1**	**5**	**1**	**4**	**2**	**122**

Based on seine haul and turtle trap results, the top predatory gamefish in pond 1 is the largemouth bass followed by white perch and black crappie. The primary panfish and forage species for largemouth bass in this pond are pumpkinseed and bluegill. The sunfish ranged from 2 to 6 inches, which includes some quality sizes. However, due to competition from pelagic, mud-sucking planktivores (gizzard shad), sunfish populations are not as abundance as they could be. The bass population is also affected because the shad and carp get too large, too quickly, for most bass consumption. These species may also stir up fine bottom sediments and reduce water clarity for the visual feeding bass. White perch and black crappie tend to overpopulate and stunt in small ponds and may serve only to compete with smaller size classes of bass.

In summary, pond 1 has some quality largemouth bass and sunfish to support a pond fishery. However, non-fishery species degrade the sportfishing potential of the pond like so many other ponds on the golf course.

Pond 2

1.1.7. Description

Pond 2 is 2.02 acres in size, and appears to drains via a linear wetland on the southern end. The pond may receive inflow from upstream via linear wetland drainages along the northeastern and southeastern shores (Figure 5). A narrow margin of brush occupies the banks of the pond along over half of the shoreline. The brushy banks are bordered by patches of alligator weed (*Alternanthera philoxeroides*) in the shallow margins of the pond.

Figure 5. Aeropines Golf Course Pond 2
(Source: Services.arcgisonline.com/arcgis/services/)

1.1.8. Water Quality

Water quality measurements were acquired on 9 April, 9 May, and 7 August 2013. Oxygen concentrations ranged from 6.5 to 11.65 mg/l in water temperatures ranging from 22.0 to 27°C (daytime measurements). The pH of the water was 6.5, which is at the acidic end of the neutral range. Though not measured, water clarity was estimated at less than 1 foot of visibility. The water quality measurements are documented in Table 8.

Table 8. Water quality measurements in pond 2

Date	Parameter	Recording
4/9/2013	Water Temperature (°C)	22.3
	Dissolved oxygen (mg/l)	11.65
	Specific Conductivity (µS)	707
	Salinity (ppt)	0.3
5/9/2013	Water Temperature (°C)	22.0
	Dissolved oxygen (mg/l)	8.4
	Ammonia Nitrogen (ppm)	0.2
	pH	6.5
8/7/2013	Water Temperature (°C)	27.0
	Dissolved oxygen (mg/l)	6.5
	Ammonia Nitrogen (ppm)	0.2
	pH	6.5

1.1.9. Fish

Fish sampling was conducted in conjunction with water quality measurements on 9 April 2013. The method used was an electrofishing boat owned and operated by the Virginia Department of Game and Inland Fisheries (VDGIF; Chad Boyce). The boat surveyed the shoreline for 625 seconds of effort and collected 9 species (Table 9). Based on electrofishing results, the top predatory gamefish in pond 2 is the largemouth bass (up to 17 inches) followed by black crappie (up to 14 inches). The primary panfish and forage species for largemouth bass in this pond are bluegill, pumpkinseed, and other sunfish species. The sunfish ranged from 3 to 7 inches, which includes some quality sizes. However, due to competition from pelagic, mud-sucking planktivores (gizzard shad), large mud-sucking omnivores (common carp), and a large minnow species (golden shiner), sunfish populations are not as abundance as they could be. The bass population is also affected because the shad, carp, and shiners get too large, too quickly, for most bass consumption. The shad and carp may also stir up fine bottom sediments and reduce water clarity for the visual feeding bass. Black crappies tend to overpopulate and stunt in small ponds and may serve only to compete with smaller size classes of bass.

Table 9. Electrofishing results from 9 April 2013 in pond 2 (effort = 625 sec). Note: Missed large eel

Species	Number	Avg. Length (mm)	Min. Length (mm)	Max. Length (mm)
American eel	4	309	220	465
Black crappie	1	368	368	368
Bluegill	13	100	50	167
Common carp	5	514	471	555
Golden shiner	3	-	-	-
Gizzard shad	1	310	310	310
Largemouth bass	1	429	429	429
Pumpkinseed	7	89	69	125
Redear sunfish	1	130	130	130
Warmouth	1	86	86	86
Grand Total	**34**	**208**	**50**	**555**

Considering an electrofishing method is biased toward collected larger fish, a second method (seine haul) was employed on 20 June 2013 in pond 2. No water quality measurements were taken in conjunction with the seine haul sampling. Two hauls of a 20ft seine collected 4 species in the smaller size classes (Table 10). The results suggest spawning of black crappie, bluegill, largemouth bass, and pumpkinseed. The seine also collected some dragonfly larvae and a mussel (2 inches).

Table 10. Seine haul results from 20 June 2013 in pond 2 (effort = 2 hauls)

Species	Size Classes (inches)								Total
	1	1.5	2	2.5	3	3.5	4.5	5	
Black crappie	29							1	30
Bluegill	42				1	1	2	2	48
Largemouth bass		4	63						67
Pumpkinseed				1		1			2
Grand Total	**71**	**4**	**63**	**1**	**1**	**2**	**2**	**3**	**147**

In summary, pond 2 has some quality largemouth bass and sunfish to support a pond fishery. However, non-fishery species degrade the sportfishing potential of the pond like so many other ponds on the golf course.

Pond 3

1.1.10. Description

Pond 3 is 0.68 acres in size, and drains via a linear wetland on the eastern side. The pond does not appear to receive any inflow from linear wetlands (Figure 6). A narrow margin of brush occupies the banks of the pond along over half of the shoreline.

Figure 6. Aeropines Golf Course Pond 3
(Source: Services.arcgisonline.com/arcgis/services/)

1.1.11. Water Quality

Water quality measurements were acquired on 9 April (Table 11). The oxygen concentration was 6.4 to 9.8 mg/l in a water temperature of 23 to 27°C (daytime measurements). The pH of the water was 8.0 to 9.0, which is at the alkaline end of the neutral range. Though not measured, water clarity was estimated at less than 1 foot of visibility. The ammonia concentration measured in this pond was 0.4 mg/l.

Table 11. Water quality measurements in pond 3

Date	Parameter	Recording
5/9/2013	Water Temperature (°C)	23.0
	Dissolved oxygen (mg/l)	9.8
	Ammonia Nitrogen (ppm)	0.4
	pH	9.0
8/7/2013	Water Temperature (°C)	27.0
	Dissolved oxygen (mg/l)	6.4
	Ammonia Nitrogen (ppm)	0.4
	pH	8.0

1.1.12. Fish

Though electrofishing was not conducted on this pond, a couple of seine hauls were made on 20 June 2013. No water quality measurements were taken in conjunction with the seine haul sampling. Two hauls of a 20ft seine collected 8 species in the smaller size classes (Table 12). The results suggest spawning of black crappie, bluegill, golden shiner, and largemouth bass in pond 3. A common carp was also observed in this pond, apart from the sampling effort.

Table 12. Seine haul results from 20 June 2013 in pond 3 (effort = 2 hauls)

	Size classes (inches)					
Species	**1**	**2**	**3**	**4**	**5**	**Total**
Black crappie	158	0	0	0	0	158
Bluegill	13	19	9	1	1	43
Golden shiner	18	0	0	0	0	18
Largemouth bass	2	1	1	0	0	4
Grand Total	**173**	**20**	**10**	**1**	**1**	**223**

Based on seine haul results, the top predatory gamefish in pond 3 is the largemouth bass followed by black crappie. The primary panfish and forage species for largemouth bass in this pond is bluegill. The bluegill ranged from 1 to 5 inches, which does not include quality sizes. However, due to competition from a large mud-sucking omnivore (common carp) and large minnow species (golden shiner), the bluegill population is not as abundance as it could be. The bass population is also affected because the shiners and carp get too large, too quickly, for most bass consumption. The carp may also stir up fine bottom sediments and reduce water clarity for the visual feeding bass. Black crappie tend to overpopulate and stunt in small ponds and may serve only to compete with smaller size classes of bass.

In summary, pond 3 has some largemouth bass that could support a pond fishery. However, non-fishery species degrade the sportfishing potential of the pond like so many other ponds on the golf course.

Pond 4

1.1.13. Description

Pond 4 is 6.05 acres in size, and appears to drains to pond 5 via a culvert pipe (Figure 7). The banks did not even have a narrow margin of brushy vegetation. Many areas of the pond shoreline are eroding with sections of the shoreline collapsing into the pond. This erosion is likely caused or expedited by the lack of shoreline vegetation at the pond. Patches of alligator weed (*Alternanthera philoxeroides*) were observed in the shallow margins of the pond.

Figure 7. Aeropines Golf Course Pond 4
(Source: Services.arcgisonline.com/arcgis/services/)

1.1.14. Water Quality

Water quality measurements were acquired on 9 April, 9 May, and 7 August 2013. Oxygen concentrations ranged from 7.0 to 9.12 mg/l in water temperatures ranging from 17.5 to 27.5°C (daytime measurements). The pH of the water was between 6 and 6.5, which is at the acidic end of the neutral range. Though not measured, water clarity was estimated at less than 1 foot of visibility. The water quality measurements are documented in Table 13.

Table 13. Water quality measurements in pond 4

Date	Parameter	Recording
4/9/2013	Water Temperature (°C)	17.5
	Dissolved oxygen (mg/l)	9.12
	Specific Conductivity (µS)	1121
	Salinity (ppt)	0.6
	pH	6-6.5
5/9/2013	Water Temperature (°C)	24.0
	Dissolved oxygen (mg/l)	7.8
	Ammonia Nitrogen	0.2
	pH	6.5
8/7/2013	Water Temperature (°C)	27.5
	Dissolved oxygen (mg/l)	7.0
	Ammonia Nitrogen (ppm)	0.2
	pH	6.5

1.1.15. Fish

Fish sampling was conducted in conjunction with water quality measurements on 9 April 2013. The method used was an electrofishing boat owned and operated by the Virginia Department of Game and Inland Fisheries (VDGIF; Chad Boyce). The boat surveyed the shoreline for 923 seconds of effort and collected 10 species (Table 14). Based on electrofishing results, the top predatory gamefish in pond 4 is the largemouth bass (up to 21 inches). The primary panfish and forage species for largemouth bass in this pond are bluegill and other sunfish species. The sunfish ranged from 2 to 6 inches, which includes some quality sizes. However, due to competition from pelagic, mud-sucking planktivores (gizzard shad) and large mud-sucking omnivores (common carp), sunfish populations are not as abundance as they could be. The bass population is also affected because the shad and carp get too large, too quickly, for most bass consumption. These species may also stir up fine bottom sediments and reduce water clarity for the visual feeding bass. White perch tend to overpopulate and stunt in small ponds and may serve only to compete with smaller size classes of bass. A crayfish was also collected in this pond during the sampling event.

Table 14. Electrofishing results from 9 April 2013 in pond 4 (effort = 923 sec).
Note: Missed numerous eels

Species	Number	Avg. Length (mm)	Min. Length (mm)	Max. Length (mm)
American eel	7	207	150	320
Bluegill	10	126	60	159
Chain pickerel	1	264	264	264
Common carp	32	474	381	621
Green sunfish	1	135	135	135
Gizzard shad	2	321	308	334
Largemouth bass	4	406	275	528
Pumpkinseed	1	87	87	87
Redear sunfish	2	71	62	80
White perch	15	119	101	162
Grand Total	**75**	**301**	**60**	**621**

In summary, pond 4 has some quality largemouth bass and sunfish to support a pond fishery. However, non-fishery species degrade the sportfishing potential of the pond like so many other ponds on the golf course.

Pond 5

1.1.16. Description

Pond 5 is 2.98 acres in size, and drains via stream channel forming the western shoreline (Figure 8). The pond received drainage from the stream channel forming the eastern shoreline. The pond is also connected to pond 5 via a culvert pipe. Along most of the shoreline, the banks did not even have a narrow margin of brushy vegetation; an exception being the wooded southwestern shoreline. Many areas of the pond shoreline are eroding with sections of the shoreline collapsing into the pond. This erosion is likely caused or expedited by the lack of shoreline vegetation at the pond. Patches of alligator weed (*Alternanthera philoxeroides*) and milfoil (*Myriophyllum* spp.) were observed in the shallow margins of the pond.

Figure 8. Aeropines Golf Course Pond 5
(Source: Services.arcgisonline.com/arcgis/services/)

1.1.17. Water Quality

Water quality measurements were acquired on 9 April and 9 May, 2013. Oxygen concentrations ranged from 7.5 to 9.12 mg/l in water temperatures ranging from 17.5 to 24°C (daytime measurements). The pH of the water was 6 to 6.5, which is at the acidic end of the neutral range. Though not measured, water clarity was estimated at less than 1 foot of visibility. The water quality measurements are documented in Table 15.

Table 15. Water quality measurements in pond 5

Date	Parameter	Recorded
4/9/2013	Water Temperature (°C)	17.5
	Dissolved oxygen (mg/l)	9.12
	Specific Conductivity (µS)	1121
	Salinity (ppt)	0.6
	pH	6-6.5
5/9/2013	Water Temperature (°C)	24.0
	Dissolved oxygen (mg/l)	7.5
	Ammonia Nitrogen	0.2
	pH	6.5
8/7/2013	Water Temperature (°C)	27.0
	Dissolved oxygen (mg/l)	6.4
	Ammonia Nitrogen (ppm)	0.2
	pH	6.5

1.1.18. Fish

Fish sampling was conducted in conjunction with water quality measurements on 9 April 2013. The method used was an electrofishing boat owned and operated by the Virginia Department of Game and Inland Fisheries (VDGIF; Chad Boyce). The boat surveyed the shoreline for 900 seconds of effort and collected 7 species (Table 16). Based on electrofishing results, the top predatory gamefish in pond 5 is the largemouth bass (up to 19 inches). The primary panfish and forage species for largemouth bass in this pond are bluegill and other sunfish species. The sunfish ranged from 2 to 5 inches, which does not includes quality sizes. American eel were observed but not collected during electrofishing.

Table 16. Electrofishing results from 9 April 2013 in pond 5 (effort = 900 sec). Note: Eel observed; missed quarter of bass and sunfish

Species	Number	Avg. Length (mm)	Min. Length (mm)	Max. Length (mm)
Bluegill	8	93	57	127
Common carp	29	483	392	606
Green sunfish	1	128	128	128
Largemouth bass	6	322	115	471
Pumpkinseed	2	128	125	131
Redear sunfish	3	94	72	138
Warmouth	2	70	49	90
Grand Total	**51**	**343**	**49**	**606**

Considering an electrofishing method is biased toward collected larger fish, a second method (seine haul) was employed on 20 June 2013 in pond 5. No water quality measurements were taken in

conjunction with the seine haul sampling. Two hauls of a 20ft seine collected 5 species in the smaller size classes (Table 17). The results suggest spawning of black crappie, bluegill, golden shiner, gizzard shad, and largemouth bass. A number of grass shrimp were also collected in the seine hauls.

Table 17. Seine haul results from 20 June 2013 in pond 5 (effort = 2 hauls).

	Size Classes (inches)				
Species	**1**	**2**	**3**	**4**	**Total**
Black crappie	0	1	0	0	1
Bluegill	1	1	4	1	7
Golden shiner	8	0	0	0	8
Gizzard shad	55	0	0	0	55
Largemouth bass	1	0	0	0	1
Total	**65**	**2**	**4**	**1**	**72**

Due to competition from a pelagic, mud-sucking planktivore (gizzard shad), a large mud-sucking omnivores (common carp), and a large minnow species (golden shiner), sunfish populations are not as abundance as they could be. The bass population is also affected because the shad, carp, and shiner get too large, too quickly, for most bass consumption. The shad and carp may also stir up fine bottom sediments and reduce water clarity for the visual feeding bass. Black crappie tend to overpopulate and stunt in small ponds and may serve only to compete with smaller size classes of bass.

In summary, pond 5 has some quality largemouth bass to support a pond fishery. However, non-fishery species degrade the sportfishing potential of the pond like so many other ponds on the golf course.

Pond 6

1.1.19. Description

Pond 6 is 0.72 acres in size, and does not have an obvious drain or receiving drainage apart from overland flow (Figure 9). The banks are a mixture of trees and brush, and there are willow trees (*Salix* species) growing in the pond interior, suggesting very shallow water. Along the tree-covered eastern shoreline, the nearshore waters dropped steeply to over 4 feet deep. Dense beds of submerged vegetation (possibly musk grass; *Chara* species) were also observed in the shallower, open waters of the pond.

Figure 9. Aeropines Golf Course Pond 6
(Source: Services.arcgisonline.com/arcgis/services/)

1.1.20. Water Quality

Water quality measurements were acquired on 9 April (Table 18). The oxygen concentration was 3.9 to 5.9 mg/l in a water temperature of 21 to 24.5°C (daytime measurements). The pH of the water was 6.0, which is at the acidic end of the neutral range. Though not measured, water clarity was higher than most other ponds on the Golf Course. The water was also stained brown from the abundance of trees around the banks and interior. The ammonia concentration measured in this pond was 0.2 ppm.

Table 18. Water quality measurements in pond 6

Date	Parameter	Recorded
5/9/2013	Water Temperature (°C)	21.0
	Dissolved oxygen (mg/l)	5.9
	Ammonia Nitrogen	0.2
	pH	6.0
8/7/2013	Water Temperature (°C)	24.5
	Dissolved oxygen (mg/l)	3.9
	Ammonia Nitrogen (ppm)	0.2
	pH	6.0

1.1.21. Fish

A couple of short seine hauls in pond 6 managed to collect dozens of Mosquitofish and a 1 inch largemouth bass. The presence of a very young bass suggests spawning activity in this pond. However, the forage base and dense habitat are unsuitable for a quality bass fishery.

Pond 7

1.1.22. Description

Pond 7 is 0.67 acres in size, and does not have an obvious drain or receiving drainage apart from overland flow (Figure 10). The banks are fully tree covered, and there was duckweed (Lemnoideae sub-family) covering the entire area of surface water.

Figure 10. Aeropines Golf Course Pond 7 (Source: Google Earth)

1.1.23. Water Quality

Water quality measurements were acquired on 9 May (Table 19). The oxygen concentration was 0.02 to 0.4 mg/l in a water temperature of 18 to 27.5°C (daytime measurements). The pH of the water was 6.0, which is at the acidic end of the neutral range. Though not measured, water clarity was higher than most other ponds on the Golf Course. The water was also stained brown from the abundance of trees around the banks and interior. The ammonia concentration measured in this pond was 0.8 to 1.5 ppm. No fish sampling was conducted in this pond because of the low dissolved oxygen reading.

Table 19. Water quality measurements in pond 7

Date	Parameter	Recorded
5/9/2013	Water Temperature (°C)	18.0
	Dissolved oxygen (mg/l)	0.4
	Ammonia Nitrogen (ppm)	0.8
	pH	6.0
8/7/2013	Water Temperature (°C)	27.5
	Dissolved oxygen (mg/l)	0.02
	Ammonia Nitrogen (ppm)	1.5
	pH	6.0

Streams

1.1.24. Description

The two streams segments sampled are shown on Figure 11. The downstream location was severely degraded habitat, in terms of siltation, with an abundance of milfoil (*Myriophyllum* spp.), filamentous algae, and snags along a forested riparian zone. The upstream location was downstream from a bridge, along a stream segment whose banks were cleared of forest vegetation. The stream bottom was muddy sand and the shallow margins were choked with emergent vegetation. The water at both locations was very shallow (1-2 feet) with a thick layer of mud in pools and along the shallow margins.

Figure 11. Aeropines Golf Course stream sampling locations (left is downstream, right is upstream) (Source: Google Earth)

1.1.25. Water Quality

Water quality measurements were taken off the bridge at the downstream location on 9 May 2013. The oxygen concentration was 13.82 mg/l in a water temperature of 22°C (daytime measurements). Other water quality measurements were specific conductivity (804 µS) and salinity (0.4 ppt). Water quality at the upstream site was not measured.

1.1.26. Fish

At the downstream location, fish sampling was conducted in conjunction with water quality measurements on 9 April 2013. The method used was a backpack electrofishing unit owned and

operated by the Virginia Department of Game and Inland Fisheries (VDGIF; Chad Boyce). The backpack shocker surveyed the shoreline for 250 seconds of effort and collected 5 species. The species were bluegill (2 at 2.5 inches), bluespotted sunfish (1 at 2.6 inches), mosquitofish (10), golden shiner (1 at 3.7 inches), and pumpkinseed (1 at 3.3 inches).

At the upstream location, fish sampling was conducted using a 20 foot seine pulled upstream. The species collected were largemouth bass (6 at 2 inches), mosquitofish (7), bluespotted sunfish (4 at 2-3 inches), pumpkinseed (16 at 2-5 inches), warmouth (1 at 4.5 inches), unidentified sunfish species (2 at 3 inches), and an unidentified bullhead species (4 at 2 inches). The seine also collected a clam (5 mm), crayfish, and grass shrimp.

Conclusion and Recommendations

The ponds on the Aeropines Golf Course are populated by a mixture of desirable gamefish (e.g., largemouth bass, bluegill, redear sunfish), an ESA candidate species (American eel), and notorious undesirable species (e.g., common carp, gizzard shad, golden shiner) that were either introduced or managed to immigrate from downstream in the West Neck Creek watershed. Of course, management goals for the ponds depend on their current or prospective uses (e.g., fishing, aesthetics, pollutant storage/treatment).

The pond game fisheries could be improved by killing all the fish and starting over with a recommended ratio of largemouth bass, bluegill, redear sunfish, and channel catfish. However, there is no way to drain the ponds to achieve a population reset. There is also the potential consequence of removing the species that keep the water murky (e.g., common carp, gizzard shad), thus allowing nuisance aquatic vegetation to overwhelm the system. In any case, a reset would not prevent further immigration or introduction of undesirable species in the future. Establishing and maintaining a fishery in one or more ponds would require removing the fish (pump out or rotenone application) after blocking off both inflow and outflow for a time. Low riser pipes could then be installed to drain overflow from the ponds and prevent future immigration of fish or vegetation. However, supporting a pond fishery should be secondary considering the primary purpose of the ponds is to provide traditional golf course aesthetics and the cost of making any improvements.

Typical golf course ponds have banks devoid of bushy vegetation and water stained with dye to reduce water clarity for nuisance weed growth. However, the eroding banks of such ponds could be considered a reduction in aesthetic quality. Establishing a shoreline zone of low wetland plants could improve both aesthetics (by reducing erosion) and nutrient removal of surface runoff. The removal of excess nutrients by the wetland plants could also improve water quality in the ponds and downstream. However, an improvement in water clarity could lead to an overabundance of nuisance aquatic weeds if they are already in the pond (true for pond 5). In such cases, pond dye could be applied to reduce water clarity for the nuisance weeds.

Based on these recommendations, a comprehensive plan could be developed for each pond that maximizes the aesthetic qualities of the ponds (shoreline vegetation established and improved water quality) and improves the fishery, if desired.

Amphibians and Reptiles

Field surveys for amphibians and reptiles were conducted on 12 March, 9 April, 9 May and 20 June 2013 to species present in and around the Aeropines golf course ponds on NAS Oceana. Prior to this effort, no formal survey had been conducted with only anecdotal field observations of herpetofauna species of the golf course ponds. Prior to the field work, a list of potential species was compiled to establish field methodologies and field survey strategies based on species-specific habitat preferences. This list was created by gathering data from field guides, the National Amphibian Atlas (http://armi.usgs.gov/national_amphibian_atlas.php), and museum records (http://herpnet.org/portal.html).

Field Methods

Visual encounter surveys were the primary technique used by biologists to conduct the field work. This survey method involved searching in and around the ponds for amphibians and reptiles when the probability of encounter was high (appropriate microhabitat, weather, and time of day for the target species). This technique was conducted during daylight and nighttime hours by walking along the perimeter of the golf course ponds searching for animals within their microhabitats. A second technique using during this survey included driving and walking the golf cart paths looking for individuals crossing or resting on the roadway. A third technique used during the survey was listening for the breeding calls of frogs and toads. This technique was used to identify species and helpful at locating specific ponds where these species were breeding. Lastly, hoop net traps were used to capture and identify turtle species within the ponds. Amphibians and reptiles encountered were identified to species and a digital photograph was recorded of most captured species.

Results

1.1.27. Amphibians

In total from all survey events, five species of amphibians were observed in or near the Aeropines golf course ponds at NAS Oceana. Of the species observed, the American Bullfrog (*Lithobates catesbeianus*), Northern Green Frog (*Lithobates clamitans melanota*) and Southern Leopard Frog (*Lithobates sphenocephalus*) were present in most ponds (Table 20). The Southern Toad (*Anaxyrus terrestris*) and Spring Peeper (*Pseudacris crucifer*) were found in the least number of ponds. Five amphibian species occurred at pond 2 and 3 whereas four species were encountered at pond 6. The remaining ponds and the stream had three or less species. A chorus of Spring Peepers was heard and observed during a nighttime survey on March 12, 2013 at ponds 2 and 6 and adjacent to the golf course behind building 847. During the same survey, a Southern Leopard Frog chorus was observed at ponds 0, 2, 3 and 6. Tadpoles of the Southern Toad were observed in ponds 2 and 3 during the May 2013 survey event. These data suggest that ponds 0, 2, 3, and 6 provide important breeding habitat for several species of frogs and toads. This may be the result of these ponds having

more gently sloping banks, with shallow water with aquatic vegetation growing in areas along portions of their perimeters. In comparison, ponds 1, 4, 5, and 7 generally have steeper sloping banks with no aquatic vegetation and deeper waters along their perimeters.

No salamander species were encountered during this investigation. We did not find this surprising since the majority of salamander species that are potential to occur on the installation are forest dwelling species. Due to the lack of forested habitat around the majority of the ponds and the lack of fallen logs and braches to provide habitat for salamanders, it is unlikely that they occupy the golf course ponds. However, we believe that Pond 7 has the greatest potential for salamanders, particularly the Red-spotted newt (*Notophthalmus viridescens viridescens*), since it has forested habitat along its western edge.

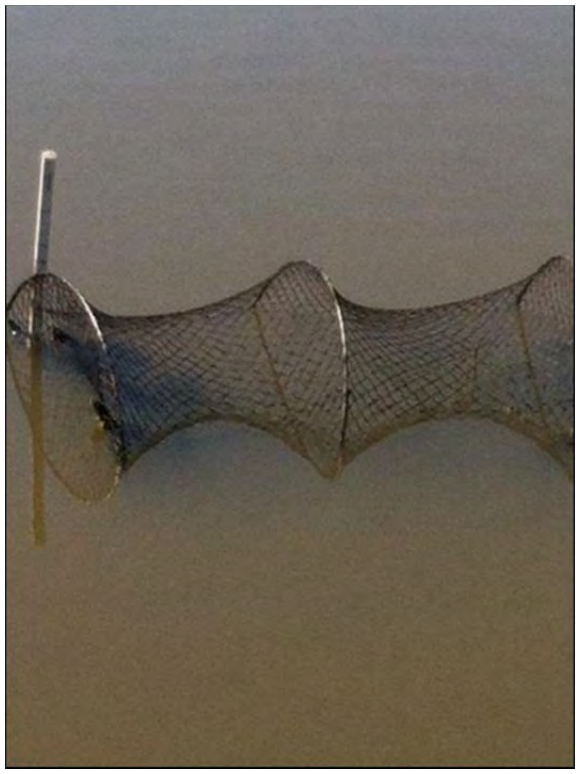
Table 20. Amphibian species confired at the Aeropines Golf Course Ponds

Scientific Name	Common Name	Pond 0	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5	Pond 6	Pond 7	Stream
Anaxyrus terrestris	Southern Toad			X	X	X				
Lithobates catesbeianus	American Bullfrog	X		X	X		X	X		X
Lithobates clamitans melanota	Northern Green Frog	X	X	X	X	X		X	X	
Lithobates sphenocephalus	Southern Leopard Frog	X	X	X	X	X	X	X	X	
Pseudacris crucifer	Spring Peeper			X	X			X		
Acris gryllus	Southern Cricket Frog		X							

1.1.28. Reptiles

In total from all survey events, eight species of reptiles were observed in or near the Aeropines golf course ponds at NAS Oceana (Table 21). One lizard species (Little Brown Skink [*Scincella lateralis*]) was observed in the wooded habitat near the perimeter of Pond 7 and one snake species (Northern Watersnake [*Neriodia sipedon]*) was observed on the edge of the stream west of Pond 5.

Although not observed during this investigation, observations of Eastern Ratsnakes (P*antherophis alleganiensis*) and Northern Rough Greensnakes (*Opheodrys aestivus aestivus*) were reported by



grounds maintenance personnel on the golf course.

Aquatic turtles were frequently observed basking on the edge of most of the golf course ponds and swimming in the ponds. Hoop net turtle traps were deployed in ponds 0, 2, 1, 4, and 6 on 20 June 2013. As a result of the trapping event, nearly 70 turtles of six species were captured. No turtles were captured in pond 2 whereas ponds 4 and 6 had five species each. Sixty one percent of the species captured were Yellow-bellied Sliders (*Trachemys scripta scripta*), 16% were Common Snapping turtles (*Chelydra serpentina serpentine*) and 14% were Eastern Painted Turtles (*Chrysemys picta picta*). These three species were also found in the greatest number of golf course ponds (> 4 ponds). One Eastern Musk Turtle (*Sternotherus odoratus*) was found in Pond 4, and the three Northern Red-bellied Cooters (*Pseudemys rubriventris*) were found in ponds 1 and 6. The invasive Red-eared slider (*Trachemys scripta elegans*) was observed in ponds 0, 4 and 6. All captured turtle species appeared healthy.

Table 21. Reptile species confirmed at the Aeropines Golf Course Ponds

Scientific Name	Common Name	Pond 0	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5	Pond 6	Pond 7	Stream
Scincella lateralis	Little Brown Skink								X	
Nerodia sipedon sipedon	Northern Watersnake									X
Chelydra serpentina serpentina	Common Snapping Turtle	X	X			X	X	X		X
Chrysemys picta picta	Eastern Painted Turtle		X			X	X	X		
Sternotherus odoratus	Eastern Musk Turtle					X				
Pseudemys rubriventris	Northern Red-bellied Cooter		X					X		
Trachemys scripta scripta	Yellow-bellied Slider	X	X			X	X	X	X	
Trachemys scripta elegans	Red-eared Slider	X				X		X		

Conclusion and Recommendations

The ponds located on the Aeropines golf course at NAS Oceana support a variety of amphibian and reptile species typical to southeastern Virginia. Based on the survey results, five amphibians and eight reptile species were document in or around the ponds and stream. The highest diversity of amphibian species was found in ponds 2 and 3, whereas the greatest reptile species diversity was found in ponds 4 and 6. Pond 6 had the highest combined amphibian and reptile species diversity (nine species). Amphibians selected ponds that contained gently sloping banks with shallow water aquatic vegetation. This habitat structure was not a selected by the turtles, which were found along the barren/steep backs of the ponds.

The following recommendations will assist with protecting and enhancing the amphibians and reptiles populations in and around the Aeropines golf course and ponds:

- Avoid mowing (or raise the mower deck height to 8 inches) adjacent to the shoreline of the ponds. Leaving a buffer of natural vegetation around the ponds will provide cover for amphibians and reptiles in addition to limit fertilizer input into the ponds.
- Follow fertilizer, herbicide and insecticide label directions carefully; use the minimum amounts needed to achieve management objectives
- Provide educational materials to maintenance personnel and golfers of the species present on the golf course and encourage them not to kill or harass them when encountered.

- If invasive/exotic plant species (such as Phragmites) begin to grow in the ponds, initiate a control program. Amphibians and reptiles are unable to live in places choked with invasive plant species.
- Consider removing the fish from one or many ponds. Fish of all kinds eat eggs, larvae, tadpoles and adult frogs.
- Consider adding basking logs in one or many of the ponds for turtles. At this time none exist and the turtles are basking on the pond banks, making them more vulnerable to predation.

Birds

Bird species observations were documented during every visit to the golf course. Bird species in around the ponds were identified using binoculars and by listening for species-specific calls. This was not a formal survey but was anecdotal observations. In total from all survey events, 28 species of birds were observed in or near the Aeropines golf course ponds (table 22). Of the species, the Double-crested Cormorant, Canada Goose, Mallard, Red-winged Blackbird, Great Blue Heron, and Great Egret were the most frequent species observed. Ponds 2 and 4 had the greatest number of species diversity (nine and eight respectfully) and ponds 1, 3, and 6 had the least species diversity (two, and three species). The observation of the eagle was recorded during the May 2013 field survey and was of an individual soaring overhead.

Table 22. Bird species observed in and around the Aeropines golf course

Common Name	Pond 0	Pond 1	Pond 2	Pond 3	Pond 4	Pond 5	Pond 6	Pond 7
Double-crested Cormorant	X	X	X	X	X			
Mallard	X	X	X	X		X		
Hooded Merganser			X					
Spotted Sandpiper			X					
Canada Goose			X			X		
Red-winged Blackbird	X		X		X			
Eastern Kingbird			X					
Eastern Mockingbird			X					
Northern Cardinal			X					
American Robin				X	X			

Great Crested Flycatcher							X	
Eastern Towhee							X	
Tufted Titmouse								X
Kill Deer			X					
American Crow					X			
Fish Crow						X		
Red-belied Woodpecker					X			
Pileated Woodpecker								X
Bobwhite Quail					X			
Red-tailed Hawk	X							
Bald Eagle								X
Osprey	X							
Great Blue Heron		X			X	X		X
Green Heron							X	
Great Egret			X		X	X		
Chipping Sparrow				X				
Yellow-billed Cuckoo				X				
Indigo Bunting		X						

Conclusion and Recommendations

Golf courses can be an oasis for wildlife within a manmade environment. Aeropines Golf Course is no exception, with a variety of habitats that include pine woodlands, mix woodlands, old fields, freshwater marsh, ponds, and streams. These habitats are fragmented and produce many ecotones in a relative

small space. Though habitat fragmentation can have a negative impact on many species with particular specialized habitat requirements, it can also be an attractant to other species that are habitat generalist and those which prefer edge type habitats. This is especially true for birds and though a formal survey was not conducted, it is apparent that the Aeropines Golf Course is habitat for a variety of bird species. The following recommendations may help improve existing and create new habitats at the golf course ponds.

- Reduce or discontinue herbicide spraying on the shoreline vegetation allowing this vegetation to reestablish and maintain vegetation buffers next to the ponds (pond 1 and 2 have areas that are good examples of shoreline vegetation). Shoreline vegetation may decrease Canada goose usage of the golf course by limiting easy access to the ponds.
- Reduce or discontinue mowing of the vegetation next to the shoreline at the ponds allowing vegetation to reestablish and maintain a vegetation buffer next to the ponds (pond 1 and 2 have areas that are good examples of shoreline vegetation). Shoreline vegetation may decrease Canada goose usage of the golf course by limiting easy access to the ponds.
- Plant native trees along the shoreline along many of the ponds. In areas that would not impede the golfers but add to the aesthetics of the pond and increase their wildlife value.
- Plant native wetlands plants in appropriate locations in the ponds to create in water habitats. Herbaceous or shrub wetlands can be excellent wildlife habitats for birds and many other species. These areas would also create areas for fish nurseries that are lacking in many of the ponds. Pond 2, 3, 5 may have areas suited for this type of vegetation management.

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NAVFAC Atlantic Biological Resource Services

Contract: N62470-13-D-8016; Task Order: WE04

30 December 2015

Stream Assessment Surveys for Naval Auxiliary Landing Field Fentress (NALFF)

Final Report

Prepared for:
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TABLES

FIGURES

EXECUTIVE SUMMARY

This Project assessed the current condition of selected streams and floodplain wetlands at Naval Auxiliary Landing Field Fentress (NALFF). Seasonal (summer and spring) backpack electrofishing surveys were conducted in streams and floodplain wetlands. In addition to electrofishing, streams were also evaluated for current suitability of habitat (e.g., fish passage) and the potential for enhancements to habitat accessibility.

These data will be used to supplement any existing data and used in current and future environmental planning and management at NALFF. Additionally, these data were analyzed to develop improvement recommendations to habitat as well as fish populations, which are presented in this report. Survey biologists used a modified version of the U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols (RBP) in order to collect a representative sample of the fish assemblage from the appropriate habitat composition in NALFF streams and floodplain wetlands (Barbour et al. 1999). Field crews used the Habitat Assessment Field Data Sheets for Low Gradient Streams, as provided in Barbour et al. (1999). The RBP protocols are included as Appendix D to this report. A "score" was assigned to each of these categories for each surveyed reach so that relative comparisons can be made between reaches and streams. Qualitative habitat surveys were also used to assess pond habitat quality. Additionally, a barrier survey using a combination of assessment protocols was used to identify potential impediments to fish migration within NALFF streams. Water quality was recorded *in situ* at every stream and floodplain wetland during each sampling event, using a hand held multi-parameter meter. Additionally, water grab samples were collected and submitted for laboratory analyses.

In accordance with EPA RBP standards, NALFF streams all fell within marginal and suboptimal categories for habitat quality. Fish surveys at NALFF steams yielded fish assemblages typical of degraded, channelized coastal plain streams. NALFF streams yielded 702 individual fish represented by 23 species. Notably, American eel, a migratory species, were present in NALFF waterbodies. Barrier survey data identified both potential and existing impediments to fish migration through the NALFF installation. Floodplain wetlands fish surveys yielded a total of 30 individual fish, all of which were eastern mudminnow. These data show that NALFF streams and floodplain wetlands offer little to no recreational value. Periodic monitoring of fish populations and evaluation/repair of some culverts is recommended.

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1 INTRODUCTION

1.1 OBJECTIVES

The purpose of this survey was to assess the current condition of the biological resources and habitats of select streams and flood wetlands at Naval Auxillary Landing Field Fentress (NALFF). Assessments included seasonal backpack electrofishing surveys, habitat and water quality measurements, and the characterization of physical barriers to migratory fishes, especially American eel (*Anguilla rostrata*) and alosines, including alewife (*Alosa pseudoharengus*), blueback herring (*A. aestivalis*), American shad (*A. sapidissima*), and hickory shad (*A. mediocris*).

The results of this survey and assessment will be used to supplement any existing data and be incorporated into current and future environmental planning documents, such as the Integrated Natural Resources Management Plan (INRMP) or Environmental Assessments (EA) at NALFF.

1.2 SITE DESCRIPTION

Naval Auxillary Landing Field Fentress (NALFF) is located approximately 7 miles (mi.) (11 kilometers [km]) southwest of Naval Air Station Oceana (NASO) near the community of Fentress in what is now the City of Chesapeake. It encompasses 2,556 acres (ac.) (3,549 hectares [ha]). NALFF is generally bounded by Mount Pleasant Road to the north, Carter Road to the west, Long Ridge Road to the south, and Fentress Airfield Road to the southeast. A detailed description of the site's current and historical operations and land use can be found in the facility's Final INRMP (Navy 2014).

NALFF has an extensive network of artificial drainages and channelized streams, including a major portion of Pocaty Creek (Figure **1**). Stormwater runoff drains into Pocaty Creek, which flows east into the North Landing River/Intercoastal Waterway. NALFF property north of Mount Pleasant Road is part of the riparian forested wetland of the North Landing River and typically retains surface water year round. There are no ponds or other water bodies on NALFF.

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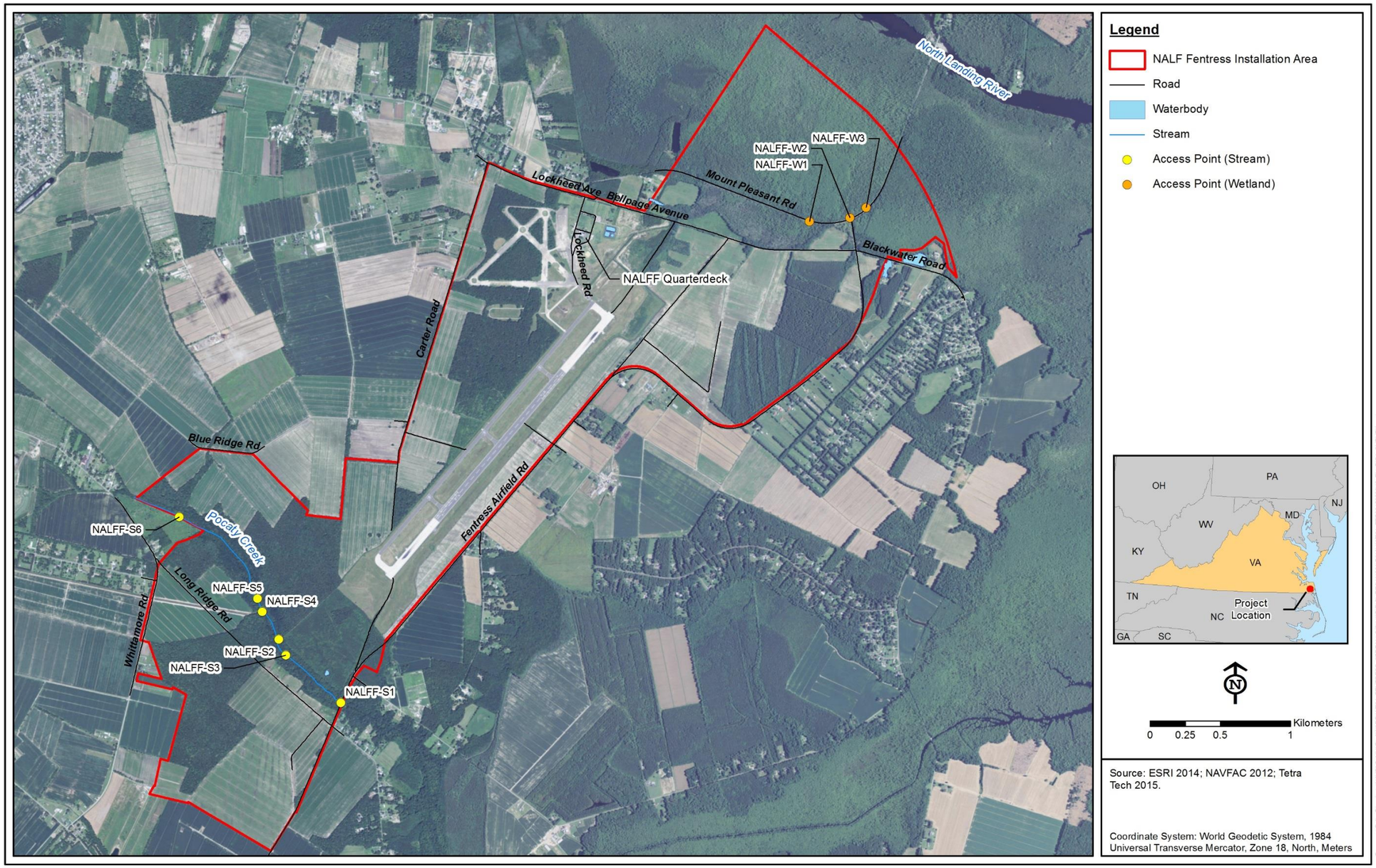

Figure 1: Naval Auxiliary Landing Field Fentress Site Overview of Targeted Stream and Floodplain Wetland Survey Locations

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1.3 FISHERIES MANAGEMENT

Fisheries management at NALFF is focused on the natural and channelized streams of Pocaty Creek, its tributary streams, and the flooded forest tracts associated with the North Landing River. NALFF is primarily a landlocked installation, therefore the ichthyofauna is largely comprised of freshwater species. However, Pocaty Creek provides a connection to estuarine waters further downstream, so the presence of migratory fish species is possible. Fish previously observed at Pocaty Creek include pirate perch (*Aphredoderus sayanus*), redfin pickerel (*Esox americanus*), bluegill (*Lepomis macrochirus*), and largemouth bass (*Micropterus salmoides*).

No rare, threatened, or endangered fish species listed under the federal Endangered Species Act (ESA) have been identified at the Installation; however, blueback herring (*Alosa aestivalis*) and American eel (*Anguilla rostrata*) have been petitioned for listing within ranges that overlap NALFF. A 2013 status review of blueback herring by the National Marine Fisheries Service (NMFS) found that listing under the ESA was not warranted (78 FR 48943–48994), however this determination continues to be controversial and could be revisited by regulators and petitioners. The American eel was petitioned for listing under the ESA in 2010. In 2011, the U.S. Fish and Wildlife Service (USFWS) issued a finding that listing of the species may be warranted, and initiated a status review (76 FR 60431–60444), which was completed in October 2015. USFWS found that listing under the ESA was not warranted (80 FR 60834-60850).

Recommendations for the management of fish resources, such as conservation of fish diversity, cooperation with state and federal agencies, and regular monitoring of natural resources, have been included in the most recent INRMP from 2014 (Navy 2014). The Navy also supports the protection of watersheds through initiatives such as establishing or enhancing riparian forest buffers along unprotected waterways.

2 ASSESSMENT METHODS

The purpose of this study was to perform fish community assessments on targeted streams and wetlands located at NALFF. An additional goal was to qualitatively characterize habitat and identify barriers to fish movement that may affect anadromous and catadromous species by performing a walk-over survey of the streams. In total, five streams and three floodplain wetlands were surveyed in August 2014 and April 2015; habitat and barrier surveys were conducted once. The resulting data and analyses presented here will help characterize existing fish populations and habitat within these Installations; this characterization will aid in ensuring compliance with applicable federal, state, and local statutes and regulations, and with U.S. Department of Defense (DOD) policies, instructions, and guidance. For all field surveys, a Trimble GeoXH GeoExplorer 6000 Series Global Positioning System (GPS) with sub-meter capabilities collected position data.

2.1 WATERBODY SELECTION

Geographic Information System (GIS) layers were used to identify all freshwater stream reaches and wetlands within the NALFF boundaries. Identified waterbodies were cross-referenced with the U.S. Geological Survey (USGS) stream layer and the surface water course centerlines layer to focus only on freshwater streams (Figure 2) and specific wetland areas (Figure 3). A list of streams and ponds were selected based on data needs, accessibility, and scoping requirements (Table 1). Stream site NALFF-S3 (S3) was originally identified as a potential survey reach on the site map; however, it was not sampled because there was no clearly-defined stream channel at that location and no flow was observed. It is possible that the recent construction of the Chesapeake City ditch (located at S4) altered the drainage pattern of S3, causing any flow that may have previously existed in S3 to be diverted to S4. The streams and wetlands listed in Table 1 represent those selected for evaluation during this survey, and Figure 2 shows the corresponding geographic locations of the survey effort. Figure 3 shows the three wetlands sites surveyed (NALFF-W1, -W2, and -W3) within one contiguous wetland area.

Table 1: Streams and Wetlands Surveyed at Naval Auxilary Landing Field Fentress

Waterbody type	Site ID[1]	Name	Location and description
Streams	NALFF-S1	Pocaty Creek	Main Stream Channel at NALFF, flows into North Landing River.
	NALFF-S2	Unnamed	Tributary of Pocaty Creek, drains the area around NALFF runway.
	NALFF-S4	Unnamed	Tributary of Pocaty Creek, drains the agricultural fields south of Pocaty Creek.
	NALFF-S5	Unnamed	Intermittent tributary of Pocaty Creek, drains the agricultural fields north of Pocaty Creek.
	NALFF-S6	Unnamed	Tributary of Pocaty Creek, drains the agricultural fields north of Pocaty Creek.
Floodplain wetlands	NALFF-W1	Unnamed	Forested swamp north of Mt. Pleasant Rd.
	NALFF-W2		
	NALFF-W3		

[1]NALFF-S3 was originally identified as a potential survey reach on the site map; however, it was not sampled because there was no clearly-defined stream channel at that location and no flow was observed

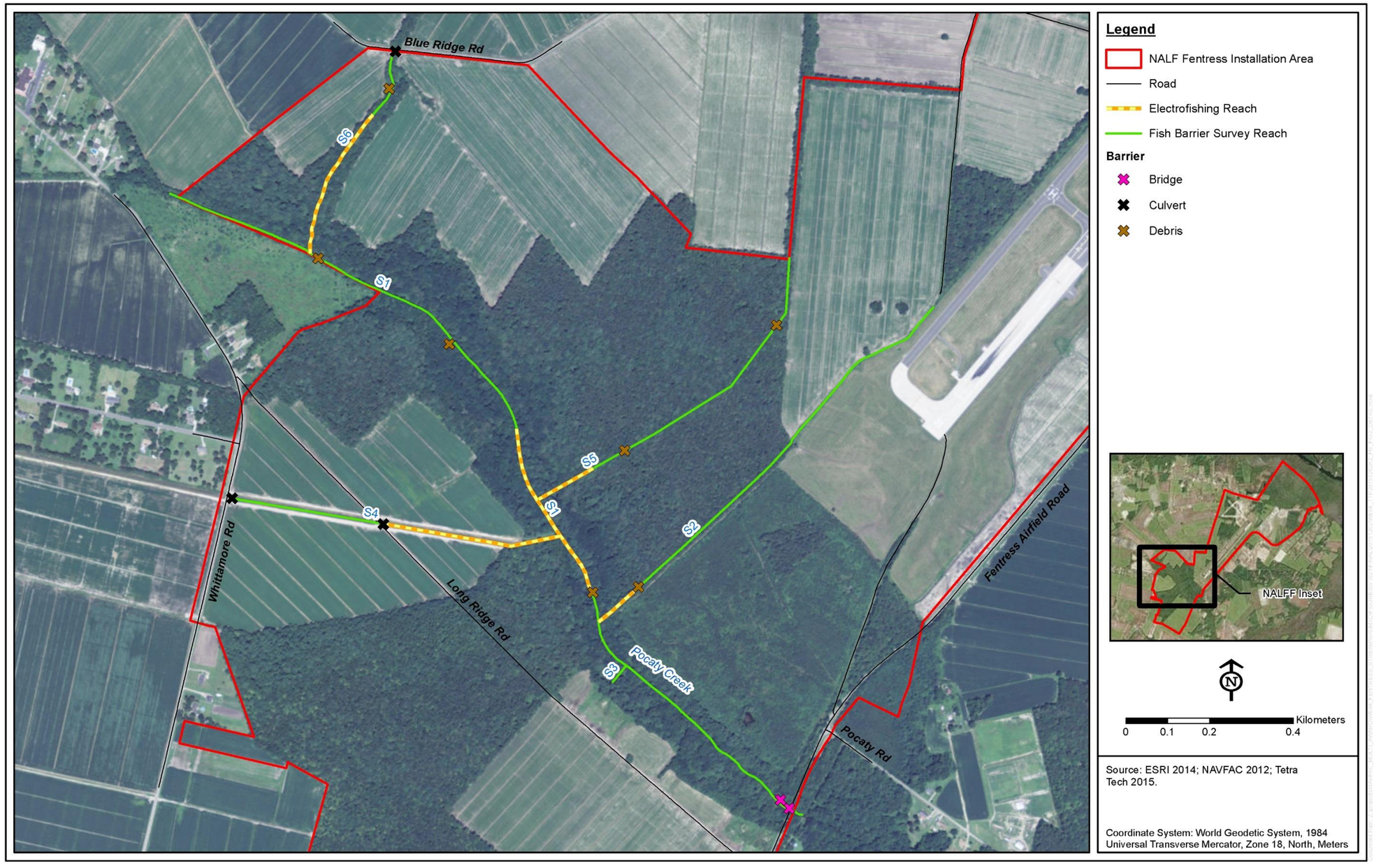

Figure 2: Selected Streams Surveyed at Naval Auxiliary Landing Field Fentress. Note that S3 stream channel is approximated and was not surveyed, as discussed in Section 2.1.

Figure 3: Selected Wetland Areas Surveyed at Naval Auxiliary Landing Field Fentress. Note that the Buffered Area Depicts an approximate 25 m Radius of the Meandering Survey Approach Discussed in Section 2.3.1.

2.2 STREAMS

The stream survey methods consisted of a biological (fish) and physical habitat assessment, as modified from the U.S. Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols (RBP) developed by Barbour et al. (1999) (Appendix D). Fish surveys at all stream locations used backpack electrofishing methods in accordance with the modified RBP. The one-time habitat assessment used visual-based observations to quantify the conditions of the habitat. Water quality was collected *in situ*, as well as for laboratory analyses, with electrofishing efforts.

2.2.1 HABITAT SURVEY

Most of the stream habitat assessment parameters are based on physical characteristics; therefore, the habitat characterization was conducted as a "one-time" characterization for each stream reach. Other parameters, such as water quality (*in-situ* and grab samples) and flow are dynamic and were recorded during each visit.

The RBP habitat survey was performed once on each stream reach that was also sampled for the fish assessment during a walk-over survey. Tetra Tech biologists attempted to walk the wadeable portions of each stream, ensuring that the 150-meter (m) survey reaches would capture a representative sample of stream features (e.g., riffles, runs, pools). Where applicable, natural fish barriers or habitat breaks were used to delineate the start or end of a reach.

For this study, Tetra Tech used the Habitat Assessment Field Data Sheets for Low Gradient Streams, as provided in Barbour et al. (1999) (see Appendix B for blank data sheets). A "score" was assigned to each of these categories for each surveyed reach (NALFF-S1, -S2, -S4, -S5, and -S6) so that relative comparisons can be made between reaches and streams (Table 2). Further detail on scoring and criteria used can be found in Barbour et al. 1999.

By assigning a score and condition category to the ten visual-based habitat assessment parameters described in Table 2, a stream can be assessed and given a total score related to its condition. Scores ranging from 0 to 20 were assigned to each of the ten visual-based habitat assessment parameters, with 0 being a "poor" score and 20 being an "optimal" score. After scoring all parameters, a final score was determined for each reach. The final score can range from 0 to 200, with a score of 0 to 59 representing a "poor" condition; 60 to 112 representing a "marginal" condition; 113 to 165 representing a "sub-optimal" condition; and 166 to 200 representing an "optimal" condition. This rapid, qualitative physical habitat assessment was conducted at each NALFF stream reach that was also assessed for fish populations. Water quality sampling methods were similar between streams and wetlands, and are described in Section 2.4.

Table 2: Rapid Bioassessment Protocol (RBP) Parameters

RBP habitat parameter	Components analyzed in this survey
Physical characterization (one-time)	• Riparian and watershed land use • Stream origin and type • Riparian/canopy vegetation features • Instream parameters – channel width, depth, relative flow, high water mark, and substrate • Proportion of riffles, runs, and pools • Degree of channelization • Potential fish barriers (not part of RBP, but included in this survey)

Water quality (each visit)	• *In situ* measurements, such as water temperature, dissolved oxygen, and conductivity were collected for each stream reach.
	• Grab samples were collected to measure a total of three parameters (listed below) for each stream reach:
	  ○ Total Nitrogen (TN)
	  ○ Total Phosphorus (TPhos) & ortho-Phosphate (SRP) – Method 365.1
	  ○ Total Suspended Solids (TSS) – Method SM 2340D

Habitat features (one-time)	• Large woody debris/debris dams • Aquatic vegetation • Available cover
Visual-based habitat assessment (low gradient streams) (one-time)	• Epifaunal substrate/available cover • Pool substrate characterization • Pool variability • Sediment deposition • Channel flow status • Channel alteration • Channel sinuosity • Bank stability • Bank vegetative protection • Riparian vegetative zone width

2.2.2 BARRIER SURVEY

A combination of assessment protocols was used to identify potential barriers to fish migration within NALFF streams. Fish barrier surveys are typically implemented to assess the potential for habitat use by migratory fishes that may encounter obstacles in their migration, such as culverts, debris dams, beaver dams, or other physical blockages to migration. Additional data forms were included to facilitate the fish barrier survey as a supplement to the modified RBP survey. The fish barrier survey and accompanying data forms were adapted from state natural resource agencies (McInnch and Garman 2004, 1999; Vermont Agency of Natural Resources 2009), which were also recently applied to stream habitat surveys at other Hampton Roads Navy installations; Naval Support Activity (NSA) Northwest Annex, NASO, and the associated Dam Neck Annex (DNA) (Tetra Tech and Stell Environmental 2014; Tetra Tech 2015a, b). Copies of blank field data forms are included in Appendix B. During the modified RBP survey, each of the potential barriers to fish migration were inventoried for as much of a stream as possible within the installation boundaries, beyond the reaches assessed for habitat and fish. The stream was walked by

two field scientists starting at the downstream end of each stream (at the installation boundary, or confluence with another stream) and walking upstream until reaching an apparent habitat break or other boundary. Tetra Tech staff walked the entire wadeable length of each stream to the farthest extent practical (the installation boundary, in most cases) to record and characterize potential barriers to fish migration. Each bridge or culvert crossing and other potential barrier (e.g., beaver dam or large debris dam) was inventoried during the survey and physical measurements of the barrier were obtained in accordance with the data sheet. Photographs were also taken of representative barriers and included in the photograph log (Appendix A).

2.2.3 FISH SURVEY

Fish surveys were conducted at five stream sites within NALFF (reaches S1, S2, S4, S5, and S6). The goal was to sample all five sites during each sampling event, but dry conditions precluded the fish survey at NALFF-S5 in August. The fish sampling methods were modified from the EPA's RBP for fish (Barbour et al. 1999). Field biologists used the 150-m fixed-distance sampling as outlined in the RBP to collect a representative sample of the fish assemblage from the appropriate habitat composition (e.g., riffles, runs, pools) (further details described in USEPA 2007). Where applicable, natural fish barriers or habitat breaks were used to delineate the start or end of a reach.

The downstream start point at each surveyed reach was marked with a temporary pin flag and recorded as a GPS point. A tape measure was used to delineate the 150-m reach of the stream. The upstream end of the reach was also marked with a temporary pin flag and a GPS point. Water quality measurements, including temperature, specific conductance, dissolved oxygen, and percent oxygen saturation, were obtained at the downstream start point of each surveyed reach.

A Smith-Root LR-24 backpack electrofishing unit was used for all stream sites. The LR-24 was calibrated through the "auto-setup" function; then settings such as voltage, frequency, and duty-cycle were fine-tuned according to water parameters and operator experience to maximize the effectiveness of the electrofishing unit and safety of the fish and operator. A single-pass protocol was used. Backpack electrofishing protocols were consistent with those recommended by the U.S. Fish and Wildlife Service (USFWS 2010) and the American Fisheries Society (AFS 2008). The survey began at the downstream end of each reach. The fish survey continued upstream in a bank-to-bank sweeping technique, covering all wadeable habitats within the reach. Effort was measured in duration (seconds [s]) of active electrofishing, or "trigger" time. Variation in effort between reaches is typical due to stream width, depth, and habitat types.

A 12-ft. jon-boat owned and operated by the Virginia Department of Game and Inland Fish (VDGIF), was equipped with a Smith-Root 1.5 kVA pulse box electrofishing unit was used to sample NALFF-S1 during August surveys. In general, boat electrofishing protocols were consistent with those used by the USFWS (USFWS 2010) and the American Fisheries Society (AFS 2008). Stunned fish were captured and stored in a livewell until they were processed at the end of the survey.

At the end of the reach, fish were identified and counted. At least 30 individuals of each species were measured and weighed (total length [TL] to the nearest millimeter [mm]], mass in grams [g]), prior to being released back into the stream. All individuals were observed for any deformities, erosion, lesions, or tumors (DELT anomalies). Fish were identified to the lowest practical taxonomic level in the field based on external characteristics using taxonomic keys, including, "The Freshwater Fishes of Virginia" (Jenkins and Burkhead 1994). Page et al. (2013) was used to ensure accurate common and scientific fish names.

2.3 FLOODPLAIN WETLANDS

The methods used for wetland surveys for this study consisted of a biological (fish) assessment and water quality (*in-situ* and grab samples) collections. Surveys were within a similar framework as outlined above for streams, with the exception of the habitat and barrier survey, which were not conducted at the floodplain wetland sites.

2.3.1 FISH SURVEY

A standardized RBP or fish survey method such as those described for streams (Barbour et al. 1999) or small standing waters (Pope et al. 2009) does not exist for sampling fishes within a forested wetland. Therefore, previous surveys of this habitat type have utilized highly variable sampling designs and equipment (electrofishing, seines, lift nets, fish traps, and Rotenone) with inconsistent results due to the physical restrictions of the structured habitat (e.g., tree trunks, cypress knees, stumps, snags, etc.) (Adamus and Brandt 1990). Knight and Bain (1996) evaluated four quantitative (area-standardized electrofishing, trap nets, small-mesh gillnets, and large-mesh gillnets) and two qualitative (non-standardized electrofishing and larval dip netting) sampling techniques. They determined that non-standardized electrofishing was adequate to evaluate species composition in a rapid bioassessment approach (Knight and Bain 1996).

For consistency with the rapid bioassessment approach used for streams, non-standardized electrofishing was used to sample fishes in the forested riparian wetlands at NALFF. Fish surveys were conducted at three floodplain wetland sites within NALFF. All three sites were sampled during each sampling event. Three representative areas were surveyed using backpack electrofishing methods. Semi-protected areas were targeted in order to minimize escape of any partially-stunned fish in this otherwise open swamp. A meandering approach was used and the effort was focused on areas that were more readily accessible, within an approximate 25-m radius of the access point. These points are shown in Figure 3, with a 25-m buffer to indicate the extent of coverage. Large portions of the swamp were not wadaeble due to the water depth and soft bottom, which resulted in greater than waist deep water in most areas. Therefore, shallower areas with more solid footing was the limiting factor in locating the survey sites. All fishes collected were identified, weighed, and measured as previously described in Section 2.2.3. All starting locations were recorded with a GPS point.

2.4 WATER QUALITY

Water quality was recorded *in situ* at every stream and wetland during each sampling event, using a hand held multi-parameter meter (YSI 556). Parameters measured included water temperature (degrees Celsius [°C]), dissolved oxygen (milligrams per liter [mg/L] and percent [%] saturation), pH, and conductivity (milliSiemens per centimeter [mS/cm]).

Additionally, water grab samples were submitted for laboratory analyses at TestAmerica Laboratories Inc. in Savannah, GA. Laboratory analysis measured total nitrogen (TN), total phosphorus (TPhos), ortho-phosphate (SRP), and total suspended solids (TSS). TN was measured using EPA Method 351.2, as well as a calculated method. TPhos was analyzed in accordance with EPA Method 365.4. SRP analysis used EPA Method 365.1. TSS was measured using SM 2540D.

2.5 DATA ANALYSIS

Field data were transferred from field data sheets to a Microsoft Excel spreadsheet. Metrics calculated from the data included catch per unit effort (CPUE) and a species diversity index. CPUE allows for a

standardization of the fishing effort across streams, which enables comparisons where effort was not consistent. CPUE was calculated by dividing the total number of fish collected at each stream by the total sampling time (in seconds) of each stream. Species richness, commonly denoted as *R*, is simply the number of different species present in the dataset. A diversity index allows for comparisons of species diversity among multiple locations (streams in this case). The Simpson index (λ) measures the degree of concentration and is calculated by:

$$\lambda = \sum_{i=1}^{R} {p_i}^2$$

where p_i is the proportional abundance of each species within each sampling reach (number of individuals of species *i*, divided by the total number of individuals [*n*] in each sampling reach) and *R* is species richness. Values of λ range from 0 to 1, with lower values representing higher diversity. Another diversity parameter that is often used is the Shannon-Wiener diversity index (*H'*), which is calculated by using the proportional abundance of each species observed in the sample, as follows:

$$H' = -\sum_{i=1}^{R} p_i \cdot \ln p_i$$

In this equation, p_i is again the proportional abundance of each species and *R* is species richness. The resulting *H'* values are the Shannon-Wiener diversity index values for each sampling reach, with higher values corresponding to greater diversity.

3 RESULTS

In general, fish surveys in streams captured a wide range of species, with 23 species captured in the NALFF streams; however, in the NALFF wetlands, only eastern mudminnows were observed. A total of 732 individual fishes were captured from all sites, with the greatest numbers (702) and diversity (23 species) occurring in the streams. The most abundant species were pirate perch (*Aphredoderus sayanus*), eastern silvery minnow (*Hybognathus regius*), and redear sunfish (*Lepomis microlophus*), respectively. Only 30 individuals were captured during wetland electrofishing efforts, all of which were eastern mudminnow. All fishes captured from the NALFF stream and wetland sampling efforts are shown in Table 3.

Table 3: All Fishes Collected from the 2014/2015 NALFF Stream and Wetland Sampling

Common name	Species	*NALFF occurrence*	
		Streams	Wetlands
American eel	*Anguilla rostrata*	●	
Bluegill	*Lepomis macrochirus*	●	
Bowfin	*Amia calva*	●	
Brown bullhead	*Ameiurus nebulosus*	●	
Chain pickerel	*Esox niger*	●	
Common carp	*Cyprinus carpio*	●	
Creek chubsucker	*Erimyzon oblongus*	●	
Eastern mosquitofish	*Gambusia holbrooki*	●	
Eastern mudminnow	*Umbra pygmaea*	●	●
Eastern silvery minnow	*Hybognathus regius*	●	
Gizzard shad	*Dorosoma cepedianum*	●	
Golden shiner	*Notemigonus crysoleucas*	●	
Green sunfish	*Lepomis cyanellus*	●	
Largemouth bass	*Micropterus salmoides*	●	
Mud sunfish	*Acantharchus pomotis*	●	
Pirate perch	*Aphredoderus sayanus*	●	
Pumpkinseed	*Lepomis gibbosus*	●	
Redear sunfish	*Lepomis microlophus*	●	
Redfin pickerel	*Esox americanus*	●	
Rock bass	*Ambloplites rupestris*	●	
Warmouth	*Lepomis gulosus*	●	
Yellow bullhead	*Ameiurus natalis*	●	
Yellow perch	*Perca flavescens*	●	
Unidentified juvenile sunfish	*Centrarchidae sp.*	●	

3.1 STREAMS

3.1.1 HABITAT

The habitat and barrier surveys were conducted from 12 to 15 August 2014 and 7 to 8 April 2015. Most of the reaches were 150 m in length, with one longer and one shorter. The stream reach locations are shown in Figure 2. Table 4 highlights the physical characteristics of the stream, with full results of the habitat survey and RBP assessment provided in the raw field data sheets in Appendix C.

A majority of NALFF streams were perennial, originating as airfield or agricultural field drainage. NALFF-S5 was categorized as intermittent, because it was dry during the August survey, but not during the April survey. Although the tributary streams (S2–S6) exhibited higher water levels during the spring 2015 survey compared to the summer 2014 survey, the water level within Pocaty Creek (S1) was substantially lower during the spring survey. The coastal plain streams in this part of Virginia commonly exhibit wind-driven water levels (i.e., higher levels during easterly winds, and lower levels during westerly winds), as was likely the case for Pocaty Creek during this time (VDGIF, personal communication).

The streams were highly channelized and surrounded by forest, open field, and military airfield land, with mixed hardwood trees providing partial to full shade. Nearly all of the banks were stable with minimal erosion or scouring within the surveyed reach. None of the surveyed reaches showed signs of non-point source pollution outside of the agricultural drainage, or irregular odors. A rather unique sediment deposit was observed in NALFF-S2, which completely blocked the stream channel at observed flows (see photo #144934000 and #144948000, Appendix A), suggesting an upstream source of erosion and sediment transport (possibly either the agricultural fields or the runway).

The results of the physical habitat surveys of NALFF streams indicated that they are highly disturbed and do not offer optimal habitat for aquatic organisms (Table 5). All surveyed stream reaches fell within the “marginal” or “sub-optimal”categories. The lack of available epifaunal substrate or cover limited the quality of fish habitat for most of these streams. Most streams lacked suitable pool habitat, greatly limiting habitat variability throughout the surveyed streams. Channel sinuosity was another parameter that most surveyed reaches lacked because of the degree of channelization for each stream. This also contributed to the lack of pool habitat throughout most reaches as well. Generally, NALFF streams scored well on bank stability, falling within the “optimal” and “suboptimal” categories; although NALFF-S5 and NALFF-S6 scored in the “marginal” category (Table 5). Fish barriers also presented potential fish passage issues within some of the stream reaches (Table 6).

NALFF-S1 is Pocaty Creek, which is the primary stream channel at NALFF. S1 runs west-east along the southern portion of the installation and intersects Fentress Airfield Rd. at the installation boundary. The surveyed habitat reach extended well beyond the typical 150 m reach, to cover the entire 2,200 m length of the creek on installation property. The habitat survey began at Fentress Airfield Rd. and continued to the western installation boundary, downstream of where Pocaty Creek crosses underneath Wittamore Rd. and becomes an agricultural ditch. The width of S1 ranged from 6.0 to 8.0 m and its depth was 0.5 to 1.0 m. This reach is a natural stream channel, but with areas of channelization, and is surrounded by forest, field, and military airfield use. The dominant riparian vegetation was a mix of oak, hickory, and paw paw which provided a shaded canopy. The morphological stream types that comprised the reach were: 95% run and 5% pool. Pool formation was associated with large debris dams. The water was turbid (opaque) with floating algae and filamentous algae clusters throughout the reach. The bottom sediments were extremely soft, which made this stream unwadaeble for its entire reach, therefore the habitat survey and barrier survey were conducted by canoe. Sediments consisted of silt

(40%), clay (40%) and sand (20%). Areas of organic detritus and muck-mud were also present. NALFF-S1 scored a 114 based on the RBP, which is considered "sub-optimal" habitat.

The NALFF-S1 barrier survey reach covered from Fentress Airport Rd. up to the installation boundary downstream from the road crossing at Wittamore Rd. There were five potential fish passage barriers identified: two bridges and three debris dams. Bridges did not present any fish passage obstacles because of high clearances and minimal blockages (Photo #145023000, Appendix A). Debris dams were composed of leaf litter, trash, and small/large woody debris. Debris Dam-1 (Photo #DSCF0275, Appendix A) is large enough to potentially deter river herring from migrating past that point (VDGIF, personal communication). Additionally, five partial debris dams (which do not block the entire channel width) were observed within the surveyed reach.

NALFF-S2 is a perennial tributary of Pocaty Creek. It is in close proximity to the airfield. The average width of the stream was 1.2 m; it was 0.3 m to 1.0 m deep. This reach was a drainage channel for the runway surrounded by forest and military airfield uses. Mixed hardwoods provided shade to most of the reach, which was 100% pooled. No aquatic vegetation was present. The bottom consisted of mostly sand (65%) and clay (30%) with small portions of silt (5%). A small amout of detritus was present. NALFF-S2 scored a 123 based on the RBP, which is considered "sub-optimal" habitat.

The NALFF-S2 barrier survey revealed a large sediment deposit, which was the only barrier identified on S2. It spanned the entire stream and created a full blockage (Photo #144934000 and #144948000, Appendix A) at the observed flow conditions. Fish passage for species other than American eel is unlikely. No partial debris dams were observed within the surveyed reach.

NALFF-S4 is a perennial tributary of Pocaty Creek and is the recently created Chesapeake City ditch, which was estimated to be constructed in 2013 to improve drainage from Wittamore Rd. Most of this reach bisects an agricultural field, with access roads less than 5 m from both banks. It is highly channelized, with a width of 7 m and a depth of 0.3 m. The morphological stream types that comprised the reach were: 95% runs and 5% pools. Broadleaf cattail (*Typha latifolia*) was the dominant vegetation within the reach, which also contained rooted emergent vegetation and attached algae. The bottom consisted of silt (50%), clay (40%), and sand (10%) with some detritus. NALFF-S4 scored an 84 based on the RBP, which is considered "marginal" habitat.

The NALFF-S4 barrier survey began at the confluence of Pocaty Creek, and progressed upstream to the installation boundary at the Whittamore Rd. culvert. There were two potential fish passage barriers within the installation encountered on this stream; both were identical concrete box culvert structure (culverts #1 and 2) and were deemed to be highly passable for fish (Photo #145108000, Appendix A). No partial debris dams were observed within the surveyed reach.

NALFF-S5 is an intermittent tributary of Pocaty Creek. The reach was dry during the August 2014 survey, so it was only surveyed during the April 2015 survey. It is channelized with a width of 1 to 2 m and a depth of 0.6 m. The reach was surrounded by forest, field, and military use. The dominant riparian vegetation consisted primarily of red maple, mixed hardwoods, and briar. Aquatic vegetation was sparse, appearing in 5% of the reach length. The water was opaque with a sheen of water surface oils in spots. The bottom consisted mostly of silt (70%) and sand (20%), with abundant organic detritus and muck-mud. NALFF-S5 scored an 111 based on the RBP, which is considered "marginal" habitat.

The NALFF-S5 barrier survey began at the confluence of Pocaty Creek, and progressed upstream to the installation boundary near an agricultural field. There were two debris dams, composed of woody debris (Photo #154358598 and #154457493, Appendix A), that exhibited minimal fish passage concerns for this stream. No partial debris dams were observed within the surveyed reach.

NALFF-S6 is a perennial tributary of Pocaty Creek. The reach bisects an agricultural field. It is channelized with a width of 1 to 2 m and a depth of 0.5 m. The riparian zone consisted primarily of paw paw and mixed hardwoods. Aquatic vegetation was absent. Oyster shell hash was found in the substrate throughout the reach. NALFF-S6 scored an 85 based on the RBP, which is considered “marginal” habitat.

The NALFF-S6 barrier survey progressed from the confluence of Pocaty Creek to the upstream culvert at Blue Ridge Rd. There were two potential fish passage barriers encountered on the portion of this stream within the installation: a debris dam and a concrete culvert. The concrete culvert was a two-culvert structure (culvert #1). One culvert was dry, and the other had 5 cm of water during the August 2014 survey (Photo #145146000, Appendix A) . The lack of water makes this structure impassible for most fish species, except for the American eel. The debris dam was composed of leaf litter and small woody debris (Photo #145155000, Appendix A), that exhibited minimal fish passage concerns for this stream. Additionally, six partial debris dams were observed within the surveyed reach.

Table 4: Physical Habitat Assessment Data for Each Stream Reach Surveyed at Naval Auxiliary Landing Field Fentress

Reach	NALFF-S1	NALFF-S2	NALFF-S4	NALFF-S5	NALFF-S6
Date	4/7/2015	8/13/2014	8/12/2015	4/8/2015	8/12/2014
Weather	Clear/sunny	Clear/sunny	65% cloud cover	Intermittent showers, 100% cloud cover	Occational drizzle, 100% cloud cover
Previous 24 hours	Intermittent showers	Intermittent showers	Intermittent showers	Intermittent showers	Intermittent showers
Watershed features	Mixed hardwood forest, agricultural field, military land use, agricultural field drainage.	Mixed hardwood forest in lower watershed. Upper watershed is primarily agricultural land and airfield.	No forest canopy. Agricultural land, reach bisects a soybean field, moderate local watershed erosion.	Mixed hardwood forest in watershed. Upper watershed is primarily agricultural land.	Mixed hardwood forest in watershed riparian zone only. Most of watershed is agricultural land.
Reach length	2,200 m	106 m	150 m	150 m	150 m
Stream width	6-8 m	1.2 m	7 m	--	1-2 m
Stream depth	0.5-1.0 m	0.5-1.0 m	0.3 m	0.6 m	0.5 m
High-water mark	0.8 m	0.9 m	0.3 m	0.1 m	0.3 m
Percent riffle	0%	0%	0%	5%	5%
Percent run	95%	0%	95%	90%	90%
Percent pool	5%	100%	5%	5%	5%
Channelization	Minimal	Moderate	High	High	High
Large woody debris	Abundant (69 m^2)	Sparse (1 m^2)	None	Sparse (2 m^2)	Sparse (2 m^2)
Dominant vegetation	Floating algae, filamentous algae in clumps	None	Rooted emergent, attached algae	None	None
Percent of reach with vegetation	20%	0%	100%	5%	0%
Dominant inorganic substrate (%)	Silt (40%)	Sand (65%)	Silt (50%)	Silt (70%)	Sand (65%)
Secondary inorganic substrate (%)	Clay (40%)	Clay (30%)	Clay (40%)	Sand (20%)	Clay (30%)

Reach	NALFF-S1	NALFF-S2	NALFF-S4	NALFF-S5	NALFF-S6
Tertiary inorganic substrate (%)	Sand (20%)	Silt (5%)	Sand (10%)	Clay (10%)	Silt (5%)
Dominant organic substrate (%)	Muck-mud (50%)	Detritus (5%)	Detritus (20%)	Muck-mud (90%)	Detritus (5%)
Secondary organic substrate (%)	Detritus (25%)	--	--	Detritus (10%)	--

NOTE: Reference photographs are located in Appendix A

Table 5: Physical Habitat Assessment Scores and Condition Categories for Each Surveyed Reach within Naval Auxiliary Landing Field Fentress Streams in the 2014/2015 Surveys

Habitat parameter		NALFF-S1		NALFF-S2		NALFF-S4		NALFF-S5		NASO-S6	
		Score	Condition	Score	Condition	Score	Condition	Score	Condition	Score	Condition
Epifaunal substrate/available cover		3	Poor	4	Poor	7	Marginal	8	Marginal	10	Marginal
Pool substrate characterization		6	Marginal	12	Sub-optimal	10	Marginal	12	Sub-optimal	7	Marginal
Pool variability		6	Marginal	13	Sub-optimal	10	Marginal	11	Sub-optimal	6	Marginal
Sediment deposition		11	Sub-optimal	15	Sub-optimal	11	Sub-optimal	9	Optimal	6	Marginal
Channel flow status		13	Sub-optimal	13	Sub-optimal	14	Sub-optimal	8	Marginal	9	Marginal
Channel alteration		15	Sub-optimal	11	Sub-optimal	1	Poor	13	Sub-optimal	8	Marginal
Channel sinuosity		8	Marginal	6	Marginal	1	Poor	6	Marginal	7	Marginal
Bank stability	Left (west)	9	Optimal	8	Sub-optimal	6	Sub-optimal	6	Marginal	3	Marginal
	Right (east)	9	Optimal	8	Sub-optimal	6	Sub-optimal	6	Marginal	4	Marginal
Vegetative protection	Left (west)	9	Optimal	10	Optimal	8	Sub-optimal	7	Sub-optimal	9	Optimal
	Right (east)	9	Optimal	7	Sub-optimal	8	Sub-optimal	7	Sub-optimal	9	Optimal
Riparian vegetative zone	Left (west)	7	Sub-optimal	10	Optimal	1	Poor	9	Optimal	4	Marginal
	Right (east)	9	Optimal	6	Sub-optimal	1	Poor	9	Optimal	7	Sub-optimal
TOTAL SCORE and OVERALL CONDITION CATEGORY		**114**	**Sub-optimal**	**123**	**Sub-optimal**	**84**	**Marginal**	**111**	**Marginal**	**85**	**Marginal**

Note: for S2, S5, S6; left bank is west, right bank is east. For S4; left bank is east, right bank is west. For S1; left bank is south, right bank is north

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Table 6: Characteristics of Potential Barriers to Fish Migration in the Surveyed Reaches of Naval Auxiliary Landing Field Fentress

Reach	NALFF-S1					NALFF-S2	NALFF-S4		NALFF-S5		NALFF-S6	
Barrier Type and ID	**Bridge 1**	**Bridge 2**	**Debris 1**	**Debris 2**	**Debris 3**	**Debris 1**	**Culvert 1**	**Culvert 2**	**Debris 1**	**Debris 2**	**Debris 1**	**Culvert 1**
Date	8/11/2014	8/11/2014	4/7/2015	4/7/2015	4/7/2015	8/13/2014	8/12/2014	8/12/2014	4/8/2015	4/8/2015	8/12/2015	8/12/2015
Barrier type	Concrete Bridge	Timber Bridge	Debris Dam	Debris Dam	Debris Dam	Debris Dam	Concrete Culvert	Concrete Culvert	Debris Dam	Debris Dam	Debris Dam	Concrete Culvert
Barrier height	--	--	0.5–0.8 m	0.3 m	0.2 m	0.4 m	--	--	0.25 m	1.0 m	0.2 m	0.3 m
Vertical water drop	--	--	None	None	0.1 m	None	0	0	0.25 m	--	0.1 m	0
Channel wetted width	19.1 m	19.1 m	6.0 m	5.0 m	3.0 m	1.2 m	6.4 m	6.4 m	1.5 m	2.0 m	2.5 m	4.9 m (pool)
Structure width/culvert length	8.7 m	4.4 m	4.0 m	2.0 m	0.5 m	0.3 m	3.0 m	3.0 m	1.5 m	2.0 m	2.0 m	11.0 m
Structure span/culvert diameter	19.1 m	--	--	--	--	1.8 m	24.4 m	24.4 m	1.0 m	3.0 m	--	1.2 m
Structure clearance	1.7 m	1.2 m	--	--	--	--	1.2 m	1.2 m	--	--	--	--
Material	Concrete	Timber	Woody debis, leaf litter	Woody debis, leaf litter	--	Sediment	Concrete	Concrete	Woody debris	Woody debris	Woody debris, leaf litter, sediment	Concrete
Number of arches/culverts	1	3	--	--	--	--	1	1	--	--	--	2
Opening obscured upstream?	No	Partially	--	--	--	--	No	No	--	--	--	No
Pool immediately downstream?	Yes	No	No	No	No	Y	--	--	Yes	No	--	Yes
Max pool depth - downstream	0.7 m	--	--	--	--	0.5	--	--	1.0 m	--	--	--
Water depth in structure	0.9–1.2 m	0.9–1.2 m	--	--	--	--	0.1 m	0.1 m	--	--	--	< 0.1 m
Bank erosion - left	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Bank erosion - right	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Armoring - left	No	Yes	--	--	--	--	Yes	Yes	--	--	--	Yes
Armoring - right	No	Yes	--	--	--	--	Yes	Yes	--	--	--	Yes
Scour - left	No	--	No	No	No	No	No	No	No	No	No	No
Scour - right	No	Yes	No	No	No	No	No	No	No	No	No	No
Beaver activity?	No	No	No	No	No	No	No	No	No	No	No	No
Beaver dam nearby? - downstream (distance)	No	No	No	No	No	No	No	No	No	No	No	No
Partial debris-dam tally for reach	5					0	--		--		6	

Reach	NALFF-S1					NALFF-S2	NALFF-S4		NALFF-S5		NALFF-S6	
Barrier Type and ID	**Bridge 1**	**Bridge 2**	**Debris 1**	**Debris 2**	**Debris 3**	**Debris 1**	**Culvert 1**	**Culvert 2**	**Debris 1**	**Debris 2**	**Debris 1**	**Culvert 1**
Remarks	Fentress Airfield Rd. No barrier to fish migration.	Partial debris dam under collapsed arch. No barrier to fish migration.	Large debris dam; likely a barrier to migration of river herring, but not American eel.	Minimal fish passage concerns.	Minimal fish passage concerns.	Buildup of sediment creates a fish barrier to most species, passable only at high flows, except for American eel.	No barrier to fish migration.	No barrier to fish migration.	Minimal fish passage concerns.	Minimal fish passage concerns.	Minimal fish passage concerns.	One culvert dry, the other less than 0.1 m water depth. Fish barrier to most species, passable only at high flows, except for American eel,.

NOTE: Reference photographs are located in Appendix A

3.1.2 FISH

A total of 702 fishes, represented by 23 species, were collected from electrofishing the five NALFF stream reaches during two different time periods. All individuals were positively identified at the species level in the field with the exception of juvenile sunfish sp., because distinguishing traits are lacking at that size class. Pirate perch was the most abundant species, representing 13.0% of the total catch, followed by eastern silvery minnow at 11.7%, and redear sunfish at 9.8%. Fish sampling at each stream reach was an average of 934 seconds (Table 7).

Table 7: Backpack Electrofishing Effort at Naval Auxiliary Landing Field Fentress by Stream

Stream ID	Sampling duration (seconds)	
	August 2014	April 2015
NALFF-S1	989	600
NALFF-S2	1062	900
NALFF-S4	953	1117
NALFF-S5	--	946
NALFF-S6	947	891

The frequency of occurrence for each species was different in each of the five surveyed streams (Table 8; Table 9; Table 10). American eel, bluegill, pirate perch, and pumpkinseed were universally found in all five surveyed stream reaches. Eastern mosquitofish and redear sunfish occurred in four of five streams. All other species occurred in only one to three streams. The overall length distributions within-species were similar among all surveyed streams.

Table 8: Number, Relative Abundance, Frequency of Occurrence, and Length of All Fishes Collected in Naval Auxiliary Landing Field Fentress Streams

Common name	Scientific name	Number of individuals	Total relative abundance (%)	Range of total length (mm)	Range of mass (g)
Pirate perch	*Aphredoderus sayanus*	91	13.0%	34–95	1.7–30.0
Eastern silvery minnow	*Hybognathus regius*	82	11.7%	57–109	3.0–12.0
Redear sunfish	*Lepomis microlophus*	69	9.8%	31–102	1.0–20.0
Juvenile sunfish sp.	*Centrarchidae sp.*	66	9.4%	34–71	1.0–8.0
Bluegill	*Lepomis macrochirus*	65	9.3%	37–187	1.3–115.0
Eastern mosquitofish	*Gambusia holbrooki*	57	8.1%	22–51	0.2–4.0
Pumpkinseed	*Lepomis gibbosus*	57	8.1%	36–137	1.5–34.0
American eel	*Anguilla rostrata*	48	6.8%	80–475	2.0–48.0
Golden shiner	*Notemigonus crysoleucas*	32	4.6%	53–106	1.0–11.0
Largemouth bass	*Micropterus salmoides*	27	3.8%	47–255	4.0–150.0
Redfin pickerel	*Esox americanus*	21	3.0%	112–172	8.0–38.0
Green sunfish	*Lepomis cyanellus*	20	2.8%	49–116	2.1–25.0
Yellow perch	*Perca flavescens*	19	2.7%	118–204	21.0–105.0
Eastern mudminnow	*Umbra pygmaea*	13	1.9%	46–112	2.0–16.0
Warmouth	*Lepomis gulosus*	8	1.1%	73–124	11.0–38.0
Creek chubsucker	*Erimyzon oblongus*	7	1.0%	71–189	8.0–89.0
Brown bullhead	*Ameiurus nebulosus*	6	0.9%	68–126	7.0–11.0
Gizzard shad	*Dorosoma cepedianum*	4	0.5%	67–113	6.0–13.0
Bowfin	*Amia calva*	2	0.3%	205–211	75.0–98.0
Common carp	*Cyprinus carpio*	2	0.3%	124–133	29.0–36.0
Mud sunfish	*Acantharchus pomotis*	2	0.3%	114–124	29.0–37.0
Yellow bullhead	*Ameiurus natalis*	2	0.3%	74–202	9.0–103.0
Chain pickerel	*Esox niger*	1	0.1%	281	--
Rock bass	*Ambloplites rupestris*	1	0.1%	138	47.0
Total		**702**	**100.0%**	--	--

The total number of fishes collected, species richness, and resulting species diversity varied across the five reaches, with the highest total number of individuals collected at NALFF-S4 (201 individuals) during the August 2014 survey and the least number of species and individuals were collected at NALFF-S5 (20 individuals) during April 2015 surveys. The 17 species that occurred at NALFF-S6 during August 2014 surveys resulted in a species diversity index that was greater than any other surveyed stream. The following tables and summaries present results of the fish survey by stream reach to enable comparisons among streams and seasons.

NALFF-S1. A total of 77 fishes, represented by 7 species, were collected from NALFF-S1 on 15 August 2014. Bluegill was the most abundant species, representing 26.0% of the total catch, followed by creek chubsucker and eastern silvery minnow at 23.4%, and golden shiner at 19.5% (Table 9). A total of 104 fishes, represented by 10 species, were collected from NALFF-S1 on 7 April 2015. Redear sunfish was the most abundant species, representing 37.5% of the total catch, followed by pumpkinseed at 23.1%, and eastern silvery minnow at 14.4% (Table 10).

NALFF-S2. A total of 27 fishes, represented by 5 species, were collected from NALFF-S2 on 14 August 2014. Pirate perch were the most abundant species, representing 66.7% of the total catch, followed by pumpkinseed at 18.5%, and green sunfish at 11.1% (Table 9). A total of 37 fishes, represented by 10 species, were collected from NALFF-S2 on 7 April 2015. Eastern mosquitofish and pirate perch were the most abundant species, each representing 24.3% of the total catch, followed by American eel at 16.2%, and bluegill at 10.8% (Table 10).

NALFF-S4. A total of 201 fish, represented by 13 species, were collected from NALFF-S4 on 12 August 2014. Juvenile sunfish sp. was the most abundant species, representing 23.8% of the total catch, followed by eastern silvery minnow at 20.6%, and eastern mosquitofish at 17.5% (Table 9). A total of 53 fishes, represented by 5 species, were collected from NALFF-S4 on 7 April 2015. American eel were the most abundant species, representing 37.7% of the total catch, followed by pirate perch and green sunfish each at 18.9%, and eastern mosquitofish at 13.2% (Table 10).

NALFF-S6. A total of 147 fish, represented by 17 species, were collected from NALFF-S6 on 12 August 2014. Pirate perch was the most abundant species, representing 19.7% of the total catch, followed by redfin pickerel at 14.3%, and redear sunfish at 10.9% (Table 9). A total of 36 fish, represented by 8 species, were collected from NALFF-S6 on 8 April 2015. Pirate perch was the most abundant species, representing 33.3% of the total catch, followed by pumpkinseed at 25.0%, and green sunfish at 13.9% (Table 10).

Table 9: Fish Composition in NALFF during August 2014 Sampling Period

Common name	NALFF-S1		NALFF-S2		NALFF-S4		NALFF-S6	
	#	%	#	%	#	%	#	%
Bluegill	20	26.0%	4	10.8%	20	10.0%	12	8.2%
Eastern silvery minnow	18	23.4%	--	--	46	22.9%	12	8.2%
Eastern mosquitofish	--	--	9	24.3%	27	13.4%	--	--
Juvenile sunfish sp.	--	--	3	8.1%	53	26.4%	10	6.8%
Pirate perch	--	--	9	24.3%	--	--	29	19.7%
Largemouth bass	--	--	1	2.7%	20	10.0%	6	4.1%
Redear sunfish	--	--	--	--	10	5.0%	16	10.9%
American eel	--	--	6	16.2%	13	6.5%	4	2.7%
Redfin pickerel	--	--	--	--	--	--	21	14.3%
Golden shiner	15	19.5%	--	--	--	--	2	1.4%
Yellow perch	2	2.6%	--	--	--	--		
Eastern mudminnow	--	--	2	5.4%	--	--	10	6.8%
Pumpkinseed	3	3.9%	--	--	--	--	9	6.1%
Warmouth	--	--	--	--	2	1.0%	6	4.1%
Creek chubsucker	18	23.4%	--	--	6	3.0%	--	--
Brown bullhead	--	--	--	--	--	--	5	3.4%
Gizzard shad	1	1.3%	--	--	1	0.5%	--	--
Common carp	--	--	--	--	1	0.5%	1	0.7%
Green sunfish	--	--	--	--	1	0.5%	1	0.7%
Yellow bullhead	--	--	1	2.7%	1	0.5%	--	--
Mud sunfish	--	--	1	2.7%	--	--	1	0.7%
Bowfin	--	--	--	--	--	--	2	1.4%
Rock bass	--	--	1	2.7%	--	--	--	--
Total individuals	77		37		201		147	
Time sampled (s)	989		1062		953		947	
CPUE	0.08		0.03		0.21		0.16	
Species richness (*R*)	7		10		13		17	
Simpson Diversity Index (λ)	0.22		0.17		0.17		0.10	
Shannon diversity index (H')	1.63		1.98		2.00		2.48	

Table 10: Fish Composition in NALFF during April 2015 Sampling Period

Common name	NALFF-S1		NALFF-S2		NALFF-S4		NALFF-S5		NALFF-S6	
	#	%	#	%	#	%	#	%	#	%
Pirate perch	1	1.0%	18	66.7%	10	18.9%	12	60.0%	12	33.3%
Pumpkinseed	24	23.1%	5	18.5%	6	11.3%	2	10.0%	9	25.0%
Redear sunfish	39	37.5%	--	--	--	--	1	5.0%	3	8.3%
American eel	1	1.0%	1	3.7%	20	37.7%	1	5.0%	2	5.6%
Green sunfish	--	--	3	11.1%	10	18.9%	--	--	5	13.9%
Eastern silvery minnow	15	14.4%	--	--	--	--	1	5.0%	--	--
Golden shiner	10	9.6%	--	--	--	--	--	--	2	5.6%
Bluegill	8	7.7%	--	--	--	--	1	5.0%	2	5.6%
Eastern mosquitofish	--	--	--	--	7	13.2%	2	10.0%	--	--
Yellow perch	4	3.8%	--	--	--	--	--	--	--	--
Brown bullhead	1	1.0%	--	--	--	--	--	--	--	--
Chain pickerel	1	1.0%	--	--	--	--	--	--	--	--
Eastern mudminnow	--	--	--	--	--	--	--	--	1	2.8%
Total individuals	104		27		53		20		36	
Time sampled (s)	600		900		1117		946		891	
CPUE	0.17		0.03		0.05		0.02		0.04	
Species richness (*R*)	10		5		5		7		8	
Simpson Diversity Index (λ)	0.23		0.49		0.24		0.39		0.21	
Shannon diversity index (H')	1.71		0.95		1.51		1.37		1.78	

3.1.3 WATER QUALITY

In-situ and laboratory analysis water quality results varied by stream and season. The NALFF-S5 reach was dry in August; therefore, water quality could not be measured. During both survey periods, the pH ranged from 6.53 to 9.13. Dissolved oxygen levels were consistently very low throughout the August survey period, and increased dramatically during the April survey events, likely due to lower water temperatures which were higher in August compared to April. Water quality results for streams are presented in Table 11; a full report of the laboratory analyses is included in Appendix E.**Error! Reference source not found.**

Table 11: In-situ and Laboratory Water Quality Analysis Results for Naval Auxiliary Landing Field Fentress Streams

Analysis	NALFF-S1		NALFF-S2		NALFF-S4		NALFF-S5		NALFF-S6	
	Aug	April	Aug	April	Aug	April	Aug	April	Aug	April
pH	7.40	7.29	7.30	7.39	8.00	9.13	--	6.53	7.40	8.00
DO (mg/L)	5.1	9.5	1.1	9.5	7.5	10.6	--	10.5	1.3	13.0
DO (%)	64.0%	100.2%	12.0%	96.7%	101.0%	126.5%	--	114.6%	15.5%	142.1%
Sp. Cond. (µS/cm[c])	280	710	210	250	250	290	--	470	570	620
Temp. (°C)	29.1	18.5	22.2	16.1	30.9	24.2	--	19.1	21.3	19.4
Laboratory Water Quality Results										
Nitrate as N	0.03	0.05	0.08	0.05	0.05	0.21	--	0.32	0.13	0.11
Nitrogen, Kjeldahl	0.4	0.6	0.9	0.9	0.2	0.7	--	3.4	1.1	1.2
ortho-Phosphate	0.05	0.09	0.22	0.06	0.05	0.03	--	0.07	0.28	0.12
Phosphorus	0.05	0.18	0.24	0.11	0.10	0.07	--	0.19	0.37	0.17
Total suspended solids	23	6	5	5	21	13	--	14	10	5
Total nitrogen	0.45	0.59	0.98	0.87	0.25	0.95	--	3.80	1.30	1.40

Flow conditions for NALFF streams exhibited lower average discharges (calculated as cubic feet per second [cfs]) during August 2014 when compared to April 2015 (Table 12). Reach NALFF-S5 was not surveyed in August 2014, because the stream bed was dry.

Table 12: Naval Auxiliary Landing Field Fentress Stream Discharge

Stream reach	Discharge (cubic feet per second)	
	August 2014	April 2015
NALFF-S1	(not wadeable)	0.20
NALFF-S2	0.02	0.04
NALFF-S4	0.15	0.71
NALFF-S5	(dry)	0.04
NALFF-S6	<0.01	0.01

3.2 FLOODPLAIN WETLANDS

3.2.1 FISH

A total of 30 fishes were collected from the three NALFF wetland sites during both the August 2014 and April 2015 surveys, all of which were eastern mudminnow. All individuals were positively identified at the species level in the field and no deformities, lesions, or abnormalities were observed in any of the specimens collected. Total electrofishing sampling effort durations across all three wetlands were 2,673 and 1,029 seconds for August 2014 and April 2015, respectively (Table 13).

Table 13: Backpack Electrofishing Effort at Naval Auxiliary Landing Field Fentress

Stream ID	Sampling duration (seconds)	
	August 2014	April 2015
NALFF-W1	988	347
NALFF-W2	872	350
NALFF-W3	813	332

3.2.2 WATER QUALITY

Water quality results presented in Table 14. In general, NALFF wetlands were slightly acidic (pH 5.9 to 6.6), consistent with this type of waterbody. Dissolved oxygen levels were variable between sites, despite similar water temperatures.

Table 14: Water Quality Parameters for Naval Auxiliary Landing Field Fentress

Analysis	NALFF-W1		NALFF-W2		NALFF-W3	
	Aug	Apr	Aug	Apr	Aug	Apr
pH	5.9	6.01	6.6	5.72	6.6	6.11
DO	1.3	6.31	1.7	6.17	6.1	6.33
DO %	17.5%	65.0%	21.6%	64.1%	72.9%	66.2%
Sp. Cond. (µS/cm^c)	340	254	670	219	380	259
Temp. (°C)	25.5	18.0	26.1	16.9	24.0	17.3
Laboratory Water Quality Results						
Nitrate as N	0.50	0.5	0.50	0.5	0.25	--

Analysis	NALFF-W1		NALFF-W2		NALFF-W3	
	Aug	Apr	Aug	Apr	Aug	Apr
Nitrogen, Kjeldahl	11.0	1.9	38.0	18	9.2	--
ortho-Phosphate	0.04	0.018	0.03	0.05	0.04	--
Phosphorus	1.90	0.13	4.00	1.5	1.40	--
Total suspended solids	11.00	39	38.00	270	9.20	--
Total nitrogen	290	1.9	1700	18	210	--

4 DISCUSSION AND MANAGEMENT RECOMMENDATIONS

The discussion and management recommendations in this section include general suggestions, as well as more specific discussion based on the findings from this survey. Prior to implementing any changes to the management of natural resources at NALFF, a more thorough evaluation of all available options would be necessary to ensure the best possible outcome for the management objectives of the streams and wetlands within the context of the NALFF military mission.

4.1 RECREATIONAL FISHERIES

Recreationally important species such as bluegill and largemouth bass collected in NALFF streams were too small to demonstrate much potential for recreational fishing. Largemouth bass were typically not very abundant, with less than 30 individuals of non-harvestable size classes captured across all streams. Typically, largemouth bass between 50 and 150 mm are first-year fish, with second-year fish up to 250 mm long. They do no typically exceed 350 mm until three years of age; however, 100% are expected to reach sexual maturity at lengths of 229 mm (EPA 2000; Laarman and Schneider 1985). Therefore, all largemouth bass captured in the NALFF streams during this survey have not yet reached spawning size. Stream conditions, including seasonal water level fluctuations, limited prey species, and unfavorable water quality, may contribute to the small size and limited abundance of largemouth bass.

Bluegill typically reach sexual maturity around 100 mm at age-1, which indicates 21.5% of the individuals captured in NALFF streams were capable of reproduction (IADNR 2015; Peterson et al. 2010). It can be assumed that bluegill were successfully spawning given the numerous young-of-the-year individuals under 100 mm that were recovered from NALFF streams.

The floodplain wetlands at NALFF do not offer any recreational fishing opportunities, based on the results of this survey. Seasonal water level fluctuations and poor water quality do not provide proper habitat for a healthy recreational fish population. Furthermore, as discussed in Section 2.3.1, the survey methods for determining fish species composition are rather limited, and with variable success. The non-standardized electrofishing conducted in this survey has been shown to be the most efficient, yielding the highest proportion of fishes present (up to 57% of the total catch), compared to other sampling methods used in this habitat type (Knight and Bain 1996). Given the low dissolved oxygen found in this habitat, future fish surveys may benefit from targeting the sampling effort along the perimeter of the wetland with the North Landing River, where the water quality is likely more favorable to fish utilization of this habitat type and more traditional sampling techniques can be used, such as boat electrofishing or angling.

An installation-wide wetland survey conducted by Tetra Tech in 2012 identified 1,126 acres of wetland at NALFF (Tetra Tech 2012; Tetra Tech 2014a). The northern-most area included in the fish survey consisted of 310.41 acres. Results of the wetlands survey indicated that the portion of wetland surveyed is dominated by bald cypress, water tupelo, Alabama supplejack, and netted chain fern, and consists of small, blackwater streams and swamp forest. This was further surrounded by cypress-tupelo swamp that is semi-permanently flooded by brownwater. The entire wetland lies within a 100-year floodplain associated with the North Landing River, and is contained within the Southern Watershed Area, which covers about 325 square miles (Tetra Tech 2014a).

In general, systems that experience periodic water inundation and nutrient input have high productivity (Mitsch and Gosselink 1993). Therefore, since the NALFF wetland is continuously flooded, it is not likely to support diverse fish populations. Backwaters often have low water levels or dissolved oxygen, both of

which can stress fish. Some species (e.g., mudminnow and bowfin) are better adapted to these conditions, and in general, small fish may live in these swamps year-round while larger fish would be transient residents (Mitsch and Gosselink 1993). The lack of boundaries, or the ability to deploy a barrier net in the forested wetland makes backpack electrofishing difficult, and the presence of trees, stumps, and snags makes boat electrofishing impractical. However, as discussed earlier in this section, incorporating other available sampling methods in this habitat type is not warranted, since it likely would not yield additional fish diversity. Previous wetland assessments have been conducted at this location (Tetra Tech 2012, 2014a, 2014b), so other habitat assessments should strive to follow the same protocols. This particular swamp is known to provide migrating birds with important nesting and resting habitat, so continued monitoring is encouraged (DCR-DNH 1990).

4.2 MIGRATORY FISHERIES

NALFF is connected to coastal waters via the North Landing River, with access to Currituck Sound, a protected inlet of the Atlantic Ocean located in northeastern North Carolina and southeastern Virginia. Because of this connectivity, there is the potential access for migratory fishes. Several migratory fish species utilize freshwater stream habitat within the Mid-Atlantic coastal plain (Rhode et al. 1994), including the herrings: alewife, blueback herring, American shad, and hickory shad. River herring are anadromous, meaning that they are born in freshwater and migrate into saltwater to mature. The American eel is also a ubiquitous migratory fish within these stream systems (Rhode et al. 1994). American eel are catadromous, meaning that they are born in saltwater and migrate into freshwater to mature (Jessop et al. 2002). Alewife and blueback herring (collectively river herring) were recently candidate species for listing as endangered or threatened under the ESA. In July 2013, the NMFS determined that listing river herring as threatened or endangered under the ESA was not warranted (NMFS 2013). American eel recently underwent a status review for listing under the ESA by the USFWS because they have undergone substantial declines throughout their range (USFWS 2011a). However, in October 2015, the USFWS found that listing was not warranted at this time, because, though there are stressors that cause individual mortality, the American eel is not threatened throughout its range (80 FR 60834-60850).

River herring spawn in a variety of habitats, ranging from swift-moving rivers to small tributaries above the tidal zone (NMFS 2009). They migrate during the spring months to spawn in their natal rivers, then return to coastal waters in the summer. Juveniles mature for several years in coastal waters before making their first spawning run (NMFS 2009). River herring abundances are highly variable in Virginia coastal plain streams.

American eel migrate into freshwater streams as juveniles (i.e., elvers) where they mature into the yellow eel phase, remaining in freshwater for up to 30 years. After reaching spawning age (which varies), they migrate back to the ocean (Jessop et al. 2002; USFWS 2011b). Eels are locally common, and often abundant, in Virginia coastal plain streams (Rhode et al. 1994). The eel's body form and anguilliform swimming mode is an important aspect of its ability to access freshwater habitats. The eel propels itself in an undulating motion, which they can adapt out to surfaces out of the water as well (Helfman et al. 2009). This allows juvenile elver and yellow-eel stages to "climb" under certain conditions (e.g., rough surfaces), enabling them to pass up and over what would otherwise be a barrier to migrating fishes (USFWS 2011a; Ellerby et al. 2001). Elvers have even been documented successfully climbing large vertical concrete structures, such as dams (Devine Tarbell & Associates 2006; Kleinschmidt 2000).

No river herring were observed during this survey; however, gizzard shad, which are known to move locally between fresh and brackish waters, were observed during the August survey. American eels were

captured throughout the survey at all stream locations. The sizes observed for American eel were consistent with the yellow-phase eel life stages. Therefore, the smaller yellow-phase eels present during August 2014 likely migrated into the NALFF streams and wetlands during spring 2014 and the larger yellow-phase individuals had been residents since at least the spring 2013 migration period, when they entered the streams as elvers. Yellow-phase eels reside in freshwater systems for 2 to 6 years (sometimes up to 18 years) until they reach maturity and migrate back to the ocean to spawn as silver-phase eels (VIMS 2015).

Additional targeted surveys of migratory fish species utilizing NALFF streams to assess evidence of spawning runs of river herring or American eel would provide further evidence of migratory fish use of NALFF streams and ponds. This can be done through:

- Periodic electrofishing surveys during migration windows of adult river herring or juvenile American eel, covering late-March through mid-April
- Periodic electrofishing surveys during mid-summer, to document the presence of young-of-year river herring and juvenile/adult (yellow-phase) American eels

4.3 FISH PASSAGE

Migratory fishes may become excluded from available habitat by impediments to migration, such as dams, perched culverts, or other physical structures. Coastal plain river systems in Virginia are susceptible to loss of historical spawning and rearing habitat for migratory species because of such barriers (McInninch and Garman 1999). Many physical structures are not barriers to American eel, however, since they are capable of ascending (or “climbing”) structures such as dams, or even moving over land (Devine Tarbell & Associates 2006; Kleinschmidt 2000; USFWS 2011a).

The Navy realizes the importance of ecosystem health and therefore uses the VDGIF guidance to ensure the protection of water resources on its installations. Due to future maintenance costs associated with culverts, and the loss of riparian and aquatic habitat, the VDGIF advises that stream crossings are constructed as clear-span bridges. However, if this is not possible, the VDGIF recommends countersinking any culverts below the streambed at least 6 inches (15 cm), or to use bottomless culverts, to allow passage of aquatic organisms (VDGIF 2007). The VDGIF also recommends the installation of floodplain culverts to carry bankfull discharges. Furthermore, perched or blocked culverts impede fish accessibility to upstream habitat. Culvert-1 at NALFF-S6 was perched under the observed water conditions; therefore, although American eel may be able to pass, river herring would be restricted. Improvements to NALFF-S6 can be made through the replacement or modification of the perched culvert to improve passage potential for migratory fish. Eliminating perched culverts and maintaining culvert clearance is recommended to support fish passage within existing conditions throughout the Installation. However, some of the culverts are located on municipal roads, therefore any improvements would need to be coordinated with the City of Chesapeake.

While some of the debris dams currently in place may limit the upstream passage of river herring, their habitat value contributes to the structural habitat complexity of NALFF streams. Therefore, debris dams should be left in the stream channel, even if only partially, whenever possible. As previously recommended (Tetra Tech 2015), a routine culvert monitoring and maintenance plan would limit culvert blockages that form due to weather-related events or beaver activity. Periodic maintenance, through the removal of accumulated debris piles, downed trees, and other obstructions from these structures, may positively impact the habitat accessibility within the stream channel. However, it is important to note that debris dams are a natural habitat feature in streams and often provide high-quality structured

fish habitat. Therefore any removal of debris from the stream should be limited to within the culverts to ensure that culverts remain passable. Culvert replacement should be considered for any culverts that inhibit fish passage. A stream-wide removal of debris dams would be detrimental to the habitat quality of NALFF streams.

While the habitat quality of NALFF streams were marginal to suboptimal, fish passage is a relatively minor issue within NALFF. Any fish passage issues downstream (off-installation), however, are not clear from this survey. In general, most barriers identified during the barrier survey were passable to migratory fish, except for the large barrier (S1, Barrier-1) on Pocaty Creek. NALFF-S6 had a culvert that had low to no potential for non-eel fish passage. The culvert identified in NALFF-S6 that had no potential for fish passage was perched and prohibited fish from entering. At the outlet of the culvert, there was a change in stream elevation that the culvert outlet did not follow. NALFF-S2 had a sediment deposit that prohibited fish passage to non-eel species. It also prohibited all water flow, under observed flow conditions.

In summary, maintenance and alterations are recommended in the following tiered approach to improve habitat quality for migratory fish species within NALFF:

1. Maintain culverts clear of debris or beaver dams.
2. Conduct a targeted survey of migratory fish species utilizing NALFF streams to assess evidence of spawning runs of river herring or American eel (see Migratory Fisheries, Section 4.2).
3. Since migratory fishes are confirmed to be present, the first step at improving habitat for these fishes would be to modify the network of drainage ditches to minimize sedimentation within the stream channels.
4. Once sedimentation of the stream channel has been minimized, another step toward improving habitat quality would be to evaluate stream restoration options to include natural channel design options.
5. Determine which reach is most in need of immediate restoration by reviewing baseline information to determine if sediment removal would substantially improve migratory fish habitat.
6. Additional restoration-specific surveys would be needed to determine the appropriate restoration action and stabilization method(s) with the goal of improving fish habitat.
7. Restoration options like sediment removal, various bioengineering techniques, such as log or timber cribs, natural streambed substrate, live plantings, etc. should be given priority since they can provide enhanced habitat value.
8. Once the restoration option is determined, then the appropriate permitting application packages would be needed for submittal to state and federal agency approval, before executing the work.

4.4 CHANNELIZED STREAMS

All surveyed streams at NALFF have been channelized to some degree, with the exception of S1 which appears to have maintained its natural channel for most of its length within the installation. These modifications, likely made to improve drainage across the Installation, have had detrimental impacts on habitat quality. For example, channelization increases the streambed gradient and decreases the retention time of the water in the channel. The channelized streambed inhibits normal overbank

flooding during storm events. The floodwater abatement and water quality protection functions normally provided by the floodplain and any adjacent wetlands are significantly diminished as a result (Navy 2014). This type of channelized system can experience drastic changes in water levels over a short time period, which can limit the diversity and sustainability of the fish populations. Results from this habitat assessment of NALFF streams are consistent in characterizing them as low-quality stream habitat.

4.5 WATER QUALITY

Water quality should continue to be monitored to determine any management actions. Poor water quality can be detrimental to both the physical and biological environment, therefore it should be monitored on a routine basis. The water quality conditions at NALFF and their implications for aquatic habitat quality are summarized below.

- Nitrogen is typically not limiting to productivity in freshwater systems. However, concentrations above 3.00 mg/L can indicate pollutions from fertilizers, manures, or other nutrient-rich wastes (Swistock 2015), which may have negative impacts further downstream in estuarine waters. Laboratory water quality results showed that total nitrogen levels were not exceedingly high in streams (ranged from 0.25 mg/L to 3.80 mg/L). The highest total nitrogen reading was detected in NALFF-S5 during the April survey. Concentrations were excessively high in wetlands (ranged from 1.90 mg/L to 38.00 mg/L) compared to values of 0.60-4.7 mg/L observed in similar cypress-tupelo swamps (Mitsch and Gosselink 1993). Total nitrogen was significantly higher in NALFF-W2 than the other survey areas during each sampling event (38.00 mg/L in August and 18.00 mg/L in April), so it is possible that this site had localized pollution due to nutrient runoff from agricultural fields, or another source, in the area. Potential sources of this pollution, such as runoff and wastewater, should be identified and managed where possible.
- Phosphorus is generally the limiting nutrient in freshwater systems and levels above 0.025 mg/L can indicate a potential for nuisance algae and aquatic plant growth (Swistock 2015). Phosphorus also plays a key role in phytoplankton abundance, considered to be a more limiting nutrient with regard to freshwater algal growth. Laboratory results showed phosphorus levels in streams ranged from 0.05 mg/L to 0.37 mg/L. Levels in floodplain wetlands were excessively high (0.13 mg/L to 4.00 mg/L); a similar swamp had phosphorous concentrations of 0.17-0.47 mg/L (Mitsch and Gosselink 1993). Phosphorous levels were significantly higher in NALFF-W2 than other surveyed areas during each sampling event (4.00 mg/L in August and 1.50 mg/L in April). It is likely that the source causing high nitrogen (possibly runoff from agricultural fields, or another source, in the area) at this site is also causing high phosphorous; therefore, controlling potential pollutants should decrease both nitrogen and phosphorous.
- Temperature, pH, and specific conductance were all variable between the two sampling seasons but were within their expected ranges.
- Dissolved oxygen below 5.0 mg/L for extended periods of time may cause decreased growth and higher susceptibility to disease in fish (Boyd and Boyd 2012). Dissolved oxygen levels for streams ranged from 1.1 mg/L to 7.5 mg/L. Levels were excessively low in NALFF-S2, S6, W1, and W2 during the August survey (1.1 mg/L to 1.7 mg/L). However, the higher value at W3 (6.1 mg/L) during August suggests that there may have been an error with the dissolved oxygen sensor at that particular site, because it is unlikely that a fluctuation of that magnitude would occur between two points so close together in the same wetland. Dissolved oxygen in similar forested wetlands has been measured between 0.9 and 4.0 mg/L (Mitsch and Gosselink 1993). Dissolved oxygen levels increased in all stream and wetland sites during the April survey (6.2 mg/L to 13.0

mg/L). The higher dissolved oxygen at the wetland sites during the spring may be a seasonal effect of lower temperatures and greater connectivity with water from the adjacent North Landing River. Despite the observed low dissolved oxygen at S2 and S6 during August, a diverse array of fishes were collected at these locations, suggesting that there could be areas of refuge containing higher dissolved oxygen levels within the streams (assuming there was no error with the probe).

- High phosphorus and moderate total nitrogen levels in streams could promote excessive plant growth and could potentially create eutrophic conditions, as observed in NALFF-W2.
- Extremely low dissolved oxygen levels in streams and floodplain wetlands during summer months may cause lower growth rates and increased susceptibility to disease, which may lead to stressed fish that could result in disease or fish kills. While some individual shiners collected in S1 and S4 exhibited black spot disease (photo # DSCF0283, Appendix-A), this may not be associated with water quality (Flores-Lopes and Thomaz 2011).

One method to reduce nutrient input to the streams and floodplain wetlands is to ensure that best management practices for nutrient and sediment runoff are practiced at the agricultural fields on NALFF property. Planting appropriate native trees, shrubs, and ground cover vegetation as sediment and nutrient buffers can be an effective method of establishing effective riparian buffers. These buffers would potentially capture excess nutrients and sediment that would otherwise runoff into the stream, depleting water quality. This could be an important step for these streams since their origins are agricultural field drainages.

4.6 INVASIVE SPECIES

Invasive species that may affect waterbodies in the area include various types of aquatic algae, as well as free-floating, submergent, and emergent species. Invasive fish species, such as snakehead, are also a concern in this region, but no individuals were observed during these surveys. Common carp are also invasive, but seem to be in control at NALFF, given the low numbers captured in this survey.

Fish kills can occur when high volumes of vegetation die and decay, depleting oxygen in the process; therefore, the addition of non-native species to the plant community can further decrease levels of DO. The common reed (*Phragmites australis*) is an invasive species that could potentially affect the NALFF installation, because this plant can invade both streams and ponds, and can tolerate both fresh and salt water. Alligator weed (*Alternanthera philoxeroides*), Asian spiderwort (*Murdannia keisak*), Eurasian milfoil (*Myriophyllum spicatum*), and narrowleaf cattail (*Typha angustifolia*) have potential to become invasive species on the Installation and should be monitored for. Other invasive species to monitor include red-eared slider (*Chrysemys scripta elegans*) and Asian carp species.

The nutria (*Myocastor coypus*), a relative to the native muskrat (*Ondatra zibethicus*), is a semi-aquatic invasive species capable of negatively impacting the environment. If present, nutria may feed on vegetation and outcompete native species, stunting growth of the aquatic ecosystem. However, nutria were not observed during this survey, or during the 2013 nuisance wildlife survey (Navy 2014). Although no evidence of nutria was witnessed during these surveys, natural resource managers should respond with appropriate control measures if nutria are encountered on the Installation.

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APPENDIX A - PHOTOGRAPHIC LOG

Site: NALF Fentress, Chesapeake, VA

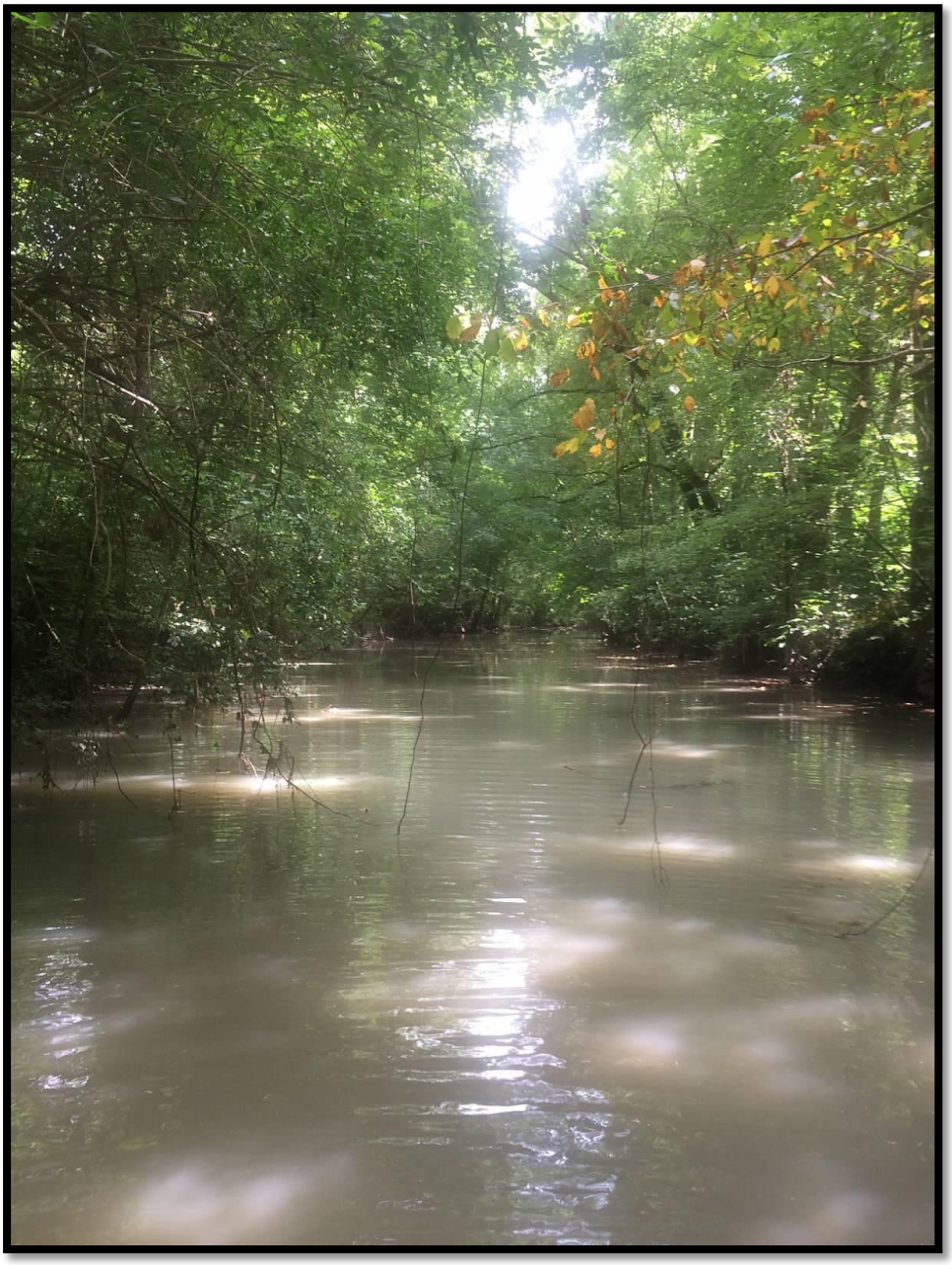
Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145055000

Date: 12 August 2014

Photographer: B. Dresser

Comments: Typical view of Pocaty Creek (S1).



Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 125306547

Date: 7 April 2015

Photographer: B. Dresser

Comments: Typical view of Pocaty Creek (S1) during low-flow conditions observed during the Spring 2015 survey.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145023000

Date: 13 August 2014

Photographer: B. Dresser

Comments: Fentress Airfield Rd. Bridge (S1, Bridge-1). This bridge is the installation boundary and the start of the surveyed portion of Pocaty Creek (S1).

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145014000

Date: 13 August 2014

Photographer: B. Dresser

Comments: Old Fentress Airfield Rd. Bridge (S1, Bridge-2). Portions of the timber-frame bridge have collapsed into the stream.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: DSCF0269

Date: 7 April 2015

Photographer: B. Dresser

Comments: Confluence of S2 with S1. Canoe used for RBP habitat survey of S1 shown here loaded with water quality sampling equipment.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: DSCF0275

Date: 7 April 2015

Photographer: E. Foster

Comments: Large debris dam on Pocaty Creek (S1, Debris-1), looking downstream.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 124921604

Date: 8 April 2015

Photographer: B. Dresser

Comments: Confluence of S4 with S1.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 144851000

Date: 14 August 2014

Photographer: B.Dresser

Comments: Boat electrofishing set-up with VDGIF at the confluence of S4 with S1.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: DSCF0281

Date: 7 April 2015

Photographer: B. Dresser

Comments: Braided channel of S5 at the confluence with S1.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145231000

Date: 7 April 2015

Photographer: B. Dresser

Comments: Debris dam on Pocaty Creek (S1, Debris-2).

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: DSCF0279

Date: 7 April 2015

Photographer: B. Dresser

Comments: Debris dam on Pocaty Creek (S1, Debris-3).

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145036000

Date: 13 August 2014

Photographer: B. Dresser

Comments: Representative forested swamp habitat for W1, W2, and W3.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 144934000

Date: 13 August 2014

Photographer: B. Dresser

Comments: Debris dam on S2 (S2, Debris-1). Note that this debris dam is primarily an accumulation of sediment.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 144948000

Date: 13 August 2014

Photographer: B. Dresser

Comments: Debris dam on S2 (S2, Debris-1). This accumulation of sediment blocked all visible streamflow within the channel.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145116000

Date: 12 August 2015

Photographer: B. Dresser

Comments: Lower portion of S4, below the recently modified Chesapeake City drainage ditch.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145108000

Date: 12 August 2015

Photographer: B. Dresser

Comments: Long Ridge Rd. Culvert (S4, Culvert-1) within the recently modified Chesapeake City drainage ditch. An identical culvert (S4, Culvert-2) exists at the installation boundary at Whittamore Rd.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 154250749

Date: 8 April 2015

Photographer: J. Cook

Comments: Typical channelized section of S5.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 154358598

Date: 8 April 2015

Photographer: J. Cook

Comments: Debris dam on S5 (S5, Debris-1).

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 154457493

Date: 8 April 2015

Photographer: J. Cook

Comments: Debris dam on S5 (S5, Debris-2).

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145224000

Date: 12 August 2015

Photographer: B. Dresser

Comments: Typical section of S6. Note the sedimentation within the stream channel, likely caused by runoff from nearby agricultural fields.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145221000

Date: 12 August 2015

Photographer: B. Dresser

Comments: Oyster shell hash deposits within the S6 streambed.

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145155000

Date: 12 August 2015

Photographer: B. Dresser

Comments: Debris dam on S6 (S6, Debris-1).

Site: NALF Fentress, Chesapeake, VA

Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 145146000

Date: 12 August 2015

Photographer: B. Dresser

Comments: Blue Ridge Rd. Culvert on S6 (S6, Culvert-1). The plastic bucket shown here contained dozens of discarded/filleted sunfish indicating potential fishing pressure at this site. During the spring survey, several deer carcases were deposited into the stream channel at this location.

Site: NALF Fentress, Chesapeake, VA

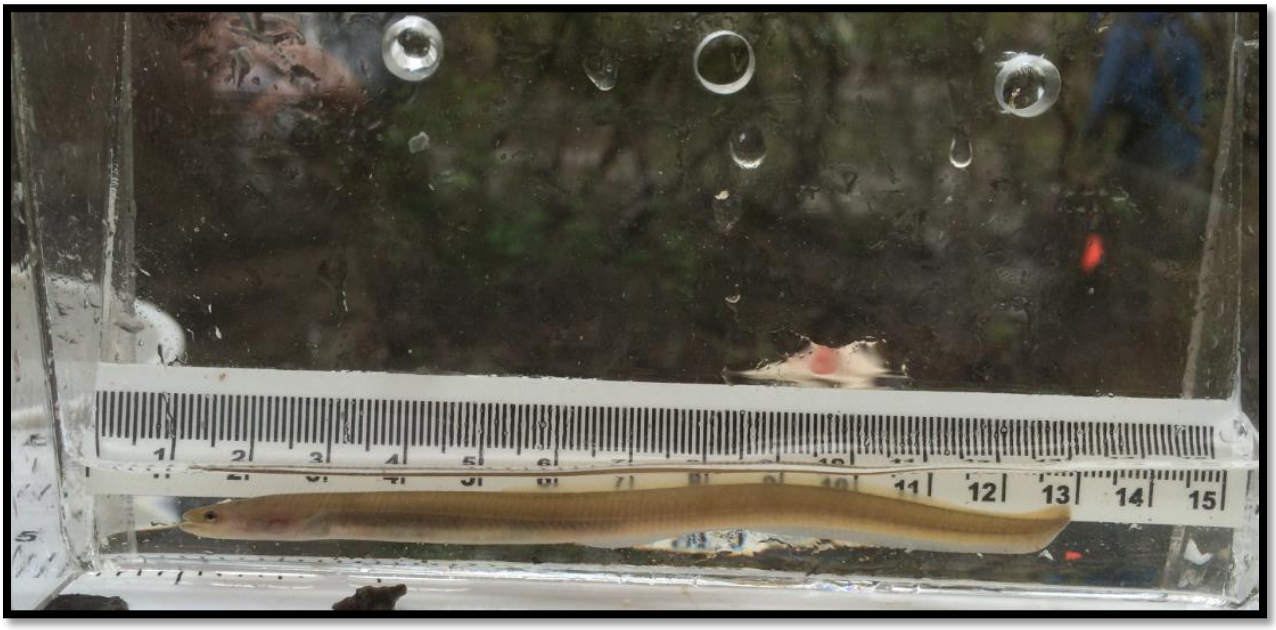
Project: Task Order WE04 NALFF Stream Assessment

Photo No.: 160857318

Date: 8 April 2015

Photographer: B. Dresser

Comments: Juvenile American eel collected in S4.



Site: NALF Fentress, Chesapeake, VA

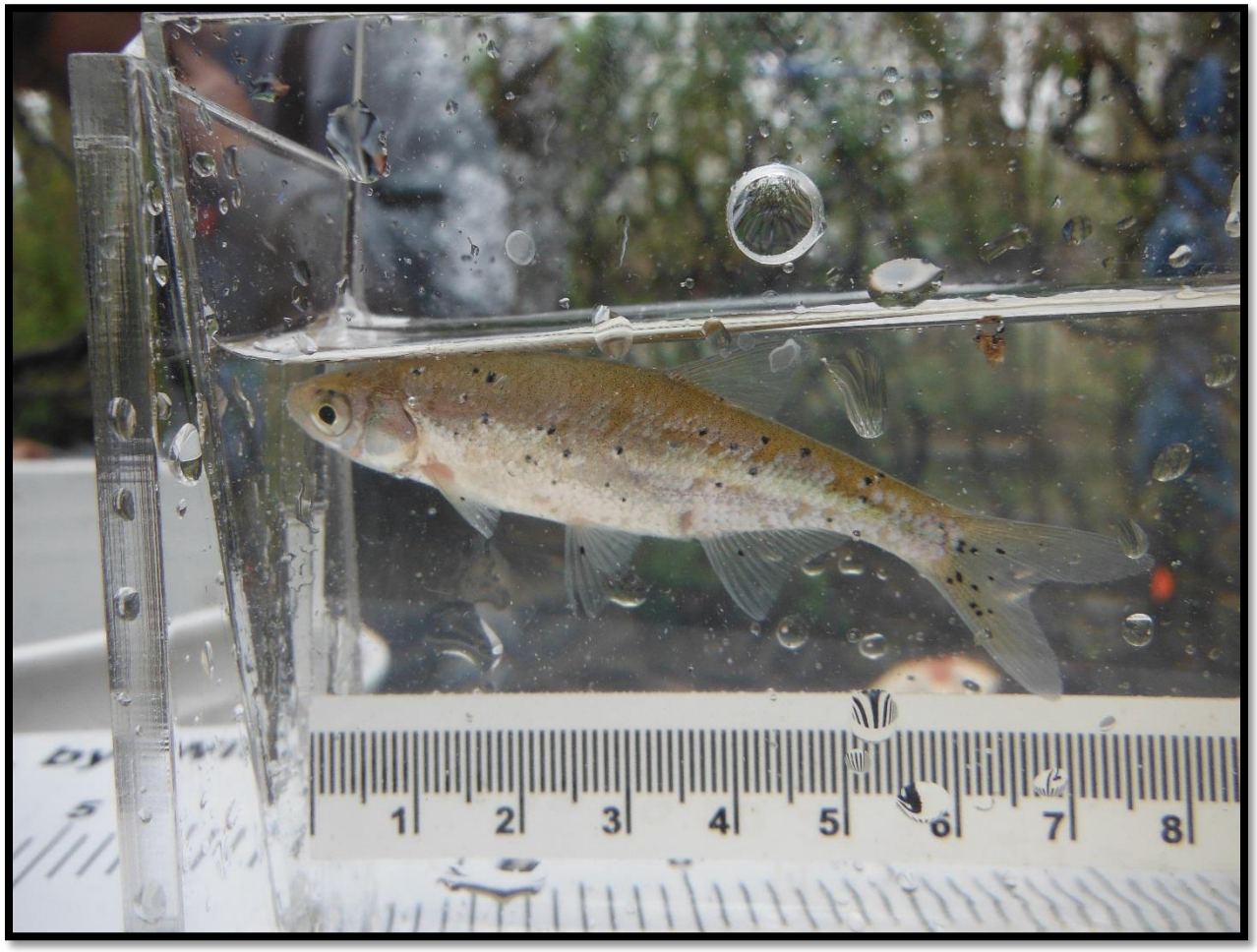
Project: Task Order WE04 NALFF Stream Assessment

Photo No.: DSCF0283

Date: 8 April 2015

Photographer: B. Dresser

Comments: Eastern silvery minnow with black spot disease, collected in S4.



APPENDIX B - BLANK DATA SHEETS

[included in PDF version only of this report]

TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project:______________________________ **Date and Time (Start-End):**________________________________ **Investigators:**____________________________________

Stream:____________________ **Reach:**____________ **Partial Debris Dam Tally for Reach:**________________________ **GPS @ Start Point:** □ Y □ N **Photo #'s:**______________

Start of Reach located at: □ Confluence with _________________ □ Installation-Specific ___________________________ □ Arbitrary location ______________________________

	Observation Parameters	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N	**Barrier Type** □ Debris Dam #_______ □ Bridge #___________ Name of Road________ □ Culvert #__________ Name of Road________ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE	□ HIGH □ MED □ LOW □ NONE
	Barrier Height					
	Vertical Water Drop					
	Pool Immediately Below?	□ Y Depth_____ □ N	□ Y Depth_____ □ N	□ Y Depth_____ □ N	□ Y Depth_____ □ N	□ Y Depth_____ □ N
	Wetted Channel Width					
	Structure Width (length, for culverts)					
	Stream Channel	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural	Upstream: □ channelized □ natural Downstream: □ channelized □ natural
	Bank Erosion?	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Scouring or undercutting of structure?	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Structure Span/Diameter					
	Beaver Activity?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
DEBRIS DAMS	Debris Dam Composition	□ woody debris □ leaf litter □ sediment □ other ___________	□ woody debris □ leaf litter □ sediment □ other ___________	□ woody debris □ leaf litter □ sediment □ other ___________	□ woody debris □ leaf litter □ sediment □ other ___________	□ woody debris □ leaf litter □ sediment □ other ___________
	Is this a Beaver Dam?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Alternate Channel Formation/Braiding?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
BRIDGE/CULVERT	Clearance					
	Bridge Material	□ concrete □ steel □ timber □ other ___________	□ concrete □ steel □ timber □ other ___________	□ concrete □ steel □ timber □ other ___________	□ concrete □ steel □ timber □ other ___________	□ concrete □ steel □ timber □ other ___________
	Culvert Material Corrugated? □ Y □ N	□ concrete □ steel □ plastic □ other ___________	□ concrete □ steel □ plastic □ other ___________	□ concrete □ steel □ plastic □ other ___________	□ concrete □ steel □ plastic □ other ___________	□ concrete □ steel □ plastic □ other ___________
	# of Arches/Culverts					
	Opening Obscured Up/Downstream	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Depth Inside Structure					
	Armoring?	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N	Left: □ Y □ N Right: □ Y □ N
	Overflow Pipe?	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N	□ Y □ N
	Substrate inside structure					
	Structure outlet is:	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall	□ partially backwatered □ at grade □ cascade/free fall
	cross sectional schematic (draw)					

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
❑	storm (heavy rain)	❑
❑	rain (steady rain)	❑
❑	showers (intermittent)	❑
____%❑	%cloud cover	❑____%
❑	clear/sunny	❑

Has there been a heavy rain in the last 7 days? ❑ Yes ❑ No

Air Temperature_____^{0} C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

STREAM CHARACTERIZATION

Stream Subsystem
❑ Perennial ❑ Intermittent ❑ Tidal

Stream Type
❑ Coldwater ❑ Warmwater

Stream Origin
❑ Glacial
❑ Non-glacial montane
❑ Swamp and bog
❑ Spring-fed
❑ Mixture of origins
❑ Other_____

Catchment Area_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
❑ Forest ❑ Commercial
❑ Field/Pasture ❑ Industrial
❑ Agricultural ❑ Other _____
❑ Residential

Local Watershed NPS Pollution
❑ No evidence ❑ Some potential sources
❑ Obvious sources

Local Watershed Erosion
❑ None ❑ Moderate ❑ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
❑ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous

dominant species present _____

INSTREAM FEATURES

Estimated Reach Length _____m

Estimated Stream Width _____m

Sampling Reach Area _____m^2

Area in km^2 (m^2x1000) _____km^2

Estimated Stream Depth _____m

Surface Velocity (at thalweg) _____m/sec

Canopy Cover
❑ Partly open ❑ Partly shaded ❑ Shaded

High Water Mark _____m

Proportion of Reach Represented by Stream Morphology Types
❑ Riffle_____% ❑ Run_____%
❑ Pool_____%

Channelized ❑ Yes ❑ No

Dam Present ❑ Yes ❑ No

LARGE WOODY DEBRIS

LWD _____m^2

Density of LWD _____m^2/km^2 **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating
❑ Floating Algae ❑ Attached Algae

dominant species present _____

Portion of the reach with aquatic vegetation _____%

WATER QUALITY

Temperature_____^{0} C

Specific Conductance_____

Dissolved Oxygen _____

pH _____

Turbidity _____

WQ Instrument Used _____

Water Odors
❑ Normal/None ❑ Sewage
❑ Petroleum ❑ Chemical
❑ Fishy ❑ Other_____

Water Surface Oils
❑ Slick ❑ Sheen ❑ Globs ❑ Flecks
❑ None ❑ Other_____

Turbidity (if not measured)
❑ Clear ❑ Slightly turbid ❑ Turbid
❑ Opaque ❑ Stained ❑ Other_____

SEDIMENT/ SUBSTRATE

Odors
❑ Normal ❑ Sewage ❑ Petroleum
❑ Chemical ❑ Anaerobic ❑ None
❑ Other_____

Oils
❑ Absent ❑ Slight ❑ Moderate ❑ Profuse

Deposits
❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand
❑ Relict shells ❑ Other_____

Looking at stones which are not deeply embedded, are the undersides black in color?
❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: FW08 DATE: ___/___/2 0___

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ○ cm	○ ft ○ cm	○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0			
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG ____

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

TETRA TECH

Water Quality - Streams, Sheet ___ of ___

Project:________________________ **Site:**________________________ **Meter:**________________________

Investigators: ________________________ **Remarks:**________________________

____

Stream Reach	Location	Date/Time	In-situ Measurements					Grab Samples			Remarks
			pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Sp. Cond. °25C (µS/cm)	Temperature (C°)	Total Nitrogen (TN)	Total Phos. ortho-Phos. (SRP)	Total Suspended Solids (TSS)	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	

APPENDIX C - FIELD DATA SHEETS

[included in PDF version only of this report]

13:10

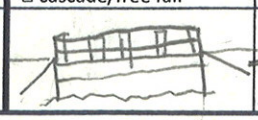
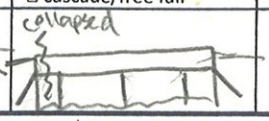
TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NALF-S1 Date and Time (Start-End): 8/11/14 13:10 Investigators: DRESSER, COOK, FOSTER

Stream: S1 Reach: POCATY Partial Debris Dam Tally for Reach: 5 GPS @ Start Point: ☒ Y ☐ N Photo #'s: _____

Start of Reach located at: ☒ Confluence with FRNT. AIRFIELD RD ☐ Installation-Specific _____ ☐ Arbitrary location _____

	Observation Parameters	Barrier Type	Barrier Type	Barrier Type	Barrier Type	Barrier Type
		☐ Debris Dam # _____ ☒ Bridge # S1-1 Name of Road FRNT. AIRFIELD RD ☐ Culvert # _____ Name of Road Old Fences GPS Point? (Y) / N	☐ Debris Dam # _____ ☒ Bridge # S1-2 Name of Road N/A ☐ Culvert # _____ Name of Road _____ GPS Point? (Y) / N	☐ Debris Dam # _____ ☐ Bridge # _____ Name of Road _____ ☐ Culvert # _____ Name of Road _____ GPS Point? Y / N	☐ Debris Dam # _____ ☐ Bridge # _____ Name of Road _____ ☐ Culvert # _____ Name of Road _____ GPS Point? Y / N	☐ Debris Dam # _____ ☐ Bridge # _____ Name of Road _____ ☐ Culvert # _____ Name of Road _____ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	NA	NA			
	Vertical Water Drop	NA	NA			
	Pool Immediately Below?	☒ Y Depth ~3-4' ☐ N	☐ Y Depth cont. ☐ N	☐ Y Depth _____ ☐ N	☐ Y Depth _____ ☐ N	☐ Y Depth _____ ☐ N
	Wetted Channel Width	62.5'	~62.5			
	Structure Width (length, for culverts)	28.4	24.4			
	Stream Channel	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☒ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	62.5'				
	Beaver Activity?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☐ woody debris ☐ leaf litter ☐ sediment ☐ other NA	☒ woody debris ☒ leaf litter ☒ sediment ☐ other Partial debris dam under collapsed arch	☐ woody debris ☐ leaf litter ☐ sediment ☐ other _____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other _____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other _____
	Is this a Beaver Dam?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance	5.5'	~4'			
	Bridge Material	☒ concrete ☐ steel ☐ timber ☐ other _____	☐ concrete ☐ steel ☒ timber ☐ other _____	☐ concrete ☐ steel ☐ timber ☐ other _____	☐ concrete ☐ steel ☐ timber ☐ other _____	☐ concrete ☐ steel ☐ timber ☐ other _____
	Culvert Material Corrugated? ☐ Y ☐ N	☐ concrete ☐ steel ☐ plastic ☐ other NA	☐ concrete ☐ steel ☐ plastic ☐ other NA	☐ concrete ☐ steel ☐ plastic ☐ other _____	☐ concrete ☐ steel ☐ plastic ☐ other _____	☐ concrete ☐ steel ☐ plastic ☐ other _____
	# of Arches/Culverts	1	3			
	Opening Obscured Up/Downstream	☐ Y ☒ N	☒ Y ☐ N Partial	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure	3-4' +	~3-4' +			
	Armoring?	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure	At grade	Clay/mud			
	Structure outlet is:	☐ partially backwatered ☒ at grade ☐ cascade/free fall	☐ partially backwatered ☒ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

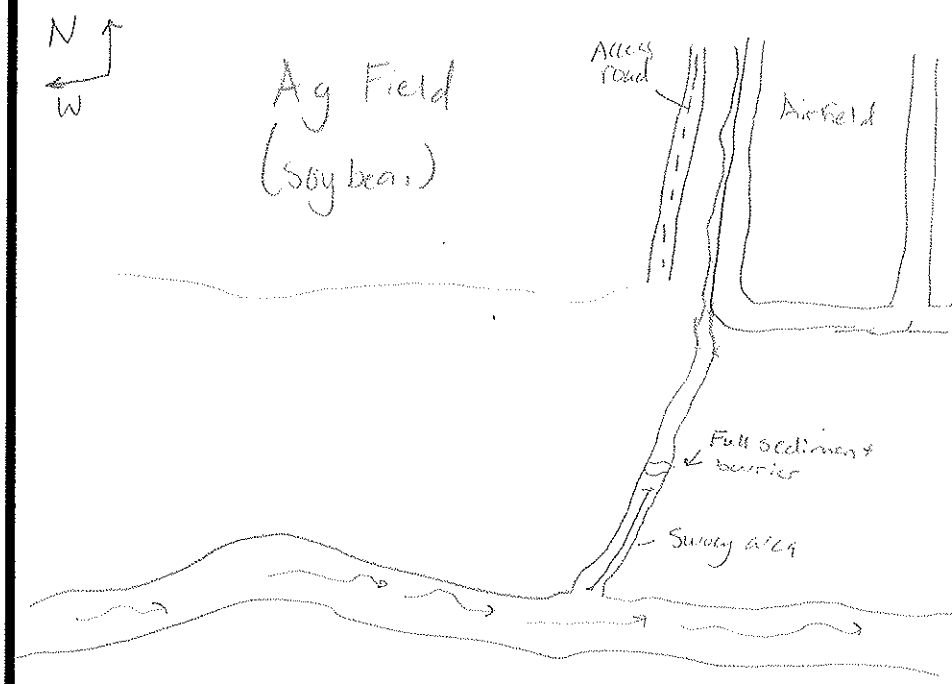
PARTIAL BARRIER = 11

old, partly collapsed bridge (wood) 3 spans, only one is blocked

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME S7. NALFF	LOCATION Fentress Airfield
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY JC	DATE 2:88 TIME 8/13/14 AM (PM) — REASON FOR SURVEY

WEATHER CONDITIONS	**Now** / **Past 24 hours** ☐ storm (heavy rain) ☑ ☐ rain (steady rain) ☐ ☐ showers (intermittent) ☐ ___%☐ %cloud cover ☐___% ☑ clear/sunny ☐ **Has there been a heavy rain in the last 7 days?** ☐ Yes ☐ No **Air Temperature** 85 °C **Other**_____
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)**



STREAM CHARACTERIZATION	**Stream Subsystem** ☑ Perennial ☐ Intermittent ☐ Tidal **Stream Type** ☐ Coldwater ☑ Warmwater **Stream Origin** ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☑ Mixture of origins ☑ Other Agriculture/military **Catchment Area**_____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☑ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Bottomland Hardwood (Red maple) Sweet gum, Pine

INSTREAM FEATURES

Estimated Reach Length 347 m/Ft

Estimated Stream Width 1.2 m

Sampling Reach Area _____ m²

Area in km² (m²x1000) _____ km²

Estimated Stream Depth _____ m

Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☐ Partly open ☑ Partly shaded ☐ Shaded

High Water Mark 0.9 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 0 % ☐ Run 0 %
☐ Pool 100 %

Channelized ☐ Yes ☑ No

Dam Present ☑ Yes ☐ No (Natural)

LARGE WOODY DEBRIS

LWD 1 m²

Density of LWD _____ m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present Marl

Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

Temperature _____ °C

Specific Conductance _____

Dissolved Oxygen _____

pH _____

Turbidity _____

WQ Instrument Used _____

Water Odors
☐ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☐ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☑ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☑ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other None

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	50%
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	—
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	65%	Marl	grey, shell fragments	—
Silt	0.004-0.06 mm	5%			
Clay	< 0.004 mm (slick)	30%			

- Banks appear to be swept clean

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NALPF S2	LOCATION Airfield Fenmss
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY JC, BO, EF	DATE 8/13/19 TIME 1:30 AM (PM) — REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 (4) 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition Further upstream would be closer to 3	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE \\	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 8 (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank (10) 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0

Total Score _____

FISH SAMPLING FIELD DATA SHEET (FRONT)

page of

STREAM NAME NAL-FF-S2	LOCATION Fortress Airfield
STATION # RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS BD, EF, JC
FORM COMPLETED BY JC	DATE 8/14/14 TIME 10:10 (AM) PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 1062 **Stream width (in meters)** Max 6*6 FT Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☑ Pools 100% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) Lcm Wg Lg Wgm L/W	ANOMALIES* D E F L M S T Z
Largemouth Bass		255 150	
Mudsunfish		124 37	
		138 [illegible]	
Bluegill		113 27	
		51 3	
		38 2	
		91 17	
Pirate Perch		77 8 37 2	
		78 8 77 8	
		78 7 43 3	
		76 7 38 2	
		36 2	

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	W	L	W	L/W	ANOMALIES* D	E	F	L	M	S	T	Z
~~[illegible]~~		202	103											
~~[illegible]~~ Yellow Bullhead														
Mosquito fish		22	1	27	1									
		33	1	27	1									
		27	1	27	1									
		29	1	26	1									
		33	1											
Juvenile Sunfish		36	2											
		38	2											
		36	3											
Mud minnow		49	3											
		46	2											
American eel		185	18	145	12									
		155	12											
		475	≈200											
		105	12											
		110	9											
Rock Bass		138	47											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~FW08~~ S2 NAEF DATE: 08/14/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
⊘ ft ○ cm	⊘ ft ○ cm	⊘ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	tenths 0	.3F	0.01	
2	0.6	.6F	0.01	
3	1.2	1.0	0.00	
4	1.8	1.0	0.01	
5	2.4	1.0	0.01	
6	3.0	1.1	0.0	
7	3.6	1.2	0.0	
8	4.2	1.2	0.01	
9	4.8	1.1	0.00	
10	5.4	0.7	0.03	
11	6.0	0.4	0.01	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

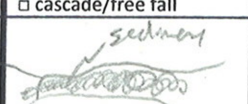
TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NALFF **Date and Time (Start-End):** 8/13/2014 **Investigators:** ____________

Stream: S7 **Reach:** ________ **Partial Debris Dam Tally for Reach:** Ø **GPS @ Start Point:** ☑ Y ☐ N **Photo #'s:** ________

Start of Reach located at: ☑ Confluence with POCATY ☐ Installation-Specific ________ ☐ Arbitrary location ________

	Observation Parameters	Barrier Type	Barrier Type	Barrier Type	Barrier Type	Barrier Type
ALL BARRIER TYPES		☐ Debris Dam #____ ☑ Bridge # 1 Name of Road____ ☐ Culvert #____ Name of Road____ GPS Point? (Y) / N	☐ Debris Dam #____ ☐ Bridge #____ Name of Road____ ☐ Culvert #____ Name of Road____ GPS Point? Y / N	☐ Debris Dam #____ ☐ Bridge #____ Name of Road____ ☐ Culvert #____ Name of Road____ GPS Point? Y / N	☐ Debris Dam #____ ☐ Bridge #____ Name of Road____ ☐ Culvert #____ Name of Road____ GPS Point? Y / N	☐ Debris Dam #____ ☐ Bridge #____ Name of Road____ ☐ Culvert #____ Name of Road____ GPS Point? Y / N
	Potential for Fish Passage	☐ HIGH ☐ MED ☐ LOW ☑ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	0.4				
	Vertical Water Drop	None/No Flow				
	Pool Immediately Below?	☑ Y Depth .5m ☐ N	☐ Y Depth____ ☐ N	☐ Y Depth____ ☐ N	☐ Y Depth____ ☐ N	☐ Y Depth____ ☐ N
	Wetted Channel Width	1.2 m				
	Structure Width (length, for culverts)	0.3 m				
	Stream Channel	Upstream: ☐ channelized ☑ natural Downstream: ☐ channelized ☑ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☐ Y ☑ N Right: ☐ Y ☑ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☐ Y ☑ N Right: ☐ Y ☑ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	1.8				
	Beaver Activity?	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☐ woody debris ☐ leaf litter ☑ sediment ☐ other ____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ____
	Is this a Beaver Dam?	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance					
	Bridge Material	☐ concrete ☐ steel ☐ timber ☐ other ____	☐ concrete ☐ steel ☐ timber ☐ other ____	☐ concrete ☐ steel ☐ timber ☐ other ____	☐ concrete ☐ steel ☐ timber ☐ other ____	☐ concrete ☐ steel ☐ timber ☐ other ____
	Culvert Material Corrugated? ☐ Y ☐ N	☐ concrete ☐ steel ☐ plastic ☐ other ____	☐ concrete ☐ steel ☐ plastic ☐ other ____	☐ concrete ☐ steel ☐ plastic ☐ other ____	☐ concrete ☐ steel ☐ plastic ☐ other ____	☐ concrete ☐ steel ☐ plastic ☐ other ____
	# of Arches/Culverts					
	Opening Obscured Up/Downstream	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure					
	Armoring?	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure					
	Structure outlet is:	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

- true fish barrier, possible only at highest flows

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME NALFF - S4	LOCATION	
STATION # S4 RIVERMILE	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS BD, EF, SC		
FORM COMPLETED BY EF	DATE 8/12/14 TIME 13:30 AM (PM)	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☑
65 % ☑	%cloud cover	☐ ___ %
☐	clear/sunny	☐

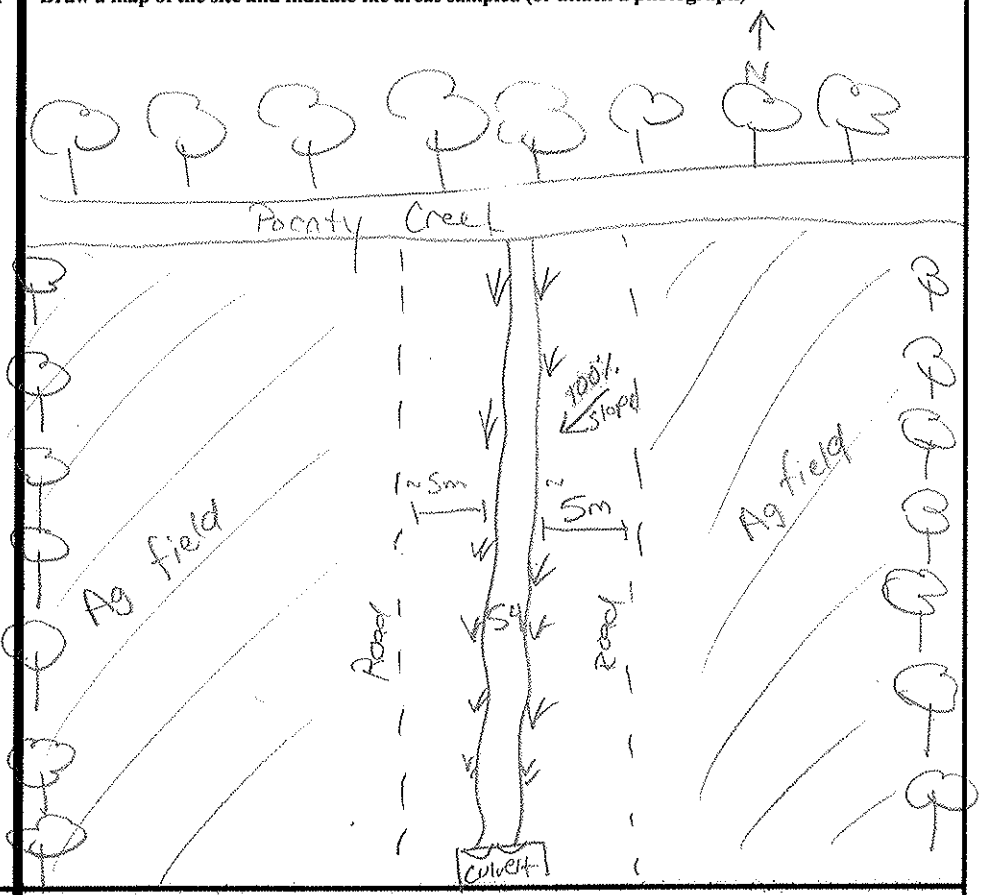
Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 23 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem ☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type ☐ Coldwater ☑ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☑ Other Ag. field drainage

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☑ Agricultural ☐ Other _____
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☑ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☑ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☐ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Agriculture — reach is set in soybean field

INSTREAM FEATURES

Estimated Reach Length 150 m
Estimated Stream Width 7 m
Sampling Reach Area _____ m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth _____ m
Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☑ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark 0.3 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle ____ % ☑ Run 95 %
☑ Pool 5 %

Channelized ☑ Yes ☐ No

Dam Present ☐ Yes ☐ No

LARGE WOODY DEBRIS

LWD 0 m²
Density of LWD 0 m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☑ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☑ Attached Algae

dominant species present Typha latifolia

Portion of the reach with aquatic vegetation 100 %

WATER QUALITY

Temperature _____ ° C
Specific Conductance _____
Dissolved Oxygen _____
pH _____
Turbidity _____
WQ Instrument Used _____

Water Odors
☐ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☐ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☐ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	20
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	50			
Clay	< 0.004 mm (slick)	40			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME S4	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS RD, EF, JC		
FORM COMPLETED BY EF	DATE 8/12/14 TIME 12:30 AM (PM)	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 (1) 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 (1) 0

Total Score 84

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NAFF 394	LOCATION Fentress Airfield
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS JC, BD, EF
FORM COMPLETED BY JC	DATE 8/12/14 TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 12:45pm End time 1:10pm Duration 953 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	W	L	W	L/W	ANOMALIES* D	E	F	L	M	S	T	Z
Bluegill		101	22	51	8	62/9								
		85	15	66	9	61/5								
		55	8	56	3	56/7								
		53	8	105	30	58/8								
		53	7	71	9	56/10								
Mosquito Fish		40	2	50	3	56/1								
		40	3	47	3	60/3								
		47	3	36	2	45/3								
		46	3	34	2	36/2								
		49	3	35	2	46/3								
~~Blue~~ Redear Sunfish		56	4	56	5									
		51	3	52	5									
		50	3	47	4									
		44	4	31	1									
		49	5	35	2									
~~Blue Gill~~		54	10											
Other Sunfish														

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		L	W	L	W	L/W	D	E	F	L	M	S	T	Z
Large mouth Bass		116	18	66	7	73/7								
		115	22	68	7	80/9								
		110	20	53	5	64/7								
		170	69	87	10	116/25								
		66	8	71	7	67/5								
Creek chub sucker		71	9	85	11									
		83	9											
		89	8											
		85	11											
		89	11											
~~Highfin shiner~~?		77	3	66	4	60/4								
↑ Eastern Silvery same as ↓ minnow		72	3	67	4	63/5								
		65	3	59	3	72/7								
		70	3	67	4	74/7								
		60	5	66	5	66/5								
~~Highfin shiner~~		63	4	62	4	79/10								
		58	3	70	6	75/8								
		69	5	59	5	68/6								
		63	4	66	5	68/6								
		62	4	57	3	72/7								
Carp (common)		133	36											
Yellow Bullhead		74	9											
Warmouth		174	38											
		73	11											
American Eel		167	10	295	48	250/32								
		153	9	221	18	260/35								
		211	13	80	2	160/15	lost more than 10 of the smallest size Eels went through net							
		275	40	275	35									
		150	9	210	25									

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NAEF 54	LOCATION Fentress Airfield
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS JC, BD, EF
FORM COMPLETED BY JC	DATE 8/6/14 TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 953 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	L	W	W	L/W	ANOMALIES* D	E	F	L	M	S	T	Z
Bluegill		54	9											
		53	5											
		50	5											
		64	7											
		66	9											
Juvenile Sunfish		57	8	59	6	46/4								
		57	8	51	6	52/5								
		55	6	54	6	50/5								
		41	5	42	4	48/5								
		45	5	37	3	51/6								
Juvenile Sunfish		49	5	51	4	44/4								
		45	4	48	4	45/4								
		46	5	71	8	55/16								
		52	5	52	6	53/5								
		56	5	47	5	46/4								
Mosquito Fish		33	1	37	2	35/3								
		46	3	46	3	36/3								
		31	1	45	4									
		48	3	36	3									
		47	3	44	4									

HHT HHT HHT HHT III

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		L	W				D	E	F	L	M	S	T	Z
Largemouth Bass		66	5											
		80	7											
		47	4											
		62	5											
		66	6											
Blueback herring		64	6											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): JC, EF

SITE ID: FW08 S4 NAFF DATE: 08/21/2014

6m

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ⊘ cm	⊘ ft ○ cm	⊘ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.0	0	
2	60	0.4	0.01	
3	120	0.4	0.05	
4	180	0.45	0.12	
5	240	0.35	0.22	
6	300	0.5	0.07	
7	360	0.5	0.04	
8	420	0.4	0.01	
9	480	0.35	0.0	
10	540	0.3	0.0	
11	600	0	0	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	.	.	
2	.	.	
3	.	.	
4	.	.	
5	.	.	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	.	.	.
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

EXAMPLE

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

14610

04/07/2009 NRSA Stream Discharge

TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NALFF Date and Time (Start-End): Investigators:

Stream: S4 Reach: Partial Debris Dam Tally for Reach: GPS @ Start Point: ☐ Y ☐ N Photo #'s:

Start of Reach located at: ☐ Confluence with ☐ Installation-Specific ☐ Arbitrary location

	Observation Parameters	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☒ Culvert # 1 Name of Road_____ GPS Point? (Y) / N	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☐ Culvert # 2 Name of Road_____ GPS Point? (Y) / N	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☐ Culvert #_____ Name of Road_____ GPS Point? Y / N	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☐ Culvert #_____ Name of Road_____ GPS Point? Y / N	Barrier Type ☐ Debris Dam #_____ ☐ Bridge #_____ Name of Road_____ ☐ Culvert #_____ Name of Road_____ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	☒ HIGH ☐ MED ☐ LOW ☐ NONE	☑ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	N/A	N/A			
	Vertical Water Drop	0	0			
	Pool Immediately Below?	☐ Y Depth_____ ☐ N	☐ Y Depth_____ ☐ N	☐ Y Depth_____ ☐ N	☐ Y Depth_____ ☐ N	☐ Y Depth_____ ☐ N
	Wetted Channel Width	21'	21 F			
	Structure Width (length, for culverts)	10 Ft	10 Ft			
	Stream Channel	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☒ channelized ☐ natural Downstream: ☒ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☒ N Right: ☐ Y ☒ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	80 Ft	80 Ft			
	Beaver Activity?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
DAM	[illegible] Composition	☐ woody debris ☐ leaf litter ☐ sediment ☐ other_____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other_____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other_____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other_____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other_____
	[illegible] Beaver Dam?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	[illegible]lternate Channel [illegible]ormation/Braiding?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	[illegible]earance	4 Ft	4 Ft			
	Bridge Material	☒ concrete ☐ steel ☐ timber ☐ other_____	☒ concrete ☐ steel ☐ timber ☐ other_____	☐ concrete ☐ steel ☐ timber ☐ other_____	☐ concrete ☐ steel ☐ timber ☐ other_____	☐ concrete ☐ steel ☐ timber ☐ other_____
	Culvert Material Corrugated? ☐ Y ☒ N	☒ concrete ☐ steel ☐ plastic ☐ other_____	☒ concrete ☐ steel ☐ plastic ☐ other_____	☐ concrete ☐ steel ☐ plastic ☐ other_____	☐ concrete ☐ steel ☐ plastic ☐ other_____	☐ concrete ☐ steel ☐ plastic ☐ other_____
	# of Arches/Culverts	1	1			
	Opening Obscured Up/Downstream	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure	0.1 m	0.1 m			
	Armoring?	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☒ Y ☐ N Right: ☒ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☒ N	☐ Y ☒ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure	Clay	Clay			
	Structure outlet is:	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

- Small ramp footbridge

LWD = 1

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME NALFF-S6	LOCATION CHESAPEAKE, VA
STATION # _____ RIVERMILE ~	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS DREESZEN, COOK, FISHER	
FORM COMPLETED BY	DATE 08TS 8/12/14 TIME 0815 (AM) PM / REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
(00) % ☒	%cloud cover	☐ ____ %
☐	clear/sunny	☐

occ. drizzle

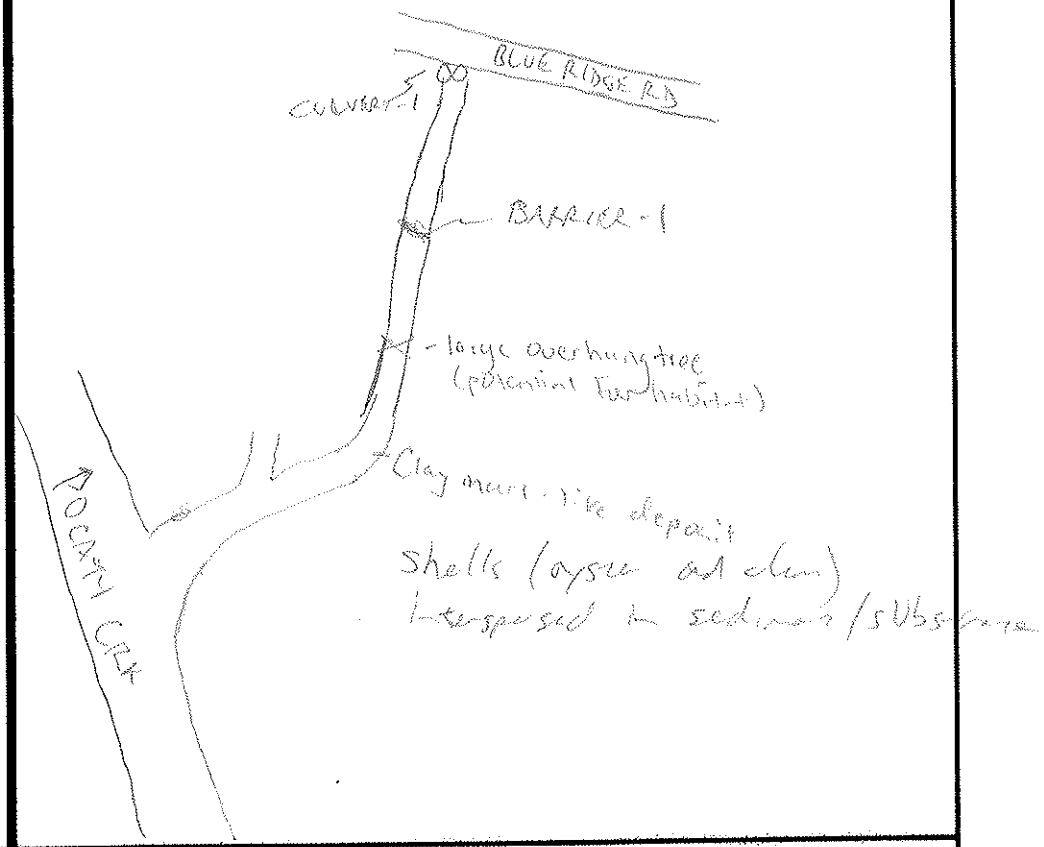
Has there been a heavy rain in the last 7 days? ☐ Yes ☒ No

Air Temperature ____ °C 80°F

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type ☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☐ Mixture of origins
☒ Other AG. FIELDS DRAINAGE

Catchment Area _____ km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☒ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☒ Agricultural ☒ Other MILITARY
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Pawi Paw

INSTREAM FEATURES

Estimated Reach Length 150 m
Estimated Stream Width 1-2 m
Sampling Reach Area 300 m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth _____ m
Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☐ Partly open ☒ Partly shaded ☐ Shaded

High Water Mark _____ m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle _____ % ☐ Run _____ %
☐ Pool _____ %

Channelized ☐ Yes ☐ No

Dam Present ☐ Yes ☐ No

LARGE WOODY DEBRIS

LWD _____ m² 5 pieces >10cm wide x 2m

Density of LWD _____ m²/km² **(LWD/ reach area)**

AQUATIC VEGETATION

NONE

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present N/A

Portion of the reach with aquatic vegetation 0 %

WATER QUALITY

Temperature _____ ° C
Specific Conductance _____
Dissolved Oxygen _____
pH _____
Turbidity _____
WQ Instrument Used _____

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other _____

Turbidity (if not measured)
☒ Clear ☐ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☒ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No N/A

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME SG NKLFF	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY JC	DATE 8/12 TIME 9:00 (AM) PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 10	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 6	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 3 (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Total Score _____

-Used Hanging Scale for weights

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NAIFF S6	LOCATION Fentress Airfield
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE 8/12/14 TIME _____ AM PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 9:00am End time 9:40am Duration 947 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		Len	Wg	Len	Wg	L/W	D	E	F	L	M	S	T	Z
Redfin Pickerel		117	10	113	10	160/32								
		119	10	135	15	119/17								
		134	15	113	9	114/10								
		115	10	141	20	146/13								
		113	10	170	11	121/13								
Largemouth Bass		78	8	65	5									
		67	5											
		60	5											
		70	8											
		57	5											
Pirate Perch		35	2	78	9	42/5								
		61	8	56	7	54/5								
		41	5	54	5	41/3								
		41	3	53	3	61/5								
		45	4	42	3	60/4								
Redfin Pickerel		199	14	172	38									
		112	9											
		118	10											
		117	9											
		117	9											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		L	W	L	W	L/W	D	E	F	L	M	S	T	Z
Brown Bullhead		8[illegible]	10											
		90	10											
		68	7											
		76	8											
		84	11											
Mosquito Fish		35	2	51	3	28/1								
		36	2	32	1	34/1								
		32	2	33	2									
		25	1	30	1									
		32	2	38	2									
Carp (common)		124	29											
Bowfin		205	75											
		211	98											
Mudminnow		112	12	83	9									
		48	3	67	8									
		100	16	56	3									
		93	13	55	3									
~~[illegible]~~		68	8	50	3									
~~[illegible]~~		66	5											
Golden Shiner		57	5											
Pirate Perch		53	6	43	3	55/5								
		57	6	38	2	54/3								
		42	3	52	3	50/3								
		34	2	46	3	46/3								
		83	11	49	3									
Warmouth		94	19	78	11									
		111	21											
		115	24											
		113	29											
		114	23											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

Shiner - 8 dorsal ray, 1st ray [illegible] no second
- 15 anal rays
- no barbels
- mouth "U" shaped
- front of dorsal closer to mouth than anal fin
- 17 scales ~ body depth
- 45 scales lateral line

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NALF 56	LOCATION Fentress Air Field
STATION #________ RIVERMILE________	STREAM CLASS
LAT ____________ LONG ____________	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE 8/12/14 TIME ______ AM PM — REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ❑ tote barge ❑ other ____________ **Block nets used?** ❑ YES ☑ NO **Sampling Duration** Start time 9:00am End time 9:40am Duration 947 **Stream width (in meters)** Max________ Mean________
HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Riffles____% ❑ Pools____% ❑ Runs____% ❑ Snags____% ❑ Submerged Macrophytes____% ❑ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	W	L	W		ANOMALIES* D	E	F	L	M	S	T	Z
Pumpkinseed		112	25	94	18									
		80	12	83	10									
		86	15	36	3									
		81	10	38	2									
		54	5											
~~Flier~~ Redear Sunfish		79	9	67	9	57/5								
		76	9	41	3	40/2								
		102	20	42	3	49/3								
		44	2	41	3	57/5								
		68	9	50	5	60/3								
~~Warmouth like?~~ Mud Sunfish		114	29											
Bluegill		55	5	64	5	59/3								
		64	9	66	7	37/2								
		50	5	39	7									
		64	3	50	3									
		67	6	158	3									

Warmouth like (mud Sunfish)
- distinct lateral banding
- rounded caudal fin
- 11 dorsal spines
- 11 dorsal rays
- 11 anal spines
- 10 anal rays

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	W	L	W	L/W	ANOMALIES* D	E	F	L	M	S	T	Z
~~Blue spotted~~		116	25	-										
Green Sunfish														
Juvenile Sunfish		35	2	36	1									
		35	2	40	3									
		44	2	41	2									
		34	1	46	2									
		37	1	38	2									
~~Blue~~ Redear Sunfish		42	3											
American Eel		180	18											
		170	15											
		250	45											
		170	25											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

~~Blue spotted~~ - 10 dorsal spines
- 3 anal spines
- Orange fringe on caudal, dorsal, and anal

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): JC, EF

SITE ID: ~~EW08~~ Fentress S6 DATE: 08/21/2014

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ◉ cm	◉ ft ○ cm	◉ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0	0.02	
2	21	0.2	0.00	
3	42	0.2	0.01	
4	63	0.3	0.00	
5	84	0.35	0.01	
6	105	0.35	0.01	
7	126	0.70	0.01	
8	147	0.60	0.00	
9	168	0.50	0.00	
10	189	0.50	0.00	
11	210	0.3	0.00	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	____.__	____.__	
2	____.__	____.__	
3	____.__	____.__	
4	____.__	____.__	
5	____.__	____.__	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	____.__	____.__	____.__
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

14610

04/07/2009 NRSA Stream Discharge

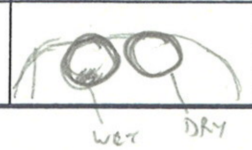
TETRA TECH

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: NALFF **Date and Time (Start-End):** 8/12/14 **Investigators:** ____________

Stream: S6 **Reach:** ________ **Partial Debris Dam Tally for Reach:** HHT I **GPS @ Start Point:** ☑ Y ☐ N **Photo #'s:** ________

Start of Reach located at: ☑ Confluence with POCATY ☐ Installation-Specific ________ ☐ Arbitrary location ________

	Observation Parameters	Barrier Type	Barrier Type	Barrier Type	Barrier Type	Barrier Type
ALL BARRIER TYPES		☑ Debris Dam # 1 ☐ Bridge # ____ Name of Road ____ ☐ Culvert # ____ Name of Road ____ GPS Point? (Y) / N	☐ Debris Dam # ____ ☐ Bridge # ____ Name of Road ____ ☑ Culvert # 1 Name of Road ____ GPS Point? Y / N	☐ Debris Dam # ____ ☐ Bridge # ____ Name of Road ____ ☐ Culvert # ____ Name of Road ____ GPS Point? Y / N	☐ Debris Dam # ____ ☐ Bridge # ____ Name of Road ____ ☐ Culvert # ____ Name of Road ____ GPS Point? Y / N	☐ Debris Dam # ____ ☐ Bridge # ____ Name of Road ____ ☐ Culvert # ____ Name of Road ____ GPS Point? Y / N
	Potential for Fish Passage	☐ HIGH ☐ MED ☑ LOW ☐ NONE	☐ HIGH ☐ MED ☑ LOW ☑ NONE (x [illegible])	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	15cm	0.3 m			
	Vertical Water Drop	5 cm	~~0.3m~~ ∅ cascade			
	Pool Immediately Below?	☐ Y Depth____ ☐ N	☑ Y Depth____ ☐ N	☐ Y Depth____ ☐ N	☐ Y Depth____ ☐ N	☐ Y Depth____ ☐ N
	Wetted Channel Width	2m up / 2.5m down	16 ft (pool)			
	Structure Width (length, for culverts)	2 m	36 ft			
	Stream Channel	Upstream: ☑ channelized ☐ natural Downstream: ☑ channelized ☐ natural	Upstream: ☑ channelized ☐ natural Downstream: ☑ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☑ Y ☐ N Right: ☑ Y ☐ N	Left: ☑ Y ☐ N Right: ☑ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☐ Y ☑ N Right: ☐ Y ☑ N	Left: ☐ Y ☑ N Right: ☐ Y ☑ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	N/A	4 ft dia			
	Beaver Activity?	☐ Y ☑ N	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☑ woody debris ☑ leaf litter ☑ sediment ☐ other ____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ____	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ____
	Is this a Beaver Dam?	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance					
	Bridge Material	☐ concrete ☐ steel ☐ timber ☐ other ____	☑ concrete ☐ steel ☐ timber ☐ other ____	☐ concrete ☐ steel ☐ timber ☐ other ____	☐ concrete ☐ steel ☐ timber ☐ other ____	☐ concrete ☐ steel ☐ timber ☐ other ____
	Culvert Material Corrugated? ☐ Y ☐ N	☐ concrete ☐ steel ☐ plastic ☐ other ____	☑ concrete ☐ steel ☐ plastic ☐ other ____	☐ concrete ☐ steel ☐ plastic ☐ other ____	☐ concrete ☐ steel ☐ plastic ☐ other ____	☐ concrete ☐ steel ☐ plastic ☐ other ____
	# of Arches/Culverts		2			
	Opening Obscured Up/Downstream	☐ Y ☐ N	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure		L=5cm R=DRY			
	Armoring?	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☑ Y ☐ N Right: ☑ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☐ N	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure		N/a			
	Structure outlet is:	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☑ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

CWD = HHT

~~[illegible]~~ oyster/clam shells dragline ^And to create substrate remnant oyster reef ?

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NAIFF-W1	LOCATION Fentress Air Field
STATION # ______ RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS BO, EF, JC
FORM COMPLETED BY JC	DATE ~~9/26~~ 08/13 TIME 9:30 (AM) PM — REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ❑ tote barge ❑ other ______ **Block nets used?** ❑ YES ☑ NO **Sampling Duration** Start time ______ End time ______ Duration 988 **Stream width (in meters)** Max N/A Mean N/A
HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Riffles____% ❑ Pools____% ❑ Runs____% ❑ Snags____% ❑ Submerged Macrophytes____% ❑ Other ( )____%
GENERAL COMMENTS	-Wetland (Salix Nigra, Taxodium distichum, Red maple, Sweetgum, Black gum, Willow) Inundated with abundant detritus and duckweed

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L	W	L	W		ANOMALIES* D	E	F	L	M	S	T	Z
Mudminnow		41	2	73	9									
		53	5	37	4									
		77	9											
		43	3											
		62	6											

followed zig-zag pattern w/in swamp, between trees

FISH SAMPLING FIELD DATA SHEET (FRONT)

page of

STREAM NAME NAFF - W2	LOCATION Forbes Airfield
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS BO, EF, JC
FORM COMPLETED BY JC	DATE 8/13 TIME 10:30 (AM) PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time _____ End time _____ Duration 872 **Stream width (in meters)** Max N/A Mean N/A
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other (____)____%
GENERAL COMMENTS	- Same population and habitat as W1

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		Lm	Wg	L	W		D	E	F	L	M	S	T	Z
Mud minnow	4	56	6											
		56	6											
		61	7											
		62	7											

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME NAIFF - W3	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS BD, JL, EF
FORM COMPLETED BY JL	DATE 8/13 TIME 11:30 (AM) PM / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☐ NO **Sampling Duration** Start time 11:00 End time 11:30 am Duration 813 **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	Same community as W1 and W2, though less Lilac vegetation

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		Lcm	Wg	Lcm	Wg	L/W	D	E	F	L	M	S	T	Z
Mud Minnow		67	8	72	6	63/5								
		77	6	60	4									
		48	4	61	4									
		69	6	41	3									
		60	5	46	4									

TETRA TECH

8/21/14

Water Quality - Streams, Sheet ___ of ___

Project: _____ **Site:** NALFF **Meter:** YSI 600/556

Investigators: SC / BD / EF **Remarks:** _____

Stream Reach	Location	Date/Time	In-situ Measurements					Grab Samples			Remarks
			pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Sp. Cond.°25C (µS/cm)	Temperature (C°)	Total Nitrogen (TN)	Total Phos. ortho-Phos. (SRP)	Total Suspended Solids (TSS)	
S2	Fentress	8/21/14 10:00am	7.25	1.06	12.0	0.211	22.18	☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
S6	Fentress	8/21/14 11:00 am	7.39	1.34	15.5	.573	21.29	☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
S4	Fentress	8/21/14 11:50am	8.01	7.53	101	.251	30.85	☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
S1	Fentress	8/21/14 12:00pm	7.44	5.12	64.0	.277	29.12	☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
W1	Fentress	8/21/14 12:45pm	5.91	1.32	17.5%	.340	25.46	☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
W3	Fentress	8/21/14 12:53	6.64	6.09	72.9%	.379	24.00	☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
W2	Fentress	8/21/14 1:00pm	6.56	1.71	21.6%	.670	26.09	☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	
								☐ bottle(s) filled	☐ bottle(s) filled	☐ bottle(s) filled	

Waterbody: Pocaty
Gear: Small Boat Pulse Box 12' Shocker Single Boom
Effort: 989 seconds
Collected by: CB, Tech

Date: 8-15-14
Location: 0830-
Notes:

Water Temp: 21.9
DO: 5.27 mg/L
Specific Conductivity: 303
Salinity: 0.1 ppt

	Spp	TL (mm)	WT (g)	~~Sex~~ TL	~~ID#~~ WT	
1A	Bluegill	122	32			1
		97	17	79	10	2
		176	115	70		3
		125	37	89	13	4
		124	40	77	7	5
		113	26	76	8	6
		102	19			7
		73	6			8
		69	7			9
		119	28			10
2A	Yellow Perch	137	30	139	29	11
		133	26			12
		147	33			13
		143	32			14
		152	37			15
		126	25			16
		132	26			17
		139	32			18
		126	21			19
		137	25			20
3	Golden Shiner	56	2	63	2	21
		55	2	60	2	22
		57	2	53	1	23
		66	3	60	3	24
		64	2	102	10	25
		59	1	106	11	26
		53	1	103	10	27
		67	2	102	9	28
		63	2			29
		56	1			30
4 *	Eastern Silvery	106	11	109	11	31
		89	8	100	10	32
		93	9	106	10	33
		66	4	103	11	34
		65	3	97	9	35
		95	7	103	10	36
		105	12	96	8	37
		108	12	104	11	38
		104	11	107	11	39
		106	11	64	3	40
2B	Yellow Perch	136	30			41
		204	105			42
		122	23			43
		155	43			44
						45
						46
						47
						48
						49
						50

	Spp	TL (mm)	WT (g)	~~Sex~~	~~ID#~~	
5	Pumpkin Seed	115	31			1
		117	34			2
						3
						4
						5
						6
						7
						8
						9
						10
6	Creek Chub Sucker	189	89			11
						12
						13
						14
						15
						16
						17
						18
						19
						20
1B	Bluegill	120	30			21
		93	14			22
		66	4			23
						24
						25
						26
						27
						28
						29
						30
7	Gizzard Shad	112	12			31
		80	6			32
		113	13			33
						34
						35
						36
						37
						38
						39
						40
						41
						42
						43
						44
						45
						46
						47
						48
						49
						50

gizzard shad also have black peritoneum
→ rounded nose, check Fishes of VA

Waterbody:
Gear:
Effort:
Collected by:

Date:
Location:
Notes:

Water Temp:
DO:
Specific Conductivity:
Salinity:

Spp	TL	WT	Sex	ID#	
					1
					2
					3
					4
					5
					6
					7
					8
					9
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Spp	TL	WT	Sex	ID#	
					1
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TETRA TECH

Freshwater Stream Barrier Assessment, Sheet 1 of ___

Project: FENTRESS Date and Time (Start-End): 4/7/2015 Investigators: DRESSER, FOSTER, COOK

Stream: POCATY Reach: S1 Partial Debris Dam Tally for Reach: III GPS @ Start Point: ☒Y ☐N Photo #'s: _____

Start of Reach located at: ☒Confluence with FENTRESS AIRFIELD RD. ☐Installation-Specific _____ ☐Arbitrary location _____

	Observation Parameters	Barrier Type ☒Debris Dam # 1 ☐Bridge # ☐Culvert # Name of Road _____ GPS Point? (Y) / N	Barrier Type ☒Debris Dam # 2 ☐Bridge # ☐Culvert # Name of Road _____ GPS Point? (Y) / N	Barrier Type ☐Debris Dam # 3 ☐Bridge # ☐Culvert # Name of Road _____ GPS Point? (Y) N	Barrier Type ☐Debris Dam # ☐Bridge # ☐Culvert # Name of Road _____ GPS Point? Y / N	Barrier Type ☐Debris Dam # ☐Bridge # ☐Culvert # Name of Road _____ GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	☐HIGH ☐MED ☒LOW ☐NONE	☐HIGH ☐MED ☒LOW ☐NONE	☐HIGH ☐MED ☒LOW ☐NONE	☐HIGH ☐MED ☐LOW ☐NONE	☐HIGH ☐MED ☐LOW ☐NONE
	Barrier Height	.5 → .8	.3	0.2		
	Vertical Water Drop	NONE	NONE	0.1		
	Pool Immediately Below?	☐Y Depth____ ☒N	☐Y Depth____ ☒N	☐Y Depth____ ☒N	☐Y Depth____ ☐N	☐Y Depth____ ☐N
	Wetted Channel Width	6m	5m	3m		
	Structure Width (length, for culverts)	40m	2m	0.5m		
	Stream Channel	Upstream: ☐channelized ☒natural Downstream: ☐channelized ☒natural	Upstream: ☐channelized ☒natural Downstream: ☐channelized ☒natural	Upstream: ☐channelized ☒natural Downstream: ☐channelized ☒natural	Upstream: ☐channelized ☐natural Downstream: ☐channelized ☐natural	Upstream: ☐channelized ☐natural Downstream: ☐channelized ☐natural
	Bank Erosion?	Left: ☐Y ☒N Right: ☐Y ☒N	Left: ☐Y ☒N Right: ☐Y ☒N	Left: ☐Y ☒N Right: ☐Y ☒N	Left: ☐Y ☐N Right: ☐Y ☐N	Left: ☐Y ☐N Right: ☐Y ☐N
	Scouring or undercutting of structure?	Left: ☐Y ☒N Right: ☐Y ☒N	Left: ☐Y ☒N Right: ☐Y ☒N	Left: ☐Y ☒N Right: ☐Y ☒N	Left: ☐Y ☐N Right: ☐Y ☐N	Left: ☐Y ☐N Right: ☐Y ☐N
	Structure Span/Diameter	N/A	N/A	N/A		
	Beaver Activity?	☐Y ☒N	☐Y ☒N	☐Y ☒N	☐Y ☐N	☐Y ☐N
DEBRIS DAMS	Debris Dam Composition	☒woody debris ☒leaf litter ☐sediment ☐other _____	☒woody debris ☒leaf litter ☐sediment ☐other _____	☐woody debris ☐leaf litter ☐sediment ☐other _____	☐woody debris ☐leaf litter ☐sediment ☐other _____	☐woody debris ☐leaf litter ☐sediment ☐other _____
	Is this a Beaver Dam?	☐Y ☒N	☐Y ☒N	☐Y ☐N	☐Y ☐N	☐Y ☐N
	Alternate Channel Formation/Braiding?	☐Y ☒N	☐Y ☒N	☐Y ☐N	☐Y ☐N	☐Y ☐N
BRIDGE/CULVERT	Clearance					
	Bridge Material	☐concrete ☐steel ☐timber ☐other _____	☐concrete ☐steel ☐timber ☐other _____	☐concrete ☐steel ☐timber ☐other _____	☐concrete ☐steel ☐timber ☐other _____	☐concrete ☐steel ☐timber ☐other _____
	Culvert Material Corrugated? ☐Y ☐N	☐concrete ☐steel ☐plastic ☐other _____	☐concrete ☐steel ☐plastic ☐other _____	☐concrete ☐steel ☐plastic ☐other _____	☐concrete ☐steel ☐plastic ☐other _____	☐concrete ☐steel ☐plastic ☐other _____
	# of Arches/Culverts					
	Opening Obscured Up/Downstream	☐Y ☐N	☐Y ☐N	☐Y ☐N	☐Y ☐N	☐Y ☐N
	Depth Inside Structure					
	Armoring?	Left: ☐Y ☐N Right: ☐Y ☐N	Left: ☐Y ☐N Right: ☐Y ☐N	Left: ☐Y ☐N Right: ☐Y ☐N	Left: ☐Y ☐N Right: ☐Y ☐N	Left: ☐Y ☐N Right: ☐Y ☐N
	Overflow Pipe?	☐Y ☐N	☐Y ☐N	☐Y ☐N	☐Y ☐N	☐Y ☐N
	Substrate inside structure					
	Structure outlet is:	☐partially backwatered ☐at grade ☐cascade/free fall	☐partially backwatered ☐at grade ☐cascade/free fall	☐partially backwatered ☐at grade ☐cascade/free fall	☐partially backwatered ☐at grade ☐cascade/free fall	☐partially backwatered ☐at grade ☐cascade/free fall
	cross sectional schematic (draw)					

-See August 2014 sheet major debris dam, but passable on higher flows

WATER QUALITY:
4/7/2015

SITE	TIME	TEMP	DO%	DO	SPC mS/cm	pH	NTU TURBID.
S2	1220	16.1	96.7	9.52	0.246	7.39	5.49
~~S3~~ S6	2:20	19.4	142.1	12.99	0.62	7.95	5.22
S5	1515	19.1	114.6	10.51	0.465	6.53	11.3
S1	1545	18.5	100.2	9.50	0.71	7.29	5.32
S4	1615	24.2	126.5	10.61	0.29	9.13	14.5

W1

W2

W3

HTT

TETRA TECH

4/8/2015

Freshwater Stream Barrier Assessment, Sheet ___ of ___

Project: WE04 Date and Time (Start-End): 11:30-11:45 a.m. Investigators: Foster / Cook / Dexter

Stream: S5 Reach: ___ Partial Debris Dam Tally for Reach: HTTIII GPS @ Start Point: ☐ Y ☑ N Photo #'s: ___

Start of Reach located at: ☑ Confluence with Powers Creek ☐ Installation-Specific ___ ☐ Arbitrary location ___

	Observation Parameters	Barrier Type ☑ Debris Dam # 1 ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? (Y) / N	Barrier Type ☑ Debris Dam # 2 ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? (Y) / N	Barrier Type ☐ Debris Dam # ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? Y / N	Barrier Type ☐ Debris Dam # ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? Y / N	Barrier Type ☐ Debris Dam # ☐ Bridge # Name of Road ☐ Culvert # Name of Road GPS Point? Y / N
ALL BARRIER TYPES	Potential for Fish Passage	☐ HIGH ☐ MED ☐ LOW ☑ NONE	☐ HIGH ☐ MED ☑ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE	☐ HIGH ☐ MED ☐ LOW ☐ NONE
	Barrier Height	.25m	1 m			
	Vertical Water Drop	.25m	—			
	Pool Immediately Below?	☑ Y Depth 1m ☐ N	☐ Y Depth ___ ☑ N	☐ Y Depth ___ ☐ N	☐ Y Depth ___ ☐ N	☐ Y Depth ___ ☐ N
	Wetted Channel Width	1.5m	2m			
	Structure Width (length, for culverts)	1.5m	2m			
	Stream Channel	Upstream: ☐ channelized ☑ natural Downstream: ☐ channelized ☑ natural	Upstream: ☑ channelized ☐ natural Downstream: ☑ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural	Upstream: ☐ channelized ☐ natural Downstream: ☐ channelized ☐ natural
	Bank Erosion?	Left: ☐ Y ☐ N Right: ☑ Y ☐ N	Left: ☑ Y ☐ N Right: ☑ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Scouring or undercutting of structure?	Left: ☐ Y ☑ N Right: ☐ Y ☑ N	Left: ☐ Y ☑ N Right: ☐ Y ☑ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Structure Span/Diameter	1 m	3 m			
	Beaver Activity?	☐ Y ☑ N	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
DEBRIS DAMS	Debris Dam Composition	☑ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☑ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___	☐ woody debris ☐ leaf litter ☐ sediment ☐ other ___
	Is this a Beaver Dam?	☐ Y ☑ N	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Alternate Channel Formation/Braiding?	☐ Y ☑ N	☐ Y ☑ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
BRIDGE/CULVERT	Clearance					
	Bridge Material	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___	☐ concrete ☐ steel ☐ timber ☐ other ___
	Culvert Material Corrugated? ☐ Y ☐ N	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___	☐ concrete ☐ steel ☐ plastic ☐ other ___
	# of Arches/Culverts					
	Opening Obscured Up/Downstream	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Depth Inside Structure					
	Armoring?	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N	Left: ☐ Y ☐ N Right: ☐ Y ☐ N
	Overflow Pipe?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
	Substrate inside structure					
	Structure outlet is:	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall	☐ partially backwatered ☐ at grade ☐ cascade/free fall
	cross sectional schematic (draw)					

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: FW08 NALFF-SL DATE: 04/07/2015

○ Velocity Area

Distance Units ○ ft ○ cm	Depth Units ○ ft ○ cm	Velocity Units ○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.4	0.02	
2	65	0.7	0	
3	130	1.2	0	
4	195	1.3	0	
5	260	1.2	0.07	
6	325	1.2	0.05	
7	390	1.0	0	
8	455	0.7	0	
9	520	0.6	0.08	
10	585	0.2	0	
11	650	0.2	0	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

14610

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~FW08~~ S2 DATE: 04/07/2015

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ◉ cm	◉ ft ○ cm	○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	.8	0.01	
2	18	.8	0.01	
3	36	1.1	0.01	
4	54	1.0	0	
5	72	1.5	0.02	
6	90	1.6	0.02	
7	108	1.4	0.04	
8	126	1.3	0.02	
9	144	1.1	0	
10	~~X~~162	0.9	0	
11	180	0.6	0	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: ~~FW08~~ NALF-S4 DATE: 04/07/2015

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ◉ cm	◉ ft ○ cm	○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.4	0.17	
2	20	0.4	0.25	
3	40	0.6	0.37	
4	60	0.7	0.21	
5	80	0.8	0.38	
6	100	0.7	0.18	
7	120	0.9	0.48	
8	140	0.9	0.49	
9	160	0.7	0.41	
10	180	0.5	0.22	
11	200	0.2	0.02	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	____.__	____.__	
2	____.__	____.__	
3	____.__	____.__	
4	____.__	____.__	
5	____.__	____.__	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	____.__	____.__	____.__
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

EXAMPLE

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

14610

DISCHARGE FORM - WADEABLE

Reviewed by (Initials): _____

SITE ID: FW08 NALFF S-5 DATE: 04/07/2015

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ◉ cm	◉ ft ○ cm	○ ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.2	0	
2	25	0.3	0	
3	50	0.3	0.02	
4	75	0.7	0	
5	100	0.9	0	
6	125	0.9	0	
7	150	1.1	0	
8	175	1.0	0	
9	200	0.8	0	
10	225	0.6	0.02	
11	250	0.3	0.13	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1	___.___	___.___	
2	___.___	___.___	
3	___.___	___.___	
4	___.___	___.___	
5	___.___	___.___	

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m	___.___	___.___	___.___
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

DISCHARGE FORM - WADEABLE

Reviewed by (initials): _____

SITE ID: ~~FW08~~ NALFF-S6 DATE: 04/07/2015

○ Velocity Area

Distance Units	Depth Units	Velocity Units
○ ft ● cm	● ft ○ cm	● ft/s XX.X ○ m/s X.XX

	Dist. from Bank	Depth	Velocity	Flag
1	0	0.3	0	
2	30	0.5	0	
3	60	0.6	0.02	
4	90	0.7	0.02	
5	120	0.7	0	
6	150	0.9	0.01	
7	180	0.9	0.01	
8	210	0.9	0	
9	240	0.6	0	
10	270	0.4	0	
11	300	0.2	0	
12				
13				
14				
15				
16				
17				
18				
19				
20				

○ Timed Filling

Repeat	Volume (L)	Time (s)	Flag
1			
2			
3			
4			
5			

○ Neutral Bouyant Object

	Float 1	Float 2	Float 3
Float Dist. ○ ft ○ m			
Float Time (s)			
Flag			

Cross Sections on Float Reach

	Upper Section	Middle Section	Lower Section
Width ○ ft ○ m			
Depth 1 ○ ft ○ cm			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

○ Q Value

If discharge is determined directly in field, record value here: Q = _____ ○ cfs ○ m^3/s FLAG

Flag	Comments

Flag Codes: K = No measurement or observation made; U = Suspect measurement or observation; Q = Unacceptable QC check associated with measurement; Z = Last station measured (if not Station 20); F1, F2, etc. = Miscellaneous flags assigned by each field crew. Explain all flags in comments section.

Waterbody: Pocaty
Gear: VI-A, Smith Root
Effort: 600s
Collected by: CB, BD

Date: 4-7-15
Location:
Notes: very shallow <10-12 inches

Water Temp: 18.5°C
DO: 9.50
Specific Conductivity: 710 µS/cm
Salinity: —

	Spp	TL	~~WT~~ TL	Sex TL	ID#	
Redear Sunfish	RDE	86	68	77		1
		78	66	64		2
		55	59	59		3
		62	74	58		4
30+ IIII (III)		51	68	67		5
		73	73	66		6
		74	75	61		7
		75	72	69		8
		55	74	77		9
		69	70	64		10
Pumpkinseed	PKS	75	61	75		11
		66	78	77		12
		92	75	108		13
		126	62	75		14
		95	69			15
		130	65			16
		75	65			17
		117	67			18
		63	118			19
		137	88			20
Bluegill	BLG	50				21
		66				22
		177				23
		75				24
		187				25
		148				26
		78				27
		59				28
						29
						30
Channel Catfish	CHP	291				31
						32
						33
						34
						35
						36
						37
						38
						39
						40
Yellow Perch	YEP	169				41
		119				42
		125				43
		142				44
						45
						46
						47
						48
						49
						50

	Spp	TL	WT	Sex	ID#	
Brown Bullhead	BRB	126				1
						2
						3
						4
						5
						6
						7
						8
						9
						10
Eastern Silvery Minnow	ESM	100	108			11
		93	106			12
		100	104			13
		83	96			14
		88	94			15
		89				16
		92				17
		105				18
		92				19
		93				20
*Golden Shiner	GOS	61				21
		73				22
		66				23
		68				24
		76				25
		74				26
		83				27
		72				28
		73				29
		74				30
Pirate Perch	PRP	79				31
						32
						33
						34
						35
						36
						37
						38
						39
						40
Amer. Eel	AME	125				41
						42
						43
						44
						45
						46
						47
						48
						49
						50

Wildlife Observed:
GBH
Turkey
Wood Duck

* Black spot on most golden shiners

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of

STREAM NAME Wolff S2	LOCATION Fenton Airfield		
STATION # _____ RIVERMILE _____	STREAM CLASS		
LAT _____ LONG _____	RIVER BASIN		
STORET #	AGENCY		
GEAR	INVESTIGATORS Dresser / Fowler / Cook		
FORM COMPLETED BY Cook	DATE 10/9/2015 TIME 10:55 (AM) PM	REASON FOR SURVEY WBCM	

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 10:30 End time 10:45am Duration 900 **Stream width (in meters)** Max 2 Mean 1
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles 5 % ☐ Pools 20 % ☐ Runs 75 % ☐ Snags ____ % ☐ Submerged Macrophytes ____ % ☐ Other ( ) ____ %
GENERAL COMMENTS	Stream runs from Peachy creek to natural barrier

642-570
:72

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		mm	g	mm	g	mm/g	D	E	F	L	M	S	T	Z
Pirate Perch	18	55	2.6	57	1.9	52/2.0								
		57	2.5	60	2.8	71/4.1								
		78	4.3	55	2.5	64/3.4								
		55	2.7	59	2.6	57/2.7								
		67	3.4	57	2.5	57/3.5								
American Eel	1	250	29.8											
Pirate Perch	3	52	2.2											
		79	5.9											
		62	2.8											
Pumpkinseed	5	70	5.6											
		50	2.3											
		59	3.8											
		56	3.1											
		47	1.8											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		mm	g				D	E	F	L	M	S	T	Z
Greensunfish	3	50	2.1											
		49	2.2											
		52	2.6											

***ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NAIFF 34	LOCATION Fentress Airfield
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS Fraser / Dresser / Cook
FORM COMPLETED BY Cook	DATE 12.4.06 TIME 1:00 AM (PM) — REASON FOR SURVEY 6,1604

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 12:40 pm End time 1:00 pm Duration 117 **Stream width (in meters)** Max 3 Mean 1
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles 10 % ☐ Pools 0 % ☐ Runs 90 % ☐ Snags ____ % ☐ Submerged Macrophytes ____ % ☐ Other ( ) ____ %
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) mm / G / mm / g / mm	ANOMALIES* D	E	F	L	M	S	T	Z
Pumpkinseed	6	76 / 7.7 / 49 / 2.8								
		72 / 7.0								
		76 / 7.9								
		48 / 1.5								
		90 / 14.0								
Green Sunfish	10	69 / 5.3 / 60 / 4.7								
		58 / 4.2 / 80 / 10.2								
		66 / 5.2 / 81 / 8.9								
		84 / 11.0 / 95 / 16.5								
		90 / 14.9 / 71 / 5.8								
Pirate Perch	10	88 / 9.8 / 72 / 5.6 / 76 5.6								
		81 / 6.8 / 63 / 3.1								
		77 / 5.3 / ~~73~~								
		74 / 4.5 / 72 / 4.6								
		68 / 4.0 / 72 / 5.4								
American Eel	20	155 / 7.1 / 230 / 17.7 / 155 6.1								
		155 / 6.7 / 170 / 13.3 / 155 6.5								
		109 / 2.7 / 180 / 9.3 / 165 6.1								
		118 / 2.0 / 160 / 7.1 / 190 11.0								
		155 / 6.4 / 195 / 13.4 / 315 7.6								

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		mm	g	mm	g	m/g	D	E	F	L	M	S	T	Z
Mosquito Fish	7	37	0.5	45	1.1									
		36	0.7	40	0.2									
		37	0.4											
		45	1.1											
		47	0.9											
American Eel		110	2.2											
		120	2.3											
		110	2.2											
		116	2.5											
		116	2.4											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NAIFF S5	LOCATION Fentress Airfield
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS Cook / Foster / Dresser
FORM COMPLETED BY Cook	DATE 4/8/2015 TIME 11:55 (AM) PM — REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 11:30 End time 11:45 Duration 946 **Stream width (in meters)** Max 2 Mean 0.5
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles 5 % ☐ Pools 5 % ☐ Runs 90 % ☐ Snags ____ % ☐ Submerged Macrophytes ____ % ☐ Other ( ) ____ %
GENERAL COMMENTS	Straight run with minimal pools

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		mm/g	mm/g	mm/g			D	E	F	L	M	S	T	Z
Eastern Silvery		77/3.5								↑				
										Blackspot				
Pirate Perch		72/5.5	63/3.4	66/3.0										
		78/6	71/4.7	71/5.1										
		73/5.5	66/3.1											
		62/3.1	61/4.1											
		82/5.5	67/3.3											
Red Ear Sunfish		78/7.2												
Pumpkinseed		76/5.8												
		58/2.5												

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Mosquito Fish		34/.3												
		35/0.4												
		/												
		/												
		/												
Bluegill		73/13								X				
							Mechanical damage Crayfish bite							
American Eel		120/2.6												

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME NALF56	LOCATION Fortress AAF Field
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS Fosics / Cook / Dresser
FORM COMPLETED BY Cook	DATE 4/8/2015 TIME 2:45 AM (PM) — REASON FOR SURVEY WE04

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☑ NO **Sampling Duration** Start time 2:25pm End time 2:45pm Duration 891 **Stream width (in meters)** Max 3 Mean 1
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles 10 % ☐ Pools 10 % ☐ Runs 80 % ☐ Snags ____ % ☐ Submerged Macrophytes ____ % ☐ Other ( ) ____ %
GENERAL COMMENTS	Dead carcasses of deer at culvert.

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) mm	g	mm	g	mm/g	ANOMALIES* D	E	F	L	M	S	T	Z
Pumpkinseed	9	86	10.1	64	4.6									
		87	9.1	81	9.6									
		51	2.1	48	2.1									
		69	5.0	63	4.5									
		61	2.1											
Green Sunfish	5	61	4											
		53	2.7											
		75	8.5											
		55	3.3											
		61	4.5											
Golden Shiner	2	79	4.3											
		76	3.4											
Pirate Perch	12	95	12.2	77	4.9	51/1.9								
		74	4.7	79	4.5	77/5.5								
		63	3.0	70	4.1									
		57	2.1	68	4.1									
		73	4.5	61	4.1									

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
		mm	g	mm	g	mm/g	D	E	F	L	M	S	T	Z
Bluegill	2	69	4.8											
		60	3.5											
		64												
Redear Sunfish	3	63	4.2											
		58	2.9											
		70	5.7											
Mudminnow	1	75	4.0											
American Eel	2	180	13.9											
		110	3.0											

* **ANOMALY CODES:** D = deformities; E = eroded fins; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME W1	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE 4/8/15 TIME 3:10 AM (PM) / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☒ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time 0 End time 349 Duration _____ **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles ____% ☐ Pools ____% ☐ Runs ____% ☐ Snags ____% ☐ Submerged Macrophytes ____% ☐ Other ( ) ____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L(mm) W(g)					ANOMALIES* D	E	F	L	M	S	T	Z
Mud minnow	3	71	2.6											
		63	1.8											
		57	1.1											
Siren														
Caught one, already dead.														

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME W2	LOCATION
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE 4/8/15 TIME 3:30 AM (PM) / REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☑ back pack ☐ tote barge ☐ other _____ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time 0 End time 350 Duration _____ **Stream width (in meters)** Max _____ Mean _____
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L(mm) W(g)					ANOMALIES* D	E	F	L	M	S	T	Z
Mud Minnow		79	3.8											
		78	3.8											
		54	0.9											
		50	0.5											

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ____ of ____

STREAM NAME W3	LOCATION
STATION # ______ RIVERMILE ______	STREAM CLASS
LAT ______ LONG ______	RIVER BASIN
STORET #	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE 4/8/15 TIME 3:50 AM (PM) — REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** ☒ back pack ☐ tote barge ☐ other ______ **Block nets used?** ☐ YES ☒ NO **Sampling Duration** Start time 0 End time 332 Duration ______ **Stream width (in meters)** Max______ Mean______
HABITAT TYPES	**Indicate the percentage of each habitat type present** ☐ Riffles____% ☐ Pools____% ☐ Runs____% ☐ Snags____% ☐ Submerged Macrophytes____% ☐ Other ( )____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L(mm) W(g)					ANOMALIES* D	E	F	L	M	S	T	Z
Mud minnow	1	51	0.9											

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME Pocaty creek	LOCATION NALF - Fentress, Chesapeake, VA	
STATION # S1 RIVERMILE	STREAM CLASS	
LAT LONG	RIVER BASIN	
STORET #	AGENCY US NAVY	
INVESTIGATORS DRESSER, FOSTER, COOK		
FORM COMPLETED BY DRESSER	DATE 4/7/2015 TIME 1615 AM PM	REASON FOR SURVEY RBP

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☐	showers (intermittent)	☐
___% ☐	%cloud cover	☐ ___%
☐	clear/sunny	☐

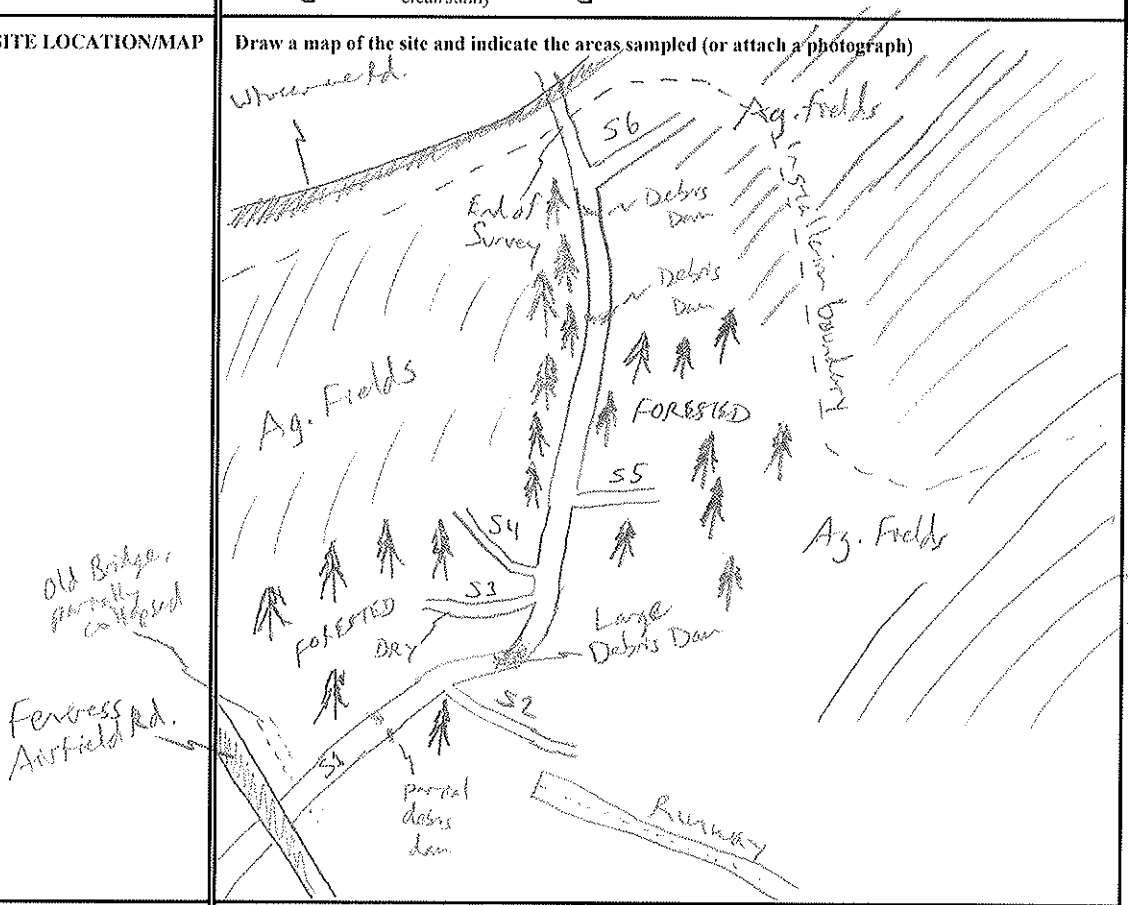
Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No

Air Temperature_____° C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☒ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☐ Spring-fed
☒ Mixture of origins
☐ Other_____

Catchment Area_____km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☒ Forest ☐ Commercial
☒ Field/Pasture ☐ Industrial
☐ Agricultural ☒ Other Machinery
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☒ Obvious sources Ag. Field Drainage

Local Watershed Erosion
☒ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

dominant species present Mixed hardwoods (Oak - Hickory - Pawpaw)

INSTREAM FEATURES

Estimated Reach Length 2000 m
Estimated Stream Width 6-8 m
Sampling Reach Area _____ m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth 0.5-1.0 m
Surface Velocity (at thalweg) _____ m/sec Low-flow → See Flow Data

Canopy Cover
☐ Partly open ☒ Partly shaded ☐ Shaded

High Water Mark 0.8 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 0 % ☒ Run 95 %
☒ Pool 5 %

Channelized ☐ Yes ☒ No
Dam Present ☐ Yes ☒ No

LARGE WOODY DEBRIS

LWD 69 m² ||||-|||| ||||-|||| |||

Density of LWD _____ m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
☒ Floating Algae ☐ Attached Algae

dominant species present Filamentous Algae in clumps

Portion of the reach with aquatic vegetation 20 %

WATER QUALITY

Temperature 18.5 °C
Specific Conductance 710 µS/cm
Dissolved Oxygen 9.50
pH 7.29
Turbidity 5.32
WQ Instrument Used YSI / LaMotte

Water Odors
☒ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils few among w/sheen
☐ Slick ☒ Sheen ☐ Globs ☐ Flecks
☒ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☒ Slightly turbid ☐ Turbid
☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☒ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☒ Anaerobic ☐ None
☐ Other _____

Oils
☒ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits at trib. confluences
☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand
☐ Relict shells ☒ Other fine silt/clay

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No N/A

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	25
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	0	Muck-Mud	black, very fine organic (FPOM)	50
Gravel	2-64 mm (0.1"-2.5")	0			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	40			
Clay	< 0.004 mm (slick)	40			

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME POCATY CREEK	LOCATION NALF PENTRESS, CHESAPEAKE VA	
STATION # S1 RIVERMILE	STREAM CLASS	
LAT LONG	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS DRESSER, FOSTER, COOK		
FORM COMPLETED BY DRESSER	DATE 4/7/2015 TIME 1615 AM PM	REASON FOR SURVEY RBP

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep, very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

Total Score 114

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME NALFF S5	LOCATION Fortress Airfield	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS Dresser / Fotos / Cook		
FORM COMPLETED BY Cook	DATE 4/9/2015 TIME 11:30 (AM) PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
☐	storm (heavy rain)	☐
☐	rain (steady rain)	☐
☑	showers (intermittent)	☑
100 % ☑	%cloud cover	☐ ___ %
☐	clear/sunny	☐

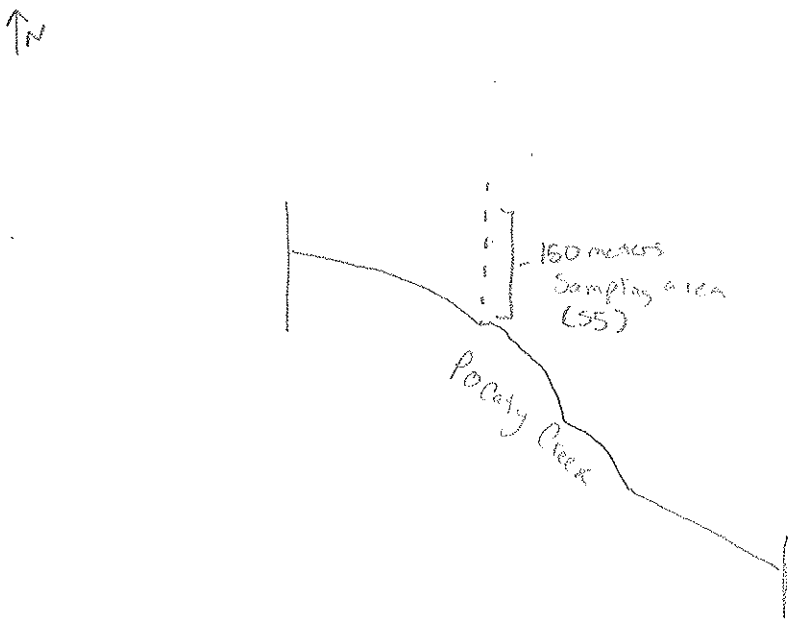
Has there been a heavy rain in the last 7 days? ☐ Yes ☑ No

Air Temperature 55 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☐ Perennial ☑ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial ☐ Spring-fed
☐ Non-glacial montane ☑ Mixture of origins
☐ Swamp and bog ☐ Other _____

Catchment Area _____ km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
☐ Forest ☐ Commercial
☐ Field/Pasture ☐ Industrial
☑ Agricultural ☑ Other Animal
☐ Residential

Local Watershed NPS Pollution
☐ No evidence ☐ Some potential sources
☐ Obvious sources

Local Watershed Erosion
☐ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous (woody vines)

dominant species present Red maple, Briar, Yellow Jessamine

INSTREAM FEATURES

Estimated Reach Length _____ m
Estimated Stream Width _____ m
Sampling Reach Area 150 m²
Area in km² (m²x1000) _____ km²
Estimated Stream Depth _____ m
Surface Velocity (at thalweg) _____ m/sec

Canopy Cover
☐ Partly open ☐ Partly shaded ☑ Shaded

High Water Mark 1 m

Proportion of Reach Represented by Stream Morphology Types
☐ Riffle 5 % ☐ Run 90 %
☐ Pool 5 %

Channelized ☐ Yes ☐ No

Dam Present ☐ Yes ☐ No

LARGE WOODY DEBRIS

LWD 2 m²
Density of LWD _____ m²/km² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
☐ Rooted emergent ☑ Rooted submergent ☐ Rooted floating ☐ Free floating
☐ Floating Algae ☐ Attached Algae

dominant species present Water ...

Portion of the reach with aquatic vegetation 5 %

WATER QUALITY

Action @ 4/17/2015 @ 15:15

Temperature 19.1 °C
Specific Conductance 0.465
Dissolved Oxygen 10.51
pH 6.53
Turbidity 11.3
WQ Instrument Used _____

Water Odors
☐ Normal/None ☐ Sewage
☐ Petroleum ☐ Chemical
☐ Fishy ☐ Other _____

Water Surface Oils
☐ Slick ☑ Sheen ☐ Globs ☐ Flecks
☐ None ☐ Other _____

Turbidity (if not measured)
☐ Clear ☑ Slightly turbid ☐ Turbid
☑ Opaque ☐ Stained ☐ Other _____

SEDIMENT/ SUBSTRATE

Odors
☐ Normal ☐ Sewage ☐ Petroleum
☐ Chemical ☐ Anaerobic ☐ None
☐ Other _____

Oils
☑ Absent ☐ Slight ☐ Moderate ☐ Profuse

Deposits
☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
☑ Relict shells ☐ Other _____

Looking at stones which are not deeply embedded, are the undersides black in color?
☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	90
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	70			
Clay	< 0.004 mm (slick)	10			

Partial Dams : 2

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME NALEF 55	LOCATION Fentress, Airfield
STATION # _____ RIVERMILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS Cook, Foster, Dresser	
FORM COMPLETED BY Cook	DATE 4/8/2015 TIME 1130 (AM) PM	REASON FOR SURVEY Fish survey

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 (6)	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 (6)	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 6 (LB)	Left Bank 10 9	8 7 (6)	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 (6)	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 7 (LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0

Total Score _____

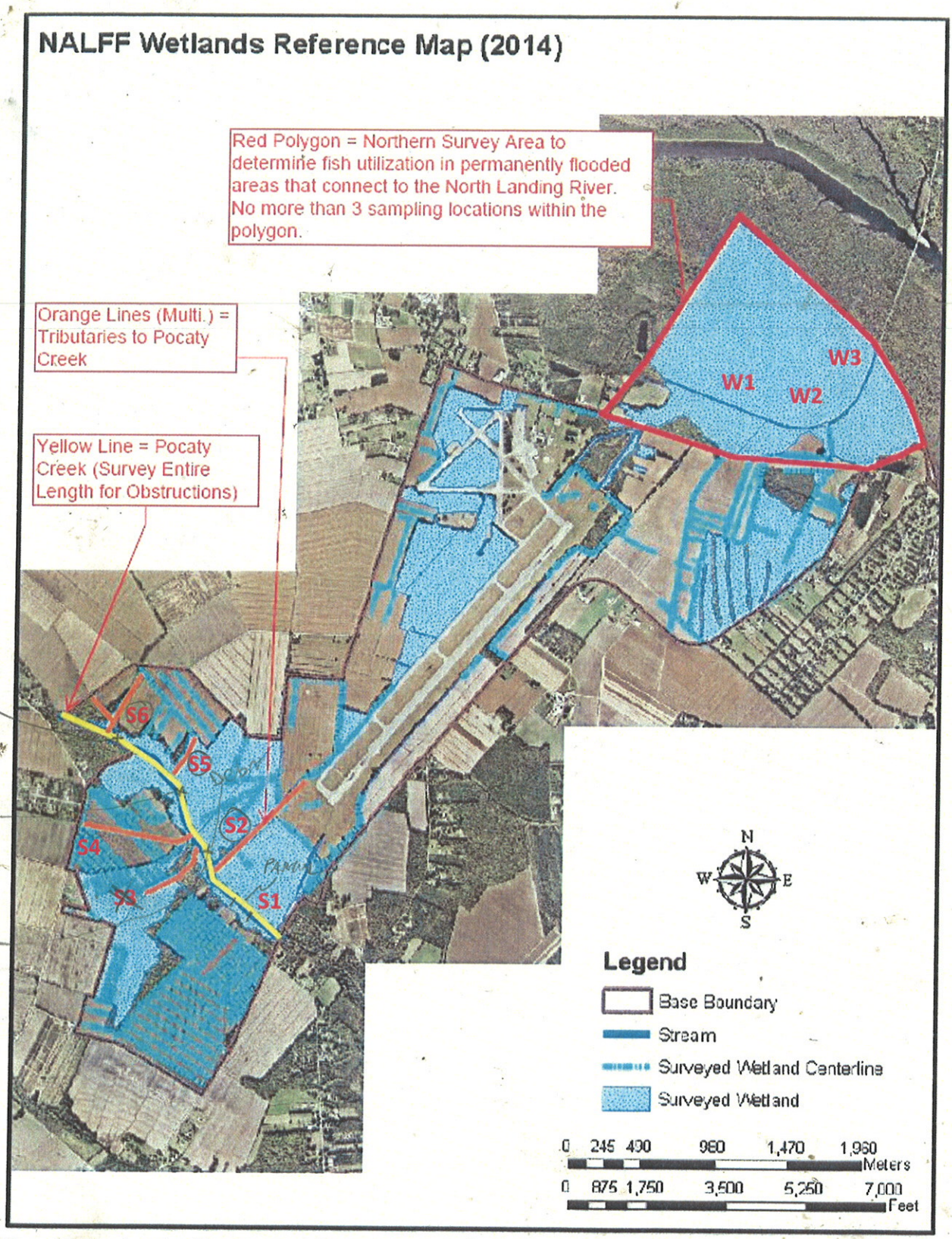


Figure 1: Freshwater Streams and Swamp Areas to be Surveyed at NALF Fentress

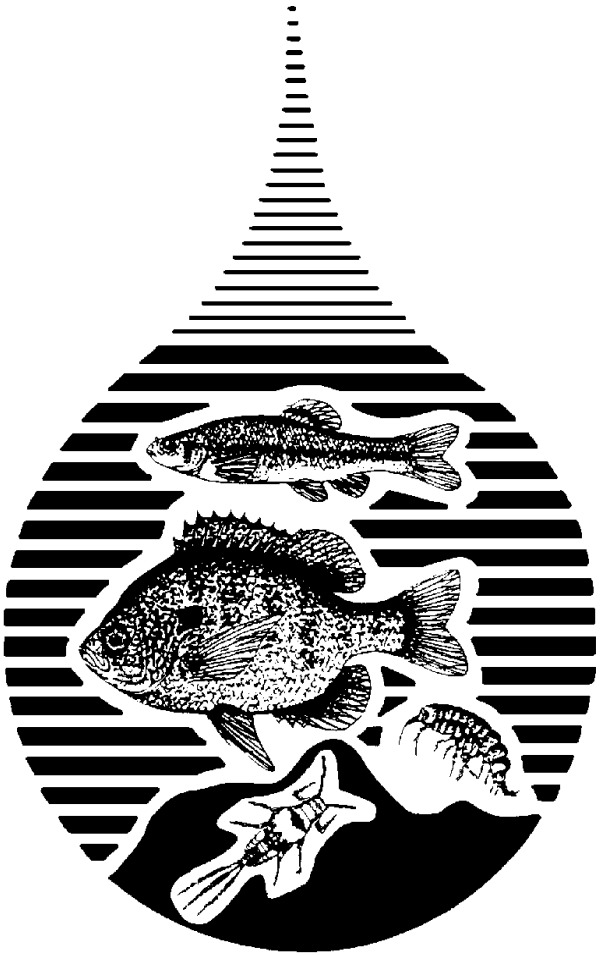
APPENDIX D - THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S (EPA) RAPID BIOASSESSMENT PROTOCOLS (RBP)

[included in PDF version only of this report]

EPA 841-B-99-002

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers:

Periphyton, Benthic Macroinvertebrates, and Fish
Second Edition



http://www.epa.gov/OWOW/monitoring/techmon.html

By:

Michael T. Barbour
Jeroen Gerritsen
Blaine D. Snyder
James B. Stribling

Project Officer:

Chris Faulkner
Office of Water
USEPA
401 M Street, NW

5 HABITAT ASSESSMENT AND PHYSICOCHEMICAL PARAMETERS

An evaluation of habitat quality is critical to any assessment of ecological integrity and should be performed at each site at the time of the biological sampling. In general, habitat and biological diversity in rivers are closely linked (Raven et al. 1998). In the truest sense, "habitat" incorporates all aspects of physical and chemical constituents along with the biotic interactions. In these protocols, the definition of "habitat" is narrowed to the quality of the instream and riparian habitat that influences the structure and function of the aquatic community in a stream. The presence of an altered habitat structure is considered one of the major stressors of aquatic systems (Karr et al. 1986). The presence of a degraded habitat can sometimes obscure investigations on the effects of toxicity and/or pollution. The assessments performed by many water resource agencies include a general description of the site, a physical characterization and water quality assessment, and a visual assessment of instream and riparian habitat quality. Some states (e.g., Idaho DEQ and Illinois EPA) include quantitative measurements of physical parameters in their habitat assessment. Together these data provide an integrated picture of several of the factors influencing the biological condition of a stream system. These assessments are not as comprehensive as needed to adequately identify all causes of impact. However, additional investigation into hydrological modification of water courses and drainage patterns can be conducted, once impairment is noted.

The habitat quality evaluation can be accomplished by characterizing selected physicochemical parameters in conjunction with a systematic assessment of physical structure. Through this approach, key features can be rated or scored to provide a useful assessment of habitat quality.

5.1 PHYSICAL CHARACTERISTICS AND WATER QUALITY

Both physical characteristics and water quality parameters are pertinent to characterization of the stream habitat. An example of the data sheet used to characterize the physical characteristics and water quality of a site is shown in Appendix A. The information required includes measurements of physical characterization and water quality made routinely to supplement biological surveys.

Physical characterization includes documentation of general land use, description of the stream origin and type, summary of the riparian vegetation features, and measurements of instream parameters such as width, depth, flow, and substrate. The water quality discussed in these protocols are *in situ* measurements of standard parameters that can be taken with a water quality instrument. These are generally instantaneous measurements taken at the time of the survey. Measurements of certain parameters, such as temperature, dissolved oxygen, and turbidity, can be taken over a diurnal cycle and will require instrumentation that can be left in place for extended periods or collects water samples at periodic intervals for measurement. In addition, water samples may be desired to be collected for selected chemical analysis. These chemical samples are transported to an analytical laboratory for processing. The combination of this information (physical characterization and water quality) will provide insight as to the ability of the stream to support a healthy aquatic community, and to the presence of chemical and non-chemical stressors to the stream ecosystem. Information requested in this section (Appendix A-1, Form 1) is standard

to many aquatic studies and allows for some comparison among sites. Additionally, conditions that may significantly affect aquatic biota are documented.

5.1.1 Header Information (Station Identifier)

The header information is identical on all data sheets and requires sufficient information to identify the station and location where the survey was conducted, date and time of survey, and the investigators responsible for the quality and integrity of the data. The stream name and river basin identify the watershed and tributary; the location of the station is described in the narrative to help identify access to the station for repeat visits. The rivermile (if applicable) and latitude/longitude are specific locational data for the station. The station number is a code assigned by the agency that will associate the sample and survey data with the station. The STORET number is assigned to each datapoint for inclusion in USEPA's STORET system. The stream class is a designation of the grouping of homogeneous characteristics from which assessments will be made. For instance, Ohio EPA uses ecoregions and size of stream, Florida DEP uses bioregions (aggregations of subecoregions), and Arizona DEQ uses elevation as a means to identify stream classes. Listing the agency and investigators assigns responsibility to the data collected from the station at a specific date and time. The reason for the survey is sometimes useful to an agency that conducts surveys for various programs and purposes.

5.1.2 Weather Conditions

Note the present weather conditions on the day of the survey and those immediately preceding the day of the survey. This information is important to interpret the effects of storm events on the sampling effort.

5.1.3 Site Location/Map

To complete this phase of the bioassessment, a photograph may be helpful in identifying station location and documenting habitat conditions. Any observations or data not requested but deemed important by the field observer should be recorded. A hand-drawn map is useful to illustrate major landmarks or features of the channel morphology or orientation, vegetative zones, buildings, etc. that might be used to aid in data interpretation.

5.1.4 Stream Characterization

Stream Subsystem: In regions where the perennial nature of streams is important, or where the tidal influence of streams will alter the structure and function of communities, this parameter should be noted.

Stream Type: Communities inhabiting coldwater streams are markedly different from those in warmwater streams, many states have established temperature criteria that differentiate these 2 stream types.

Stream Origin: Note the origination of the stream under study, if it is known. Examples are glacial, montane, swamp, and bog. As the size of the stream or river increases, a mixture of origins of tributaries is likely.

5.1.5 Watershed Features

Collecting this information usually requires some effort initially for a station. However, subsequent surveys will most likely not require an in-depth research of this information.

Predominant Surrounding Land Use Type: Document the prevalent land-use type in the catchment of the station (noting any other land uses in the area which, although not predominant, may potentially affect water quality). Land use maps should be consulted to accurately document this information.

Local Watershed Nonpoint Source Pollution: This item refers to problems and potential problems in the watershed. Nonpoint source pollution is defined as diffuse agricultural and urban runoff. Other compromising factors in a watershed that may affect water quality include feedlots, constructed wetlands, septic systems, dams and impoundments, mine seepage, etc.

Local Watershed Erosion: The existing or potential detachment of soil within the local watershed (the portion of the watershed or catchment that directly affects the stream reach or station under study) and its movement into the stream is noted. Erosion can be rated through visual observation of watershed and stream characteristics (note any turbidity observed during water quality assessment below).

5.1.6 Riparian Vegetation

An acceptable riparian zone includes a buffer strip of a minimum of 18 m (Barton et al. 1985) from the stream on either side. The acceptable width of the riparian zone may also be variable depending on the size of the stream. Streams over 4 m in width may require larger riparian zones. The vegetation within the riparian zone is documented here as the dominant type and species, if known.

5.1.7 Instream Features

Instream features are measured or evaluated in the sampling reach and catchment as appropriate.

Estimated Reach Length: Measure or estimate the length of the sampling reach. This information is important if reaches of variable length are surveyed and assessed.

Estimated Stream Width (in meters, m): Estimate the distance from bank to bank at a transect representative of the stream width in the reach. If variable widths, use an average to find that which is representative for the given reach.

Sampling Reach Area (m^2): Multiply the sampling reach length by the stream width to obtain a calculated surface area.

Estimated Stream Depth (m): Estimate the vertical distance from water surface to stream bottom at a representative depth (use instream habitat feature that is most common in reach) to obtain average depth.

Velocity: Measure the surface velocity in the thalweg of a representative run area. If measurement is not done, estimate the velocity as slow, moderate, or fast.

Canopy Cover: Note the general proportion of open to shaded area which best describes the amount of cover at the sampling reach or station. A densiometer may be used in place of visual estimation.

High Water Mark (m): Estimate the vertical distance from the bankfull margin of the stream bank to the peak overflow level, as indicated by debris hanging in riparian or floodplain vegetation, and deposition of silt or soil. In instances where bank overflow is rare, a high water mark may not be evident.

Proportion of Reach Represented by Stream Morphological Types: The proportion represented by riffles, runs, and pools should be noted to describe the morphological heterogeneity of the reach.

Channelized: Indicate whether or not the area around the sampling reach or station is channelized (e.g., straightening of stream, bridge abutments and road crossings, diversions, etc.).

Dam Present: Indicate the presence or absence of a dam upstream in the catchment or downstream of the sampling reach or station. If a dam is present, include specific information relating to alteration of flow.

5.1.8 Large Woody Debris

Large Woody Debris (LWD) density, defined and measured as described below, has been used in regional surveys (Shields et al. 1995) and intensive studies of degraded and restored streams (Shields et al. 1998). The method was developed for sand or sand-and-gravel bed streams in the Southeastern U.S. that are wadeable at baseflow, with water widths between 1 and 30 m (Cooper and Testa 1999).

Cooper and Testa's (1999) procedure involves measurements based on visual estimates taken by a wading observer. Only woody debris actually in contact with stream water is counted. Each woody debris formation with a surface area in the plane of the water surface >0.25 m^2 is recorded. The estimated length and width of each formation is recorded on a form or marked directly onto a stream reach drawing. Estimates are made to the nearest 0.5 m , and formations with length or width less than 0.5 m are not counted. Recorded length is maximum width in the direction perpendicular to the length. Maximum actual length and width of a limb, log, or accumulation are not considered.

If only a portion of the log/limb is in contact with the water, only that portion in contact is measured. Root wads and logs/limbs in the water margin are counted if they contact the water, and are arbitrarily given a width of 0.5 m Lone individual limbs and logs are included in the determination if their diameter is 10 cm or larger (Keller and Swanson 1979, Ward and Aumen 1986). Accumulations of smaller limbs and logs are included if the formation total length or width is 0.5 m or larger. Standing trees and stumps within the stream are also recorded if their length and width exceed 0.5 m.

The length and width of each LWD formation are then multiplied, and the resulting products are summed to give the aquatic habitat area directly influenced. This area is then divided by the water

surface area (km^2) within the sampled reach (obtained by multiplying the average water surface width by reach length) to obtain LWD density. Density values of 10^3 to 10^4 m^2/km^2 have been reported for channelized and incised streams and on the order of 10^5 m^2/km^2 for non-incised streams (Shields et al. 1995 and 1998). This density is not an expression of the volume of LWD, but rather a measure of LWD influence on velocity, depth, and cover.

5.1.9 Aquatic Vegetation

The general type and relative dominance of aquatic plants are documented in this section. Only an estimation of the extent of aquatic vegetation is made. Besides being an ecological assemblage that responds to perturbation, aquatic vegetation provides refugia and food for aquatic fauna. List the species of aquatic vegetation, if known.

5.1.10 Water Quality

Temperature (°C), Conductivity or "Specific Conductance" (µohms), Dissolved Oxygen (µg/L), pH, Turbidity: Measure and record values for each of the water quality parameters indicated, using the appropriate calibrated water quality instrument(s). Note the type of instrument and unit number used.

Water Odors: Note those odors described (or include any other odors not listed) that are associated with the water in the sampling area.

Water Surface Oils: Note the term that best describes the relative amount of any oils present on the water surface.

Turbidity: If turbidity is not measured directly, note the term which, based upon visual observation, best describes the amount of material suspended in the water column.

5.1.11 Sediment/Substrate

Sediment Odors: Disturb sediment in pool or other depositional areas and note any odors described (or include any other odors not listed) which are associated with sediment in the sampling reach.

Sediment Oils: Note the term which best describes the relative amount of any sediment oils observed in the sampling area.

Sediment Deposits: Note those deposits described (or include any other deposits not listed) that are present in the sampling reach. Also indicate whether the undersides of rocks not deeply embedded are black (which generally indicates low dissolved oxygen or anaerobic conditions).

Inorganic Substrate Components: Visually estimate the relative proportion of each of the 7 substrate/particle types listed that are present over the sampling reach.

Organic Substrate Components: Indicate relative abundance of each of the 3 substrate types listed.

5.2 A VISUAL-BASED HABITAT ASSESSMENT

Biological potential is limited by the quality of the physical habitat, forming the template within which biological communities develop (Southwood 1977). Thus, habitat assessment is defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour et al. 1996a). For streams, an encompassing approach to assessing structure of the habitat includes an evaluation of the variety and quality of the substrate, channel morphology, bank structure, and riparian vegetation. Habitat parameters pertinent to the assessment of habitat quality include those that characterize the stream "micro scale" habitat (e.g., estimation of embeddeddness), the "macro scale" features (e.g., channel morphology), and the riparian and bank structure features that are most often influential in affecting the other parameters.

EQUIPMENT/SUPPLIES NEEDED FOR HABITAT ASSESSMENT AND PHYSICAL/WATER QUALITY CHARACTERIZATION

- Physical Characterization and Water Quality Field Data Sheet*
- Habitat Assessment Field Data Sheet*
- clipboard
- pencils or waterproof pens
- 35 mm camera (may be digital)
- video camera (optional)
- upstream/downstream “arrows” or signs for photographing and documenting sampling reaches
- Flow or velocity meter
- *In situ* water quality meters
- Global Positioning System (GPS) Unit

* It is helpful to copy field sheets onto water-resistant paper for use in wet weather conditions

Rosgen (1985, 1994) presented a stream and river classification system that is founded on the premise that dynamically-stable stream channels have a morphology that provides appropriate distribution of flow energy during storm events. Further, he identifies 8 major variables that affect the stability of channel morphology, but are not mutually independent: channel width, channel depth, flow velocity, discharge, channel slope, roughness of channel materials, sediment load and sediment particle size distribution. When streams have one of these characteristics altered, some of their capability to dissipate energy properly is lost (Leopold et al. 1964, Rosgen 1985) and will result in accelerated rates of channel erosion. Some of the habitat structural components that function to dissipate flow energy are:

- sinuosity
- roughness of bed and bank materials
- presence of point bars (slope is an important characteristic)
- vegetative conditions of stream banks and the riparian zone
- condition of the floodplain (accessibility from bank, overflow, and size are important characteristics).

Measurement of these parameters or characteristics serve to stratify and place streams into distinct classifications. However, none of these habitat classification techniques attempt to differentiate the quality of the habitat and the ability of the habitat to support the optimal biological condition of the

region. Much of our understanding of habitat relationships in streams has emerged from comparative studies that describe statistical relationships between habitat variables and abundance of biota (Hawkins et al. 1993). However, in response to the need to incorporate broader scale habitat assessments in water resource programs, 2 types of approaches for evaluating habitat structure have been developed. In the first, the Environmental Monitoring and Assessment Program (EMAP) of the USEPA and the National Water-Quality Assessment Program (NAWQA) of the USGS developed techniques that incorporate measurements of various features of the instream, channel, and bank morphology (Meader et al. 1993, Klemm and Lazorchak 1994). These techniques provide a relatively comprehensive characterization of the physical structure of the stream sampling reach and its surrounding floodplain. The second type was a more rapid and qualitative habitat assessment approach that was developed to describe the overall quality of the physical habitat (Ball 1982, Ohio EPA 1987, Plafkin et al. 1989, Barbour and Stribling 1991, 1994, Rankin 1991, 1995). In this document, the more rapid visual-based approach is described. A cursory overview of the more quantitative approaches to characterizing the physical structure of the habitat is provided.

The habitat assessment matrix developed for the Rapid Bioassessment Protocols (RBPs) in Plafkin et al. (1989) were originally based on the Stream Classification Guidelines for Wisconsin developed by Ball (1982) and "*Methods of Evaluating Stream, Riparian, and Biotic Conditions*" developed by Platts et al. (1983). Barbour and Stribling (1991, 1994) modified the habitat assessment approach originally developed for the RBPs to include additional assessment parameters for high gradient streams and a more appropriate parameter set for low gradient streams (Appendix A-1, Forms 2,3). All parameters are evaluated and rated on a numerical scale of 0 to 20 (highest) for each sampling reach. The ratings are then totaled and compared to a reference condition to provide a final habitat ranking. Scores increase as habitat quality increases. To ensure consistency in the evaluation procedure, descriptions of the physical parameters and relative criteria are included in the rating form.

The Environmental Agency of Great Britain (Environment Agency of England and Wales, Scottish Environment Protection Agency, and Environment and Heritage Service of Northern Ireland) have developed a River Habitat Survey (RHS) for characterizing the quality of their streams and rivers (Raven et al. 1998). The approach used in Great Britain is similar to the visual-based habitat assessment used in the US in that scores are assigned to ranges of conditions of various habitat parameters.

A biologist who is well versed in the ecology and zoogeography of the region can generally recognize optimal habitat structure as it relates to the biological community. The ability to accurately assess the quality of the physical habitat structure using a visual-based approach depends on several factors:

- the parameters selected to represent the various features of habitat structure need to be relevant and clearly defined
- a continuum of conditions for each parameter must exist that can be characterized from the optimum for the region or stream type under study to the poorest situation reflecting substantial alteration due to anthropogenic activities

- the judgement criteria for the attributes of each parameter should minimize subjectivity through either quantitative measurements or specific categorical choices

- the investigators are experienced in or adequately trained for stream assessments in the region under study (Hannaford et al. 1997)

- adequate documentation and ongoing training is maintained to evaluate and correct errors resulting in outliers and aberrant assessments.

Habitat evaluations are first made on instream habitat, followed by channel morphology, bank structural features, and riparian vegetation. Generally, a single, comprehensive assessment is made that incorporates features of the entire sampling reach as well as selected features of the catchment. Additional assessments may be made on neighboring reaches to provide a broader evaluation of habitat quality for the stream ecosystem. The actual habitat assessment process involves rating the 10 parameters as optimal, suboptimal, marginal, or poor based on the criteria included on the Habitat Assessment Field Data Sheets (Appendix A-1, Forms 2,3). Some state programs, such as Florida Department of Environmental Protection (DEP) (1996) and Mid-Atlantic Coastal Streams Workgroup (MACS) (1996) have adapted this approach using somewhat fewer and different parameters.

Reference conditions are used to scale the assessment to the "best attainable" situation. This approach is critical to the assessment because stream characteristics will vary dramatically across different regions (Barbour and Stribling 1991). The ratio between the score for the test station and the score for the reference condition provides a percent comparability measure for each station. The station of interest is then classified on the basis of its similarity to expected conditions (reference condition), and its apparent potential to support an acceptable level of biological health. Use of a percent comparability evaluation allows for regional and stream-size differences which affect flow or velocity, substrate, and channel morphology. Some regions are characterized by streams having a low channel gradient, such as coastal plains or prairie regions.

Other habitat assessment approaches or a more rigorously quantitative approach to measuring the habitat parameters may be used (See Klemm and Lazorchak 1994, Kaufmann and Robison 1997, Meader et al. 1993). However, holistic and rapid assessment of a wide variety of habitat attributes along with other types of data is critical if physical measurements are to be used to best advantage in interpreting biological data. A more detailed discussion of the relationship between habitat quality and biological condition is presented in Chapter 10.

A generic habitat assessment approach based on visual observation can be separated into 2 basic approaches—one designed for high-gradient streams and one designed for low-gradient streams. High-gradient or riffle/run prevalent streams are those in moderate to high gradient landscapes. Natural high-gradient streams have substrates primarily composed of coarse sediment particles (i.e., gravel or larger) or frequent coarse particulate aggregations along stream reaches. Low-gradient or glide/pool prevalent streams are those in low to moderate gradient landscapes. Natural low-gradient streams have substrates of fine sediment or infrequent aggregations of more coarse (gravel or larger) sediment particles along stream reaches. The entire sampling reach is evaluated for each parameter. Descriptions of each parameter and its relevance to instream biota are presented in the following discussion. Parameters that are used only for high-gradient prevalent streams are marked with an “a”; those for low-gradient dominant streams, a “b”. If a parameter is used for both stream types, it is not marked with a letter. A brief set of decision criteria is given

for each parameter corresponding to each of the 4 categories reflecting a continuum of conditions on the field sheet (optimal, suboptimal, marginal, and poor). Refer to Appendix A-1, Forms 2 and 3, for a complete field assessment guide.

PROCEDURE FOR PERFORMING HABITAT ASSESSMENT

1. Select the reach to be assessed. The habitat assessment is performed on the same 100 m reach (or other reach designation [e.g., 40 x stream wetted width]) from which the biological sampling is conducted. Some parameters require an observation of a broader section of the catchment than just the sampling reach.

2. Complete the station identification section of each field data sheet and habitat assessment form.

3. It is best for the investigators to obtain a close look at the habitat features to make an adequate assessment. If the physical and water quality characterization and habitat assessment are done before the biological sampling, care must be taken to avoid disturbing the sampling habitat.

4. Complete the **Physical Characterization and Water Quality Field Data Sheet**. Sketch a map of the sampling reach on the back of this form.

5. Complete the **Habitat Assessment Field Data Sheet**, in a team of 2 or more biologists, if possible, to come to a consensus on determination of quality. Those parameters to be evaluated on a scale greater than a sampling reach require traversing the stream corridor to the extent deemed necessary to assess the habitat feature. As a general rule-of-thumb, use 2 lengths of the sampling reach to assess these parameters.

QUALITY ASSURANCE PROCEDURES

1. Each biologist is to be trained in the visual-based habitat assessment technique for the applicable region or state.

2. The judgment criteria for each habitat parameter are calibrated for the stream classes under study. Some text modifications may be needed on a regional basis.

3. Periodic checks of assessment results are completed using pictures of the sampling reach and discussions among the biologists in the agency.

Parameters to be evaluated in sampling reach:

1 EPIFAUNAL SUBSTRATE/AVAILABLE COVER

high and low gradient streams

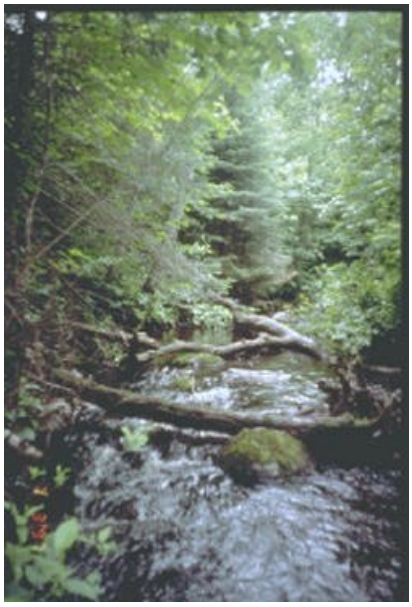
Includes the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding, or sites for spawning and nursery functions of aquatic macrofauna. A wide variety and/or abundance of submerged structures in the stream provides macroinvertebrates and fish with a large number of niches, thus increasing habitat diversity. As variety and abundance of cover decreases, habitat structure becomes monotonous, diversity decreases, and the potential for recovery following disturbance decreases. Riffles and runs are critical for maintaining a variety and abundance of insects in most high-gradient streams and serving as spawning and feeding refugia for certain fish. The extent and quality of the riffle is an important factor in the support of a healthy biological condition in high-gradient streams. Riffles and runs offer a diversity of habitat through variety of particle size, and, in many small high-gradient streams, will provide the most stable habitat. Snags and submerged logs are among the most productive habitat structure for macroinvertebrate colonization and fish refugia in low-gradient streams. However, "new fall" will not yet be suitable for colonization.

Selected References

Wesche et al. 1985, Pearsons et al. 1992, Gorman 1988, Rankin 1991, Barbour and Stribling 1991, Plafkin et al. 1989, Platts et al. 1983, Osborne et al. 1991, Benke et al. 1984, Wallace et al. 1996, Ball 1982, MacDonald et al. 1991, Reice 1980, Clements 1987, Hawkins et al. 1982, Beechie and Sibley 1997.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover **(high and low gradient)**	Greater than 70% (50% for low gradient streams) of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% (30-50% for low gradient streams) mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% (10-30% for low gradient streams) mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% (10% for low gradient streams) stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

1a. Epifaunal Substrate/Available Cover—High Gradient



Optimal Range

Poor Range

1b. Epifaunal Substrate/Available Cover—Low Gradient

Optimal Range (*Mary Kay Corazalla, U. of Minn.*)

Poor Range

2a EMBEDDEDNESS

high gradient streams

Refers to the extent to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish (shelter, spawning, and egg incubation) is decreased. Embeddedness is a result of large-scale sediment movement and deposition, and is a parameter evaluated in the riffles and runs of high-gradient streams. The rating of this parameter may be variable depending on where the observations are taken. To avoid confusion with sediment deposition (another habitat parameter), observations of embeddedness should be taken in the upstream and central portions of riffles and cobble substrate areas.

Selected References

Ball 1982, Osborne et al. 1991, Barbour and Stribling 1991, Platts et al. 1983, MacDonald et al. 1991, Rankin 1991, Reice 1980, Clements 1987, Benke et al. 1984, Hawkins et al. 1982, Burton and Harvey 1990.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
2.a Embeddedness (high gradient)	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

2a. Embeddedness—High Gradient

Optimal Range *(William Taft, MI DNR)*

Poor Range *(William Taft, MI DNR)*

2b POOL SUBSTRATE CHARACTERIZATION

low gradient streams

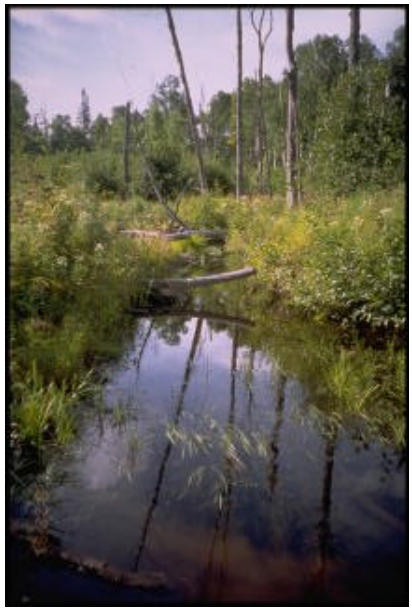
Evaluates the type and condition of bottom substrates found in pools. Firmer sediment types (e.g., gravel, sand) and rooted aquatic plants support a wider variety of organisms than a pool substrate dominated by mud or bedrock and no plants. In addition, a stream that has a uniform substrate in its pools will support far fewer types of organisms than a stream that has a variety of substrate types.

Selected References

Beschta and Platts 1986, U.S. EPA 1983.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
2b. Pool Substrate Characterization (low gradient)	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or submerged vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

2b. Pool Substrate Characterization—Low Gradient



Optimal Range
(Mary Kay Corazalla, U. of Minn.)

Poor Range

3a VELOCITY/DEPTH COMBINATIONS

high gradient streams

Patterns of velocity and depth are included for high-gradient streams under this parameter as an important feature of habitat diversity. The best streams in most high-gradient regions will have all 4 patterns present: (1) slow-deep, (2) slow-shallow, (3) fast-deep, and (4) fast-shallow. The general guidelines are 0.5 m depth to separate shallow from deep, and 0.3 m/sec to separate fast from slow. The occurrence of these 4 patterns relates to the stream's ability to provide and maintain a stable aquatic environment.

Selected References

Ball 1982, Brown and Brussock 1991, Gore and Judy 1981, Oswood and Barber 1982.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
3a. Velocity/ Depth Regimes **(high gradient)**	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (slow is <0.3 m/s, deep is >0.5 m)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

3a. Velocity/Depth Regimes—High Gradient

Optimal Range *(Mary Kay Corazalla, U. of Minn.)*
(arrows emphasize different velocity/depth regimes)

Poor Range *(William Taft, MI DNR)*

3b POOL VARIABILITY

low gradient streams

Rates the overall mixture of pool types found in streams, according to size and depth. The 4 basic types of pools are large-shallow, large-deep, small-shallow, and small-deep. A stream with many pool types will support a wide variety of aquatic species. Rivers with low sinuosity (few bends) and monotonous pool characteristics do not have sufficient quantities and types of habitat to support a diverse aquatic community. General guidelines are any pool dimension (i.e., length, width, oblique) greater than half the cross-section of the stream for separating large from small and 1 m depth separating shallow and deep.

Selected References

Beschta and Platts 1986, USEPA 1983.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
3b. Pool Variability (low gradient)	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

3b. Pool Variability—Low Gradient

Optimal Range *(Peggy Morgan, FL DEP)*

Poor Range *(William Taft, MI DNR)*

4 SEDIMENT DEPOSITION

high and low gradient streams

Measures the amount of sediment that has accumulated in pools and the changes that have occurred to the stream bottom as a result of deposition. Deposition occurs from large-scale movement of sediment. Sediment deposition may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increase in size as the channel is diverted toward the outer bank) or shoals, or result in the filling of runs and pools. Usually deposition is evident in areas that are obstructed by natural or manmade debris and areas where the stream flow decreases, such as bends. High levels of sediment deposition are symptoms of an unstable and continually changing environment that becomes unsuitable for many organisms.

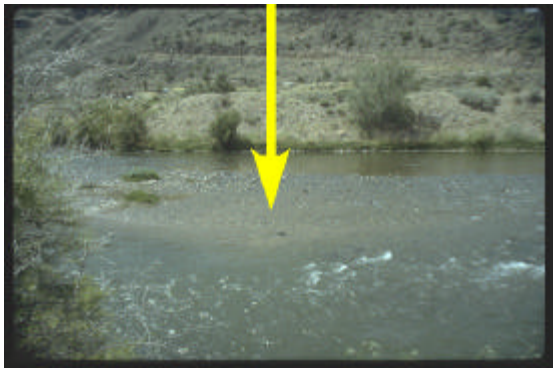
Selected References

MacDonald et al. 1991, Platts et al. 1983, Ball 1982, Armour et al. 1991, Barbour and Stribling 1991, Rosgen 1985.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
4. Sediment Deposition **(high and low gradient)**	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

4a. Sediment Deposition—High Gradient

Optimal Range



Poor Range
(arrow pointing to sediment deposition)

4b. Sediment Deposition—Low Gradient

Optimal Range

Poor Range
(arrows pointing to sediment deposition)

5 CHANNEL FLOW STATUS

high and low gradient streams

The degree to which the channel is filled with water. The flow status will change as the channel enlarges (e.g., aggrading stream beds with actively widening channels) or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the amount of suitable substrate for aquatic organisms is limited. In high-gradient streams, riffles and cobble substrate are exposed; in low-gradient streams, the decrease in water level exposes logs and snags, thereby reducing the areas of good habitat. Channel flow is especially useful for interpreting biological condition under abnormal or lowered flow conditions. This parameter becomes important when more than one biological index period is used for surveys or the timing of sampling is inconsistent among sites or annual periodicity.

Selected References

Rankin 1991, Rosgen 1985, Hupp and Simon 1986, MacDonald et al. 1991, Ball 1982, Hicks et al. 1991.

Habitat Parameter	Condition Category																					
	Optimal					Suboptimal					Marginal					Poor					
5. Channel Flow Status **(high and low gradient)**	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.					Water fills >75% of the available channel; or <25% of channel substrate is exposed.					Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

5a. Channel Flow Status—High Gradient

Optimal Range

Poor Range
(arrow showing that water is not reaching both banks; leaving much of channel uncovered)

5b. Channel Flow Status—Low Gradient

Optimal Range

Poor Range *(James Stahl, IN DEM)*

Parameters to be evaluated broader than sampling reach:

6 CHANNEL ALTERATION

high and low gradient streams

Is a measure of large-scale changes in the shape of the stream channel. Many streams in urban and agricultural areas have been straightened, deepened, or diverted into concrete channels, often for flood control or irrigation purposes. Such streams have far fewer natural habitats for fish, macroinvertebrates, and plants than do naturally meandering streams. Channel alteration is present when artificial embankments, riprap, and other forms of artificial bank stabilization or structures are present; when the stream is very straight for significant distances; when dams and bridges are present; and when other such changes have occurred. Scouring is often associated with channel alteration.

Selected References

Barbour and Stribling 1991, Simon 1989a, b, Simon and Hupp 1987, Hupp and Simon 1986, Hupp 1992, Rosgen 1985, Rankin 1991, MacDonald et al. 1991.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration **(high and low gradient)**	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

6a. Channel Alteration—High Gradient

Optimal Range

Poor Range
(arrows emphasizing large-scale channel alterations)

6b. Channel Alteration—Low Gradient

Optimal Range

Poor Range *(John Maxted, DE DNREC)*

7a FREQUENCY OF RIFFLES (OR BENDS)

high gradient streams

Is a way to measure the sequence of riffles and thus the heterogeneity occurring in a stream. Riffles are a source of high-quality habitat and diverse fauna, therefore, an increased frequency of occurrence greatly enhances the diversity of the stream community. For high gradient streams where distinct riffles are uncommon, a run/bend ratio can be used as a measure of meandering or sinuosity (see 7b). A high degree of sinuosity provides for diverse habitat and fauna, and the stream is better able to handle surges when the stream fluctuates as a result of storms. The absorption of this energy by bends protects the stream from excessive erosion and flooding and provides refugia for benthic invertebrates and fish during storm events. To gain an appreciation of this parameter in some streams, a longer segment or reach than that designated for sampling should be incorporated into the evaluation. In some situations, this parameter may be rated from viewing accurate topographical maps. The "sequencing" pattern of the stream morphology is important in rating this parameter. In headwaters, riffles are usually continuous and the presence of cascades or boulders provides a form of sinuosity and enhances the structure of the stream. A stable channel is one that does not exhibit progressive changes in slope, shape, or dimensions, although short-term variations may occur during floods (Gordon et al. 1992).

Selected References

Hupp and Simon 1991, Brussock and Brown 1991, Platts et al. 1983, Rankin 1991, Rosgen 1985, 1994, 1996, Osborne and Hendricks 1983, Hughes and Omernik 1983, Cushman 1985, Bain and Boltz 1989, Gislason 1985, Hawkins et al. 1982, Statzner et al. 1988.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
7a. Frequency of Riffles (or bends) **(high gradient)**	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

7a. Frequency of Riffles (or bends)—High Gradient

Optimal Range
(arrows showing frequency of riffles and bends)

Poor Range

7b

CHANNEL SINUOSITY

low gradient streams

Evaluates the meandering or sinuosity of the stream. A high degree of sinuosity provides for diverse habitat and fauna, and the stream is better able to handle surges when the stream fluctuates as a result of storms. The absorption of this energy by bends protects the stream from excessive erosion and flooding and provides refugia for benthic invertebrates and fish during storm events. To gain an appreciation of this parameter in low gradient streams, a longer segment or reach than that designated for sampling may be incorporated into the evaluation. In some situations, this parameter may be rated from viewing accurate topographical maps. The "sequencing" pattern of the stream morphology is important in rating this parameter. In "oxbow" streams of coastal areas and deltas, meanders are highly exaggerated and transient. Natural conditions in these streams are shifting channels and bends, and alteration is usually in the form of flow regulation and diversion. A stable channel is one that does not exhibit progressive changes in slope, shape, or dimensions, although short-term variations may occur during floods (Gordon et al. 1992).

Selected References

Hupp and Simon 1991, Brussock and Brown 1991, Platts et al. 1983, Rankin 1991, Rosgen 1985, 1994, 1996, Osborne and Hendricks 1983, Hughes and Omernik 1983, Cushman 1985, Bain and Boltz 1989, Gislason 1985, Hawkins et al. 1982, Statzner et al. 1988.

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
7b. Channel Sinuosity **(low gradient)**	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

7b. Channel Sinuosity—Low Gradient

Optimal Range

Poor Range

8 BANK STABILITY (condition of banks)

high and low gradient streams

Measures whether the stream banks are eroded (or have the potential for erosion). Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks, and are therefore considered to be unstable. Signs of erosion include crumbling, unvegetated banks, exposed tree roots, and exposed soil. Eroded banks indicate a problem of sediment movement and deposition, and suggest a scarcity of cover and organic input to streams. Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.

Selected References

Ball 1982, MacDonald et al. 1991, Armour et al. 1991, Barbour and Stribling 1991, Hupp and Simon 1986, 1991, Simon 1989a, Hupp 1992, Hicks et al. 1991, Osborne et al. 1991, Rosgen 1994, 1996.

Habitat Parameter	Condition Category											
	Optimal			Suboptimal			Marginal			Poor		
8. Bank Stability (score each bank) **Note: determine left or right side by facing downstream** **(high and low gradient)**	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.			Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.			Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.			Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE ___ (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0
SCORE ___ (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	0

8a. Bank Stability (condition of banks)—High Gradient

Optimal Range
(arrow pointing to stable streambanks)

Poor Range *(MD Save Our Streams)*
(arrow highlighting unstable streambanks)

8b. Bank Stability (condition of banks)—Low Gradient

Optimal Range *(Peggy Morgan, FL DEP)*

Poor Range
(arrow highlighting unstable streambanks)

9 BANK VEGETATIVE PROTECTION

high and low gradient streams

Measures the amount of vegetative protection afforded to the stream bank and the near-stream portion of the riparian zone. The root systems of plants growing on stream banks help hold soil in place, thereby reducing the amount of erosion that is likely to occur. This parameter supplies information on the ability of the bank to resist erosion as well as some additional information on the uptake of nutrients by the plants, the control of instream scouring, and stream shading. Banks that have full, natural plant growth are better for fish and macroinvertebrates than are banks without vegetative protection or those shored up with concrete or riprap. This parameter is made more effective by defining the native vegetation for the region and stream type (i.e., shrubs, trees, etc.). In some regions, the introduction of exotics has virtually replaced all native vegetation. The value of exotic vegetation to the quality of the habitat structure and contribution to the stream ecosystem must be considered in this parameter. In areas of high grazing pressure from livestock or where residential and urban development activities disrupt the riparian zone, the growth of a natural plant community is impeded and can extend to the bank vegetative protection zone. Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.

Selected References

Platts et al. 1983, Hupp and Simon 1986, 1991, Simon and Hupp 1987, Ball 1982, Osborne et al. 1991, Rankin 1991, Barbour and Stribling 1991, MacDonald et al. 1991, Armour et al. 1991, Myers and Swanson 1991, Bauer and Burton 1993.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
9. Vegetative Protection (score each bank) **Note: determine left or right side by facing downstream.** **(high and low gradient)**	More than 90% of the streambank surfaces and immediate riparian zones covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

9a. Bank Vegetative Protection—High Gradient

Optimal Range
(arrow pointing to streambank with high level of vegetative cover)

Poor Range
(arrow pointing to streambank with almost no vegetative cover)

9b. Bank Vegetative Protection—Low Gradient

Optimal Range *(Peggy Morgan, FL DEP)*

Poor Range *(MD Save Our Streams)*
(arrow pointing to channelized streambank with no vegetative cover)

10 RIPARIAN VEGETATIVE ZONE WIDTH

high and low gradient streams

Measures the width of natural vegetation from the edge of the stream bank out through the riparian zone. The vegetative zone serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream. A relatively undisturbed riparian zone supports a robust stream system; narrow riparian zones occur when roads, parking lots, fields, lawns, bare soil, rocks, or buildings are near the stream bank. Residential developments, urban centers, golf courses, and rangeland are the common causes of anthropogenic degradation of the riparian zone. Conversely, the presence of "old field" (i.e., a previously developed field not currently in use), paths, and walkways in an otherwise undisturbed riparian zone may be judged to be inconsequential to altering the riparian zone and may be given relatively high scores. For variable size streams, the specified width of a desirable riparian zone may also be variable and may be best determined by some multiple of stream width (e.g., 4 x wetted stream width). Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.

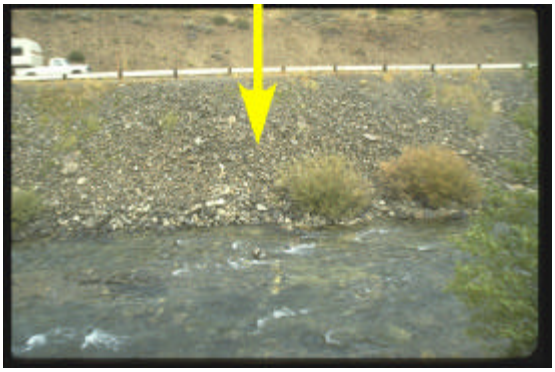
Selected References

Barton et al. 1985, Naiman et al. 1993, Hupp 1992, Gregory et al. 1991, Platts et al. 1983, Rankin 1991, Barbour and Stribling 1991, Bauer and Burton 1993.

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
10. Riparian Vegetative Zone Width (score each bank riparian zone) **(high and low gradient)**	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

10a. Riparian Vegetative Zone Width—High Gradient

Optimal Range
(arrow pointing out an undisturbed riparian zone)



Poor Range
(arrow pointing out lack of riparian zone)

10b. Riparian Vegetative Zone Width—Low Gradient

Optimal Range
(arrow emphasizing an undisturbed riparian zone)

Poor Range *(MD Save Our Streams)*
(arrow emphasizing lack of riparian zone)

5.3 ADDITIONS OF QUANTITATIVE MEASURES TO THE HABITAT ASSESSMENT

Kaufmann (1993) identified 7 general physical habitat attributes important in influencing stream ecology. These include:

- channel dimensions
- channel gradient
- channel substrate size and type
- habitat complexity and cover
- riparian vegetation cover and structure
- anthropogenic alterations
- channel-riparian interaction.

All of these attributes vary naturally, as do biological characteristics; thus expectations differ even in the absence of anthropogenic disturbances. Within a given physiographic-climatic region, stream drainage area and overall stream gradient are likely to be strong natural determinants of many aspects of stream habitat, because of their influence on discharge, flood stage, and stream power (the product of discharge times gradient). In addition, all of these attributes may be directly or indirectly altered by anthropogenic activities.

In Section 5.2, an approach is described whereby habitat quality is interpreted directly in the field by biologists while sampling the stream reach. This Level 1 approach is observational and requires only one person (although a team approach is recommended) and takes about 15 to 20 minutes per stream reach. This approach more quickly yields a habitat quality assessment. However, it depends upon the knowledge and experience of the field biologist to make the proper interpretation of observed of both the natural expectations (potentials) and the biological consequences (quality) that can be attributed to the observed physical attributes. Hannaford et al. (1997) found that training in habitat assessment was necessary to reduce the subjectivity in a visual-based approach. The authors also stated that training on different types of streams may be necessary to adequately prepare investigators.

The second conceptual approach described here confines observations to habitat characteristics themselves (whether they are quantitative or qualitative), then later ascribing quality scoring to these measurements as part of the data analysis process. Typically, this second type of habitat assessment approach employs more quantitative data collection, as exemplified by field methods described by Kaufmann and Robison (1997) for EMAP, Simonson et al. (1994), Meador et al. (1993) for NAWQA, and others cited by Gurtz and Muir (1994). These field approaches typically define a reach length proportional to stream width and employ transect measurements that are systematically spaced (Simonson et al. 1994, Kaufmann and Robison 1997) or spaced by judgement to be representative (Meador et al. 1993). They usually include measurement of substrate, channel and bank dimensions, riparian canopy cover, discharge, gradient, sinuosity, in-channel cover features, and counts of large woody debris and riparian human disturbances. They may employ systematic visual estimates of substrate embeddedness, fish cover features, habitat

types, and riparian vegetation structure. The time commitment in the field to these more quantitative habitat assessment methods is usually 1.5 to 3 hours with a crew of two people. Because of the greater amount of data collected, they also require more time for data summarization, analysis, and interpretation. On the other hand, the more quantitative methods and less ambiguous field parameters result in considerably greater precision. The USEPA applied both quantitative and visual-based (RBPs) methods in a stream survey undertaken over 4 years in the mid-Atlantic region of the Appalachian Mountains. An earlier version of the RBP techniques were applied on 301 streams with repeat visits to 29 streams; signal-to-noise ratios varied from 0.1 to 3.0 for the twelve RBP metrics and averaged (1.1 for the RBP total habitat quality score). The quantitative methods produced a higher level of precision; signal-to-noise ratios were typically between 10 and 50, and sometimes in excess of 100 for quantitative measurements of channel morphology, substrate, and canopy densiometer measurements made on a random subset of 186 streams with 27 repeat visits in the same survey. Similarly, semi-quantitative estimates of fish cover and riparian human disturbance estimates obtained from multiple, systematic visual observations of otherwise measurable features had signal:noise ratios from 5 to 50. Many riparian vegetation cover and structure metrics were moderately precise (signal:noise ranging from 2 to 30). Commonly used flow dependent measures (e.g., riffle/pool and width/depth ratios), and some visual riparian cover estimates were less precise, with signal:noise ratios more in the range of those observed for metrics of the EPA's RBP habitat score (<2).

The USEPA's EMAP habitat assessment field methods are presented as an option for a second level (II) of habitat assessment. These methods have been applied in numerous streams throughout the Mid-Atlantic region, the Midwest, Colorado, California, and the Pacific Northwest. Table 5-1 is a summary of these field methods; more detail is presented in the field manual by Kaufmann and Robison (1997).

Table 5-1. Components of EMAP physical habitat protocol.

Component	Description
1. Thalweg Profile	Measure maximum depth, classify habitat, determine presence of soft/small sediment at 10-15 equally spaced intervals between each of 11 channel cross-sections (100-150 along entire reach). Measure wetted width at 11 channel cross-sections and mid-way between cross-sections (21 measurements).
2. Woody Debris	Between each of the channel cross sections, tally large woody debris numbers within and above the bankfull channel according to size classes.
3. Channel and Riparian Cross-Sections	At 11 cross-section stations placed at equal intervals along reach length: • **Measure**: channel cross section dimensions, bank height, undercut, angle (with rod and clinometer); gradient (clinometer), sinuosity (compass backsite), riparian canopy cover (densiometer). • **Visually Estimate***: substrate size class and embeddedness; areal cover class and type (e.g., woody) of riparian vegetation in Canopy, Mid-Layer and Ground Cover; areal cover class of fish concealment features, aquatic macrophytes and filamentous algae. • **Observe & Record***: human disturbances and their proximity to the channel.
4. Discharge	In medium and large streams (defines later) measure water depth and velocity @ 0.6 depth (with electromagnetic or impeller-type flow meter) at 15 to 20 equally spaced intervals across one carefully chosen channel cross-section. In very small streams, measure discharge with a portable weir or time the filling of a bucket.

* Substrate size class and embeddedness are estimated, and depth is measured for 55 particles taken at 5 equally-spaced points on each of 11 cross-sections. The cross-section is defined by laying the surveyor's rod or tape to span the wetted channel. Woody

debris is tallied over the distance between each cross-section and the next cross-section upstream. Riparian vegetation and human disturbances are observed 5 m upstream and 5 m downstream from the cross section station. They extend shoreward 10 m from left and right banks. Fish cover types, aquatic macrophytes, and algae are observed within channel 5 m upstream and 5 m downstream from the cross section stations. These boundaries for visual observations are estimated by eye.

Table 5-2 lists the physical habitat metrics that can be derived from applying these field methods. Once these habitat metrics are calculated from the available physical habitat data, an assessment would be obtained from comparing these metric values to those of known reference sites. A strong deviation from the reference expectations would indicate a habitat alteration of the particular parameter. The close connectivity of the various attributes would most likely result in an impact on multiple metrics if habitat alteration was occurring. The actual process for interpreting a habitat assessment using this approach is still under development.

Table 5-2. Example of habitat metrics that can be calculated from the EMAP physical habitat data.

Channel mean width and depth
Channel volume and Residual Pool volume
Mean channel slope and sinuosity
Channel incision, bankfull dimensions, and bank characteristics
Substrate mean diameter, % fines, % embeddedness
Substrate stability
Fish concealment features (areal cover of various types, e.g., undercut banks, brush)
Large woody debris (volume and number of pieces per 100 m)
Channel habitat types (e.g., % of reach composed of pools, riffles, etc.)
Canopy cover
Riparian vegetation structure and complexity
Riparian disturbance measure (proximity-weighted tally of human disturbances)

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8 FISH PROTOCOLS

Monitoring of the fish assemblage is an integral component of many water quality management programs, and its importance is reflected in the aquatic life use-support designations of many states. Narrative expressions such as “maintaining coldwater fisheries”, “fishable” or “fish propagation” are prevalent in state standards. Assessments of the fish assemblage must measure the overall structure and function of the ichthyofaunal community to adequately evaluate biological integrity and protect surface water resource quality. Fish bioassessment data quality and comparability are assured through the utilization of qualified fisheries professionals and consistent methods.

The Rapid Bioassessment Protocol (RBP) for fish presented in this document, is directly comparable to RBP V in Plafkin et al. (1989). The principal evaluation mechanism utilizes the technical framework of the Index of Biotic Integrity (IBI) — a fish assemblage assessment approach developed by Karr (1981). The IBI incorporates the zoogeographic, ecosystem, community and population aspects of the fish assemblage into a single ecologically-based index. Calculation and interpretation of the IBI involves a sequence of activities including: fish sample collection; data tabulation; and regional modification and calibration of metrics and expectation values. This concept has provided the overall multimetric index framework for rapid bioassessment in this document. A more detailed description of this approach for fish is presented in Karr et al. (1986) and Ohio EPA (1987). Regional modification and applications are described in Leonard and Orth (1986), Moyle et al. (1986), Hughes and Gammon (1987), Wade and Stalcup (1987), Miller et al. (1988), Steedman (1988), Simon (1991), Lyons (1992a), Simon and Lyons (1995), Lyons et al. (1996), and Simon (1999).

The RBP for fish involves careful, standardized field collection, species identification and enumeration, and analyses using aggregated biological attributes or quantification of the numbers (and in some cases biomass, see Section 8.3.3, Metric 13) of key species. The role of experienced fisheries scientists in the adaptation and application of the RBP and the taxonomic identification of fishes cannot be overemphasized. The fish RBP survey yields an objective discrete measure of the condition of the fish assemblage. Although the fish survey can usually be completed in the field by qualified fish biologists, difficult species identifications will require laboratory confirmation. Data provided by the fish RBP can serve to assess use attainment, develop biological criteria, prioritize sites for further evaluation, provide a reproducible impact assessment, and evaluate status and trends of the fish assemblage.

Fish collection procedures must focus on a multihabitat approach — sampling habitats in relative proportion to their local representation (as determined during site reconnaissance). Each sample reach should contain riffle, run and pool habitat, when available. Whenever possible, the reach should be sampled sufficiently upstream of any bridge or road crossing to minimize the hydrological effects on overall habitat quality. Wadeability and accessability may ultimately govern the exact placement of the sample reach. A habitat assessment is performed and physical/chemical parameters measured concurrently with fish sampling to document and characterize available habitat specifics within the sample reach (see Chapter 5: Habitat Assessment and Physicochemical Characterization).

8.1 FISH COLLECTION PROCEDURES: ELECTROFISHING

All fish sampling gear types are generally considered selective to some degree; however, electrofishing has proven to be the most comprehensive and effective *single* method for collecting stream fishes. Pulsed DC (direct current) electrofishing is the method of choice to obtain a representative sample of the fish assemblage at each sampling station. However, electrofishing in any form has been banned from certain salmonid spawning streams in the northwest. As with any fish sampling method, the proper scientific collection permit(s) must be obtained before commencement of any electrofishing activities. The accurate identification of each fish collected is essential, and species-level identification is required (including hybrids in some cases, see Section 8.3.3, Metric 11). Field identifications are acceptable; however, voucher specimens must be retained for laboratory verification, particularly if there is any doubt about the correct identity of the specimen (see Section 8.2). Because the collection methods used are not consistently effective for young-of-the-year fish and because their inclusion may seasonally skew bioassessment results, fish less than 20 millimeters total length will not be identified or included in standard samples.

ELECTROFISHING CONFIGURATION AND FIELD TEAM ORGANIZATION

All field team members must be trained in electrofishing safety precautions and unit operation procedures identified by the electrofishing unit manufacturer. Each team member must be insulated from the water and the electrodes; therefore, chest waders and rubber gloves are required. Electrode and dip net handles must be constructed of insulating materials (e.g., woods, fiberglass). Electrofishers/electrodes must be equipped with functional safety switches (as installed by virtually all electrofisher manufacturers). Field team members must not reach into the water unless the electrodes have been removed from the water or the electrofisher has been disengaged.

It is recommended that at least 2 fish collection team members be certified in CPR (cardiopulmonary resuscitation). *Many* options exist for electrofisher configuration and field team organization; however, procedures will always involve pulsed DC electrofishing and a minimum 2-person team for sampling streams and wadeable rivers. Examples include:

- Backpack electrofisher with 2 hand-held electrodes mounted on fiberglass poles, one positive (anode) and one negative (cathode). One crew member, identified as the electrofisher unit operator, carries the backpack unit and manipulates both the anode and cathode poles. The anode may be fitted with a net ring (and shallow net) to allow the unit operator to net specimens. The remaining 1 or 2 team members net fish with dip nets and are responsible for specimen transport and care in buckets or livewells.

- Backpack electrofisher with 1 hand-held anode pole and a trailing or floating cathode. The electrofisher unit operator manipulates the anode with one hand, and has a second hand free for use of a dip net. The remaining 1 or 2 team members also aid in the netting of specimens, and in addition are responsible for specimen transport in buckets or livewells.

- Tote barge (pramunit) electrofisher with 2 hand-held anode poles and a trailing/floating cathode (recommended for large streams and wadeable rivers). Two team members are each equipped with an anode pole and a dip net. Each is responsible for electrofishing and the netting of specimens. The remaining team member will follow, pushing or pulling the barge through the sample reach. A livewell is maintained within the barge and/or within the sampling reach but outside the area of electric current.

The safety of all personnel and the quality of the data is assured through the adequate education, training, and experience of all members of the fish collection team. At least 1 biologist with training and experience in electrofishing techniques and fish taxonomy *must* be involved in each sampling event. Laboratory analyses are conducted and/or supervised by a fisheries professional trained in fish taxonomy. Quality assurance and quality control must be a continuous process in fisheries monitoring and assessment, and must include all program aspects (i.e., field sampling, habitat measurement, laboratory processing, and data recording).

Tote barge (pram unit) Electrofishing

Backpack Electrofishing

FIELD EQUIPMENT/SUPPLIES NEEDED FOR FISH SAMPLING—ELECTROFISHING

- appropriate scientific collection permit(s)
- backpack or tote barge-mounted electrofisher
- dip nets
- block nets (i.e., seines)
- elbow-length insulated waterproof gloves
- chest waders (equipped with wading cleats, when necessary)
- polarized sunglasses
- buckets/livewells
- jars for voucher/reference specimens
- waterproof jar labels
- 10% buffered formalin (formaldehyde solution)
- measuring board (500 mm minimum, with 1 mm increments)[a]
- balance (gram scale)[b]
- tape measure (100 m minimum)
- fish Sampling Field Data Sheet[c]
- applicable topographic maps
- copies of field protocols
- pencils, clipboard
- first aid kit
- Global Positioning System (GPS) Unit

[a] Needed only if program/study requires length frequency information

[b] Needed only if total biomass and/or the Index of Well-Being are included in the assessment process (see Section 8.3.3, Metric 13).

[c] It is helpful to copy fieldsheets onto water-resistant paper for use in wet weather conditions.

8.1.1 Field Sampling Procedures

1. A representative stream reach (see Alternatives for Stream Reach Designation, next page) is selected and measured such that primary physical habitat characteristics of the stream are included within the reach (e.g., riffle, run and pool habitats, when available). The sample reach should be located away from the influences of major tributaries and

bridge/road crossings (e.g., sufficiently upstream to decrease influences on overall habitat quality). The exact location (i.e., latitude and longitude) of the downstream limit of the reach must be recorded on each field data sheet. (If a Global Positioning System unit is used to provide location information, the accuracy or design confidence of the unit should be noted.) A habitat assessment and physical/chemical characterization of water quality should be performed within the same sampling reach (see Chapter 5: Habitat Assessment and Physicochemical Characterization).

2. Collection via electrofishing begins at a shallow riffle, or other physical barrier at the downstream limit of the sample reach, and terminates at a similar barrier at the upstream end of the reach. In the absence of physical barriers, block nets should be set at the upstream and downstream ends of the reach prior to the initiation of any sampling activities.

ALTERNATIVES FOR STREAM REACH DESIGNATION

The collection of a representative sample of the fish assemblage is essential, and the appropriate sampling station length for obtaining that sample is best determined by conducting pilot studies (Lyons 1992b, Simonson et al. 1994, Simonson and Lyons 1995). Alternatives for the designation of stream sampling reaches include:

- **Fixed-distance designation**—A standard length of stream, e.g., a 150-200-meter reach (Ohio EPA 1987), 100-meter reach (Massachusetts DEP 1995) may be used to obtain a representative sample. Conceptually, this approach should provide a mixture of habitats in the reach and provide, at a minimum, duplicate physical and structural elements such as riffle/pool sequences.

- **Proportional-distance designation**— A standard number of stream channel "widths" may be used to measure the stream study reach, e.g., 40 times the stream width is defined by Environmental Monitoring & Assessment Program (EMAP) for sampling (Klemm and Lazorchak 1995). This approach allows variation in the length of the reach based on the size of the stream. Application of the proportional-distance approach in large streams or wadeable rivers may require the establishment of sampling program time and/or distance maxima (e.g., no more than 3 hours of electrofishing or 500-meter reach per sampling site, [Klemm et al. 1993]).

3. Fish collection procedures commence at the downstream barrier. A minimum 2-person fisheries crew proceeds to electrofish in an upstream direction using a side-to-side or bank-to-bank sweeping technique to maximize area coverage. All wadeable habitats within the reach are sampled via a single pass, which terminates at the upstream barrier. Fish are held in livewells (or buckets) for subsequent identification and enumeration.

4. Sampling efficiency is dependent, at least in part, on water clarity and the field team's ability to see and net the stunned fish. Therefore, each team member should wear polarized sunglasses, and sampling is conducted only during periods of optimal water clarity and flow.

5. All fish (greater than 20 millimeters total length) collected within the sample reach must be identified to species (or subspecies). Specimens that cannot be identified with certainty in the field are preserved in a 10% formalin solution and stored in labeled jars for subsequent laboratory identification (see Section 8.2). A representative voucher collection must be retained for unidentified specimens, very small specimens, new locality records, and/or a particular region. In addition to the unidentified specimen jar, a voucher collection of a

subsample of each species identified in the field should be preserved and labeled for subsequent laboratory verification, if necessary. Obviously, species of special concern (e.g., threatened, endangered) should be noted and released *immediately* on site. Labels should contain (at a minimum) location data (verbal description and coordinates), date, collectors' names, and sample identification code and/or station numbers for the particular sampling site. Young-of-the-year fish less than 20 millimeters (total length) are not identified or included in the sample, and are released on site. Specimens that can be identified in the field are counted, examined for external anomalies (i.e., deformities, eroded fins, lesions, and tumors), and recorded on field data sheets. An example of a "Fish Sampling Field Data Sheet" is provided in Appendix A-4, Form 1. Space is available for optional fish length and weight measurements, should a particular program/study require length frequency or biomass data. However, these data *are not required* for the standard multimetric assessment. Space is allotted on the field data sheets for the *optional* inclusion of measurements (nearest millimeter total length) and weights (nearest gram) for a subsample (to a maximum 25 specimens) of each species. Although fish length and weight measurements are optional, recording a range of lengths for species encountered may be a useful routine measure. Following the data recording phase of the procedure, specimens that have been identified and processed in the field are released on site to minimize mortality.

6. The data collection phase includes the completion of the top portion of the "Fish Sampling Field Data Sheet" (Appendix A-4, Form 1),

QUALITY CONTROL (QC) IN THE FIELD

1. Quality control must be a continuous process in fish bioassessment and should include all program aspects, from field collection and preservation to habitat assessment, sample processing, and data recording. Field validation should be conduced at selected sites and will involve the collection of a duplicate sample taken from an adjacent reach upstream of the initial sampling site. The adjacent reach should be similar to the initial site with respect to habitat and stressors. Sampling QC data should be evaluated following the first year of sampling in order to determine a level of acceptable variability and the appropriate duplication frequency.

2. Field identifications of fish *must* be conducted by qualified/trained fish taxonomists, familiar with local and regional ichthyofauna. Questionable records are prevented by: (a) requiring the presence of at least one experienced/trained fish taxonomist on every field effort, and (b) preserving selected specimens (e.g., Klemm and Lazorchak 1995 recommend a subsample of a maximum 25 voucher specimens of each species) and those that cannot by readily identified in the field for laboratory verification and/or examination by a second qualified fish taxonomist (see Section 8.2). Specimens must be properly preserved and labeled (refer to Section 8.1.1, number 5). When needed, chain-of-custody forms must be initiated following sample preservation, and must include the same information as the sample container labels.

3. All field equipment must be in good operating condition, and a plan for routine inspection, maintenance, and/or calibration must be developed to ensure consistency and quality of field data. Field data must be complete and legible, and should be entered on standardized field data forms and/or digital recorders. While in the field, the field team should possess sufficient copies of standardized field data forms and chains-of-custody for all anticipated sampling sites, as well as copies of all applicable Standard Operating Procedures (SOPs).

which duplicates selected information from the physical/chemical field sheet. Information regarding the sample collection procedures must also be recorded. This includes method of fish capture, start time, ending time, duration of sampling, maximum and mean stream widths. The percentage of each habitat type in the reach is estimated and documented on the data sheet. Comments should include sampling conditions, e.g., visibility, flow, difficult access to stream, or anything that may prove to be valuable information to consider for future sampling events or by personnel unfamiliar with the site.

8.2 LABORATORY IDENTIFICATION AND VERIFICATION

Fish records of questionable quality are prevented by preserving specimens (that cannot be readily identified in the field) for laboratory examination and/or a voucher collection for laboratory verification. Specimens must be properly preserved (e.g., 10% formalin for tissue fixing and 70% ethanol for long-term storage) and labeled (using museum-grade archival labels/paper, and formalin/alcohol-proof pen or pencil). Labels should contain (at a minimum) site location data (i.e., verbal description and site coordinates), collection date, collector's names, species identification (for fishes identified in the field), species totals, and sample identification code and/or station number. All samples received in the laboratory should be tracked using a sample log-in procedure (Appendix A-4, Form 2). Laboratory fisheries professionals *must* be capable of identifying fish to the lowest possible taxonomic level (i.e., species or subspecies) and should have access to suitable regional taxonomic references (see Section 8.4) to aid in the identification process. Laboratories that do not typically identify fish, or trained fisheries professionals that have difficulty identifying a particular specimen or group of fish, should contact a taxonomic specialist (i.e., a recognized authority for that particular taxonomic group). Taxonomic nomenclature *must* be kept consistent and current. Common and scientific names of fishes from the United States and Canada are listed in Robins et al. (1991).

QUALITY CONTROL (QC) FOR TAXONOMY

1. A representative voucher collection must be retained for unidentified specimens, small specimens, and new locality records. In addition, a second voucher jar should be retained for a subsample of each species identified in the field (e.g., Klemm and Lazorchak 1995 recommend a subsample of 25 voucher specimens of each species). The vouchers must be properly preserved, labeled, and stored in the laboratory for future reference (see Section 8.2).

2. Voucher collections should be verified by a second qualified fish taxonomist, i.e., a professional other than the taxonomist responsible for the original field identifications. The word "validated" and the name of the taxonomist that validated the identification should be added to each voucher label. Specimens sent from the laboratory to taxonomic specialists should be recorded in a "Taxonomy Validation Notebook" (see Chapter 7), noting the label information and date sent. Upon return of the specimens, the date received and findings should also be recorded in the notebook (and the voucher label), along with the name of the person who performed the validation.

3. Information on samples completed (through the identification/validation process) will be tracked in a "Sample Log" notebook, to track the progress of each sample (Appendix A-4, Form 2). Sample log entries will be updated as each step is completed (e.g., receipt, identification, validation, archive).

4. A library of taxonomic literature is essential for the aid and support of identification/verification activities, and must be maintained (and updated as needed) in the laboratory. A list of selected taxonomic references is provided in Section 8.4.

8.3 DESCRIPTION OF FISH METRICS

Through the IBI, Karr et al. (1986) provided a consistent theoretical framework for analyzing fish assemblage data. The IBI is an aggregation of 12 biological metrics that are based on the fish assemblage's taxonomic and trophic composition and the abundance and condition of fish. Such multiple-parameter indices are necessary for making objective evaluations of complex systems. The IBI was designed to evaluate the quality of small Midwestern warmwater streams but has been modified for use in many regions (e.g., eastern and western United States, Canada, France) and in different ecosystems (e.g., rivers, impoundments, lakes, and estuaries).

The metrics attempt to quantify a biologist's best professional judgment (BPJ) of the quality of the fish assemblage. The IBI utilizes professional judgment, but in a prescribed manner, and it includes quantitative standards for discriminating the condition of the fish assemblage (Figure 8-1). BPJ is involved in choosing both the most appropriate population or assemblage element that is representative of each metric and in setting the scoring criteria. This process can be easily and clearly modified, as opposed to judgments that occur after results are calculated. Each metric is scored against criteria based on expectations developed from appropriate regional reference sites. Metric values

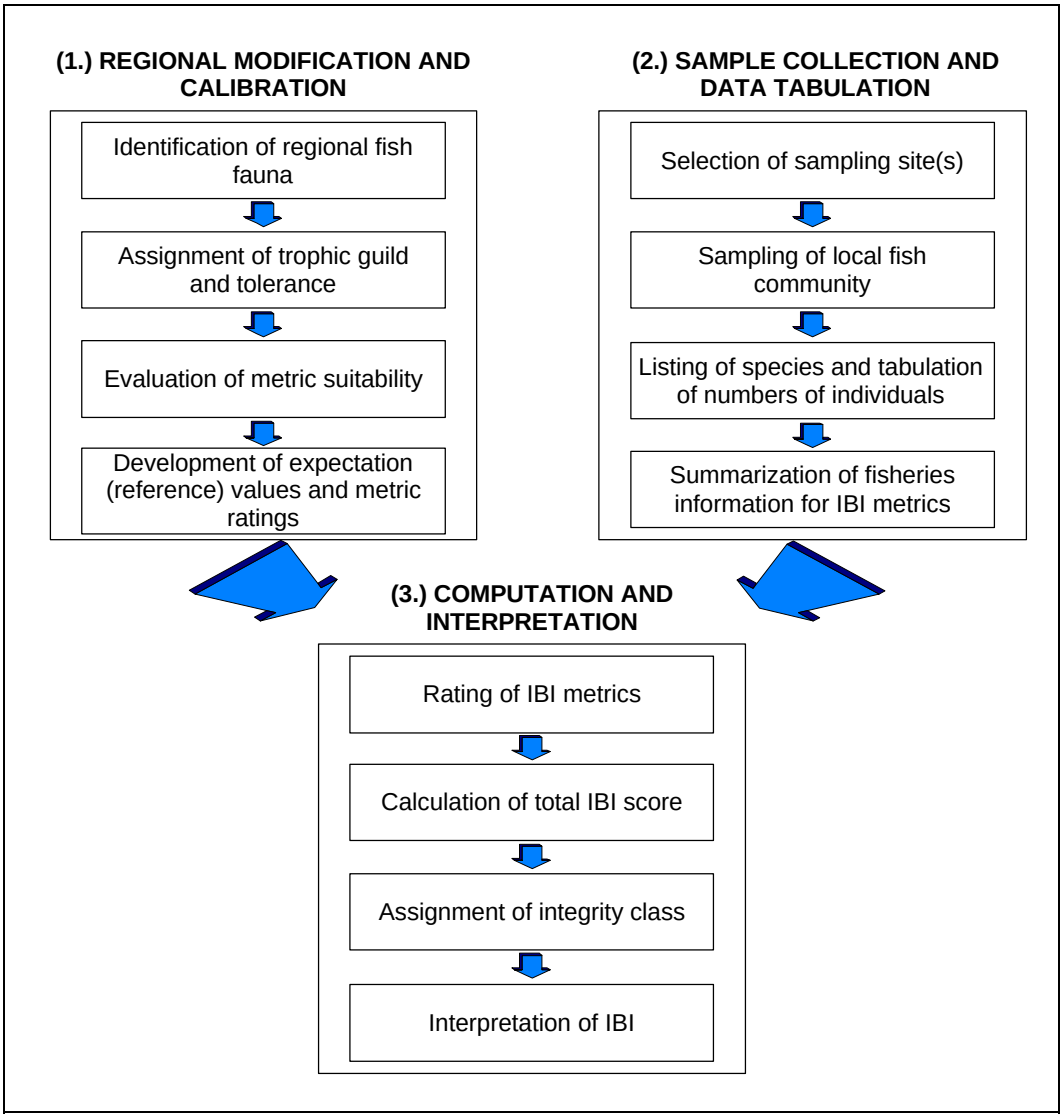

Figure 8-1. Sequence of activities involved in calculating and interpreting the Index of Biotic Integrity (adapted from Karr et al. 1986).

approximating, deviating slightly from, or deviating greatly from values occurring at the reference sites are scored as 5, 3, or 1, respectively. The scores of the 12 metrics are added for each station to give an IBI ranging from a maximum of 60 (excellent) to a minimum of 12 (very poor). Trophic and tolerance classifications of selected fish species are listed in Appendix C. Additional classifications can be derived from information in State and regional fish texts, by objectively assessing a large statewide database, or by contacting authors/originators of regional IBI programs or pilot studies. Use of the IBI by water resource agencies may result in further modifications. Many modifications have occurred (Miller et al. 1988) without changing the IBI's basic theoretical foundations.

The IBI serves as an integrated analysis because individual metrics may differ in their relative sensitivity to various levels of biological condition. A description and brief rationale for each of the 12 IBI metrics is outlined below. The original metrics described by Karr (1981) for Illinois streams are followed by substitutes used in or proposed for different geographic regions and stream sizes. Because of zoogeographic differences, different families or species are evaluated in different regions, with regional substitutes occupying the same general habitat or niche. The source for each substitute is footnoted below. Table 8-1 presents an overview of the IBI metric alternatives and their sources for various areas of the United States and Canada.

EXAMPLES OF SOURCES FOR METRIC ALTERNATIVES

Karr et al. (1986)
Leonard and Orth (1986)
Moyle et al. (1986)
Fausch and Schrader (1987)
Hughes and Gammon (1987)
Ohio EPA (1987)
Miller et al. (1988)
Steedman (1988)
Simon (1991)
Lyons (1992a)
Barbour et al. (1995)
Simon and Lyons (1995)
Hall et al. (1996)
Lyons et al. (1996)
Roth et al. (1997)
Simon (1999)

8.3.1 Species Richness and Composition Metrics

These metrics assess the species richness component of diversity and the health of resident taxonomic groupings and habitat guilds of fishes. Two of the metrics assess assemblage composition in terms of tolerant or intolerant species.

Metric 1. Total number of fish species Substitutes (Table 8-1): Total number of resident native fish species and salmonid age classes.

This number decreases with increased degradation; hybrids and introduced species are not included. In coldwater streams supporting few fish species, the age classes of the species found represent the suitability of the system for spawning and rearing. The number of species is strongly affected by stream size at most small warmwater stream sites, but not at large river sites (Karr et al. 1986, Ohio EPA 1987).

Metric 2. Number and identity of darter species Substitutes (Table 8-1): Number and identity of sculpin species, benthic insectivore species, salmonid juveniles (individuals); number of sculpins (individuals); percent round-bodied suckers, sculpin and darter species.

These species are sensitive to degradation resulting from siltation and benthic oxygen depletion because they feed and reproduce in benthic habitats (Kuehne and Barbour 1983, Ohio EPA 1987). Many smaller species live within the rubble interstices, are weak swimmers, and spend their entire lives in an area of 100-400 m^2 (Matthews 1986, Hill and Grossman 1987). Darters are appropriate in most

Mississippi Basin streams; sculpins and yearling trout occupy the same niche in western streams. Benthic insectivores and sculpins or darters are used in small Atlantic slope streams that have few sculpins or darters, and round-bodied suckers are suitable in large midwestern rivers.

Metric 3. Number and identity of sunfish species. Substitutes (Table 8-1): Number and identity of cyprinid species, water column species, salmonid species, headwater species, and sunfish and trout species.

Table 8-1. Fish IBI metrics used in various regions of North America.[a]

Alternative IBI Metrics	Midwestern United States	Central Appalachians	Sacramento-San Joaquin	Colorado Front Range	Western Oregon Ohio	Ohio Headwater Sites	Northeastern United States	Ontario	Central Corn Belt Plain	Wisconsin-Warmwater	Wisconsin-Coldwater	Maryland Coastal Plain	Maryland Non-Tidal
1. Total Number of Species	X	X	X	X				X		X		X	X
#native fish species					X	X	X		X		X		
# salmonid age classes[b]				X	X								
2. Number of Darter Species	X	X		X		X				X	X		
# sculpin species					X								
# benthic insectivore species								X					
# darter and sculpin species							X						
# darter, sculpin, and madtom species										X			
# salmonid juveniles (individuals)[b]			X		X			X					
% round-bodied suckers						X[c]							
# sculpins (individuals)			X										
# benthic species												X	X
3. Number of Sunfish Species	X			X		X				X	X		
# cyprinid species					X								
# water column species								X					
# sunfish and trout species									X				
# salmonid species			X							X			
# headwater species							X						
% headwater species							X			X			
4. Number of Sucker Species	X				X	X		X		X	X		
# adult trout species[b]			X		X								
# minnow species				X			X			X			
# sucker and catfish species									X				
5. Number of Intolerant Species	X			X	X	X		X			X	X	X	X
# sensitive species							X			X			
# amphibian species			X										
presence of brook trout									X				
% stenothermal cool and cold water species											X		
% of salmonid ind. as brook trout											X		
6. % Green Sunfish	X												
% common carp					X								
% white sucker				X				X					
% tolerant species						X	X			X	X	X	X	X
% creek chub		X											
% dace species									X				
% eastern mudminnow												X	

Table 8-1. Fish IBI metrics used in various regions of North America.[a]

Alternative IBI Metrics	Midwestern United States	Central Appalachians	Sacramento-San Joaquin	Colorado Front Range	Western Oregon Ohio	Ohio Headwater Sites	Northeastern United States	Ontario	Central Corn Belt Plain	Wisconsin-Warmwater	Wisconsin-Coldwater	Maryland Coastal Plain	Maryland Non-Tidal
7. % Omnivores	X			X		X	X	X	X	X	X		
% generalist feeders		X											
% generalists, omnivores, and invertivores													X
8. % Insectivorous Cyprinids	X											X	
% insectivores					X			X		X	X	X	X[e]
% specialized insectivores		X		X									
# juvenile trout			X										
% insectivorous species						X	X						
9. % Top Carnivores	X					X		X	X	X	X		
% catchable salmonids					X								
% catchable trout			X										
% pioneering species							X			X		X	
Density catchable wild trout			X										
10. Number of Individuals (or catch per effort)	X	X	X	X	X	X[d]	X[d]		X	X	X[d]	X	
Density of individuals								X					X
% abundance of dominant species												X	X
Biomass (per m^2)													X[f]
11. % Hybrids	X							X					
% introduced species				X	X								
% simple lithophills						X				X	X		X
# simple lithophills species							X						
% native species			X										
% native wild individuals			X										
% silt-intolerant spawners												X	
12. % Diseased Individuals (deformities, eroded fins, lesions, and tumors)	X	X		X	X	X	X	X	X	X	X	X	X

Note: X = metric used in region. Many of these variations are applicable elsewhere.

a Taken from Karr et al. (1986), Leonard and Orth (1986), Moyle et al. (1986), Fausch and Schrader (1987), Hughes and Gammon (1987), Ohio EPA (1987), Miller et al. (1988), Steedman (1988), Simon (1991), Lyons (1992a), Barbour et al. (1995), Simon and Lyons (1995), Hall et al. (1996), Lyons et al. (1996), Roth et al. (1997).

b Metric suggested by Moyle et al. (1986) or Hughes and Gammon (1987) as a provisional replacement metric in small western salmonid streams.

c Boat sampling methods only (i.e., larger streams/rivers).

d Excluding individuals of tolerant species.

e Non-coastal Plain streams only.

f Coastal Plain streams only.

These pool species decrease with increased degradation of pools and instream cover (Gammon et al. 1981, Angermeier 1987, Platts et al. 1983). Most of these fishes feed on drifting and surface invertebrates and are active swimmers. The sunfishes and salmonids are important sport species. The sunfish metric works for most Mississippi Basin streams, but where sunfish are absent or rare, other

groups are used. Cyprinid species are used in coolwater western streams; water column species occupy the same niche in northeastern streams; salmonids are suitable in coldwater streams; headwater species serve for midwestern headwater streams; and trout and sunfish species are used in southern Ontario streams. Karr et al. (1986) and Ohio EPA (1987) found the number of sunfish species to be dependent on stream size in small streams, but Ohio EPA (1987) found no relationship between stream size and sunfish species in medium to large streams, nor between stream size and headwater species in small streams.

Metric 4. Number and identity of sucker species. Substitutes (Table 8-1): Number of adult trout species, number of minnow species, and number of suckers and catfish.

These species are sensitive to physical and chemical habitat degradation and commonly comprise most of the fish biomass in streams. All but the minnows are longlived species and provide a multiyear integration of physicochemical conditions. Suckers are common in medium and large streams; minnows dominate small streams in the Mississippi Basin; and trout occupy the same niche in coldwater streams. The richness of these species is a function of stream size in small and medium sized streams, but not in large (e.g., non-wadeable) rivers.

Metric 5. Number and identity of intolerant species. Substitutes (Table 8-1): Number and identity of sensitive species, amphibian species, and presence of brook trout.

This metric distinguishes high and moderate quality sites using species that are intolerant of various chemical and physical perturbations. Intolerant species are typically the first species to disappear following a disturbance. Species classified as intolerant or sensitive should only represent the 5-10 percent most susceptible species, otherwise this becomes a less discriminating metric. Candidate species are determined by examining regional ichthyological books for species that were once widespread but have become restricted to only the highest quality streams. Ohio EPA (1987) uses number of sensitive species (which includes highly intolerant and moderately intolerant species) for headwater sites because highly intolerant species are generally not expected in such habitats. Moyle (1976) suggested using amphibians in northern California streams because of their sensitivity to silvicultural impacts. This also may be a promising metric in Appalachian streams which may naturally support few fish species. Steedman (1988) found that the presence of brook trout had the greatest correlation with IBI score in Ontario streams. The number of sensitive and intolerant species increases with stream size in small and medium sized streams but is unaffected by size of large (e.g., non-wadeable) rivers.

Metric 6. Proportion of individuals as green sunfish. Substitutes (Table 8-1): Proportion of individuals as common carp, white sucker, tolerant species, creek chub, and dace.

This metric is the reverse of Metric 5. It distinguishes low from moderate quality waters. These species show increased distribution or abundance despite the historical degradation of surface waters, and they shift from incidental to dominant in disturbed sites. Green sunfish are appropriate in small midwestern streams; creek chubs were suggested for central Appalachian streams; common carp were suitable for a coolwater Oregon river; white suckers were selected in the northeast and Colorado where green sunfish are rare to absent; and dace (*Rhinichthys* species) were used in southern Ontario. To avoid weighting the metric on a single species, Karr et al. (1986) and Ohio EPA (1987) suggest using a small number of highly tolerant species (e.g., alternative Metric 6— percent abundance of tolerant species).

8.3.2 Trophic Composition Metrics

These three metrics assess the quality of the energy base and trophic dynamics of the fish assemblage. Traditional process studies, such as community production and respiration, are time consuming to conduct and the results are equivocal; distinctly different situations can yield similar results. The trophic composition metrics offer a means to evaluate the shift toward more generalized foraging that typically occurs with increased degradation of the physicochemical habitat.

Metric 7. Proportion of individuals as omnivores. Substitutes (Table 8-1): Proportion of individuals as generalist feeders.

The percent of omnivores in the community increases as the physical and chemical habitat deteriorates. Omnivores are defined as species that consistently feed on substantial proportions of plant and animal material. Ohio EPA (1987) excludes sensitive filter feeding species such as paddlefish and lamprey ammocoetes and opportunistic feeders like channel catfish. In areas where few species fit the true definition of omnivore, the proportion of generalized feeders may be substituted (Leonard and Orth 1986).

Metric 8. Proportion of individuals as insectivorous cyprinids. Substitutes (Table 8-1): Proportion of individuals as insectivores, specialized insectivores, insectivorous species, and number of juvenile trout.

Invertivores, primarily insectivores, are the dominant trophic guild of most North American surface waters. As the invertebrate food source decreases in abundance and diversity due to habitat degradation (e.g., anthropogenic stressors), there is a shift from insectivorous to omnivorous fish species. Generalized insectivores and opportunistic species, such as blacknose dace and creek chub were excluded from this metric by Ohio EPA (1987). This metric evaluates the midrange of biological condition, i.e., low to moderate condition.

Metric 9. Proportion of individuals as top carnivores. Substitutes (Table 8-1): Proportion of individuals as catchable salmonids, catchable wild trout, and pioneering species.

The top carnivore metric discriminates between systems with high and moderate integrity. Top carnivores are species that feed, as adults, predominantly on fish, other vertebrates, or crayfish. Occasional piscivores, such as creek chub and channel catfish, are not included. In trout streams, where true piscivores are uncommon, the percent of large salmonids is substituted for percent piscivores. These species often represent popular sport fish such as bass, pike, walleye, and trout. Pioneering species are used by Ohio EPA (1987) in headwater streams typically lacking piscivores. Pioneering species predominate in unstable environments that have been affected by temporal desiccation or anthropogenic stressors, and are the first to reinvade sections of headwater streams following periods of desiccation.

8.3.3 Fish Abundance and Condition Metrics

The last 3 metrics indirectly evaluate population recruitment, mortality, condition, and abundance. Typically, these parameters vary continuously and are time consuming to estimate accurately. Instead of such detailed population attributes or estimates, general population parameters are evaluated. Indirect estimation is less variable and much more rapidly determined.

areas where toxic chemicals are concentrated. They are excellent measures of the subacute effects of chemical pollution and the aesthetic value of game and nongame fish.

Metric 13. Total fish biomass (optional).

Hughes and Gammon (1987) suggest that in larger (e.g., non-wadeable) rivers where sizes of fish may vary in orders of magnitude this additional metric may be appropriate. Gammon (1976, 1980) and Ohio EPA (1987) developed an Index of Well-Being (Iwb) and Modified Index of Well-Being (MIwb), respectively, based upon both fish abundance and biomass measures. The combination of diversity and biomass measures is a useful tool for assessing fish assemblages in larger rivers (Yoder and Rankin 1995b). Ohio EPA (1987) found that the additional collection of biomass data (i.e., in addition to abundance information needed for the IBI) required to calculate the MIwb does not represent a significant expenditure of time, providing that subsampling techniques are applied (see Field Sampling Procedures 8.1.1).

Because the IBI is an adaptable index, the choice of metrics and scoring criteria is best developed on a regional basis through use of available publications (Karr et al. 1986, Ohio EPA 1987, Miller et al. 1988, Steedman 1988; Simon 1991, Lyons 1992a, Simon and Lyons 1995, Hall et al. 1996, Lyons et al. 1996, Roth et al. 1997, Simon 1999). Several steps are common to all regions. The fish species must be listed and assigned to trophic and tolerance guilds. Scoring criteria are developed through use of high quality historical data and data from minimally-impaired regional reference sites. This has been done for much of the country, but continued refinements are expected as more ecological data become available for the fish community.

8.4 TAXONOMIC REFERENCES FOR FISH

The following references are provided as a list of taxonomic references currently being used around the United States for identification of fish. Any of these references cited in the text of this document will also be found in Chapter 11 (Literature Cited).

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ENCLOSURE 22 Northern Long-Eared Bat Surveys

NAVFAC Atlantic Biological Resource Services

Contract: N62470-13-D-8016; Task Order: WE07, Option Task 04

Northern Long-Eared Bat Survey Report

Naval Air Station Oceana
Virginia Beach, Virginia

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1.0 INTRODUCTION

Tetra Tech, Inc., was contracted to collect information on the federally-threatened northern long-eared bat (*Myotis septentrionalis*) (NLEB) at Naval Air Station Oceana (NAS Oceana or Installation) located in Virginia Beach, Virginia. The survey concentrated on areas of interest (i.e., areas with height obstructions interfering with the airfield operations) as identified by the Navy (Figure 1-1 and 1-2). In accordance with the work plan (Tetra Tech 2015), the objective of this project was to determine the presence or absence of NLEB following protocols established by the United States Fish and Wildlife Service (USFWS) and detailed in the *Northern Long-Eared Bat Interim Conference and Planning Guidance* (USFWS 2014) and the *2015 Range-Wide Indiana Bat Summer Survey Guidelines (USFWS 2015)*. This survey included presence/absence mist-net field capture and acoustic surveys.

Mist-netting efforts were concentrated in suitable NLEB habitat within the areas of interest and nets were strategically placed in flight paths, often near drinking water, to maximize chances of catching NLEB. Mist-netting allowed both a snapshot of what species, and in what abundance, were utilizing the areas of interest and provided an opportunity to attach radio-transmitters. Species identification through mist-netting is considered more reliable than acoustic recording alone.

If NLEB had been captured, radio telemetry surveys would have been conducted to discover if these bats were using maternity roosts on the Installation. If a roost(s) had been located, data would have been collected to characterize the bats' selected site(s). If roosts had been found, emergence counts would have been performed to detect the presence of maternity colonies. Maternity colonies are of special interest because they must be protected in white-nose syndrome (WNS) areas under the threatened species 4(d) rule (USFWS 2016a). In the absence of NLEB capture, acoustic surveys were performed in suitable NLEB habitat to further detect if NLEB were utilizing the Installation. Information collected on NLEB presence can be used by natural resource managers to make informed land-use decisions on the Installation in areas occupied by this vulnerable species.

2.0 SPECIES BACKGROUND

On April 2, 2015, the USFWS announced that the NLEB was listed as threatened with an interim section 4(d) rule. The intent of the 4(d) rule was to provide the USFWS flexibility in implementing the Endangered Species Act (ESA) by modifying regulations necessary to provide for the conservation of a threatened species while not overburdening private landowners, state agencies, and others with blanket regulations that do not further the conservation of the species. A final 4(d) rule for NLEB was released on January 14, 2016 (USFWS 2016a) and became effective February 16, 2016. USFWS determined that WNS was, and continues to be the primary threat to NLEB. USFWS further determined that regulating other sources of mortality or harm, such as habitat loss, would not effectively conserve the species.

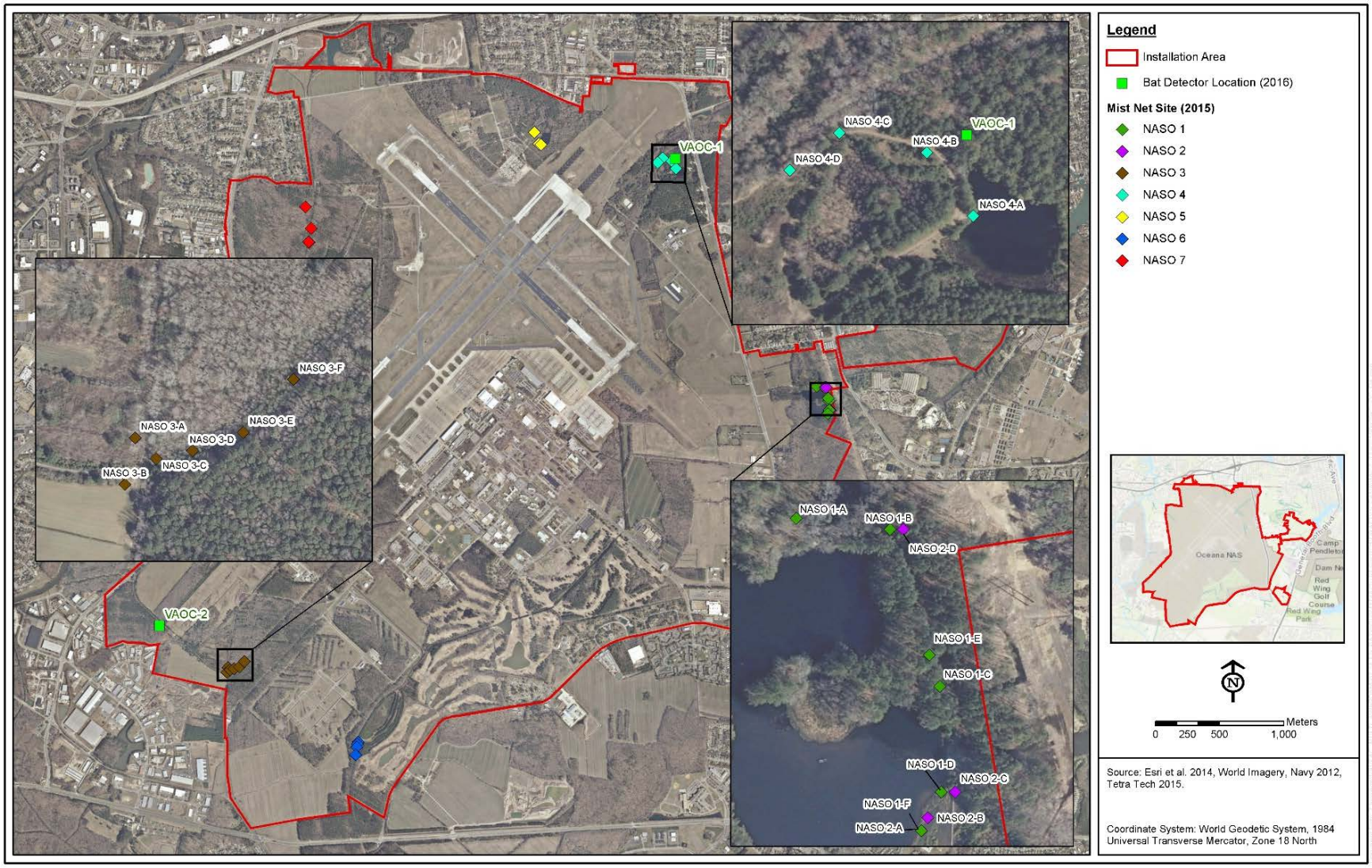

Figure 1-1. Regional Setting and Mist Netting Locations of NAS Oceana, Virginia.

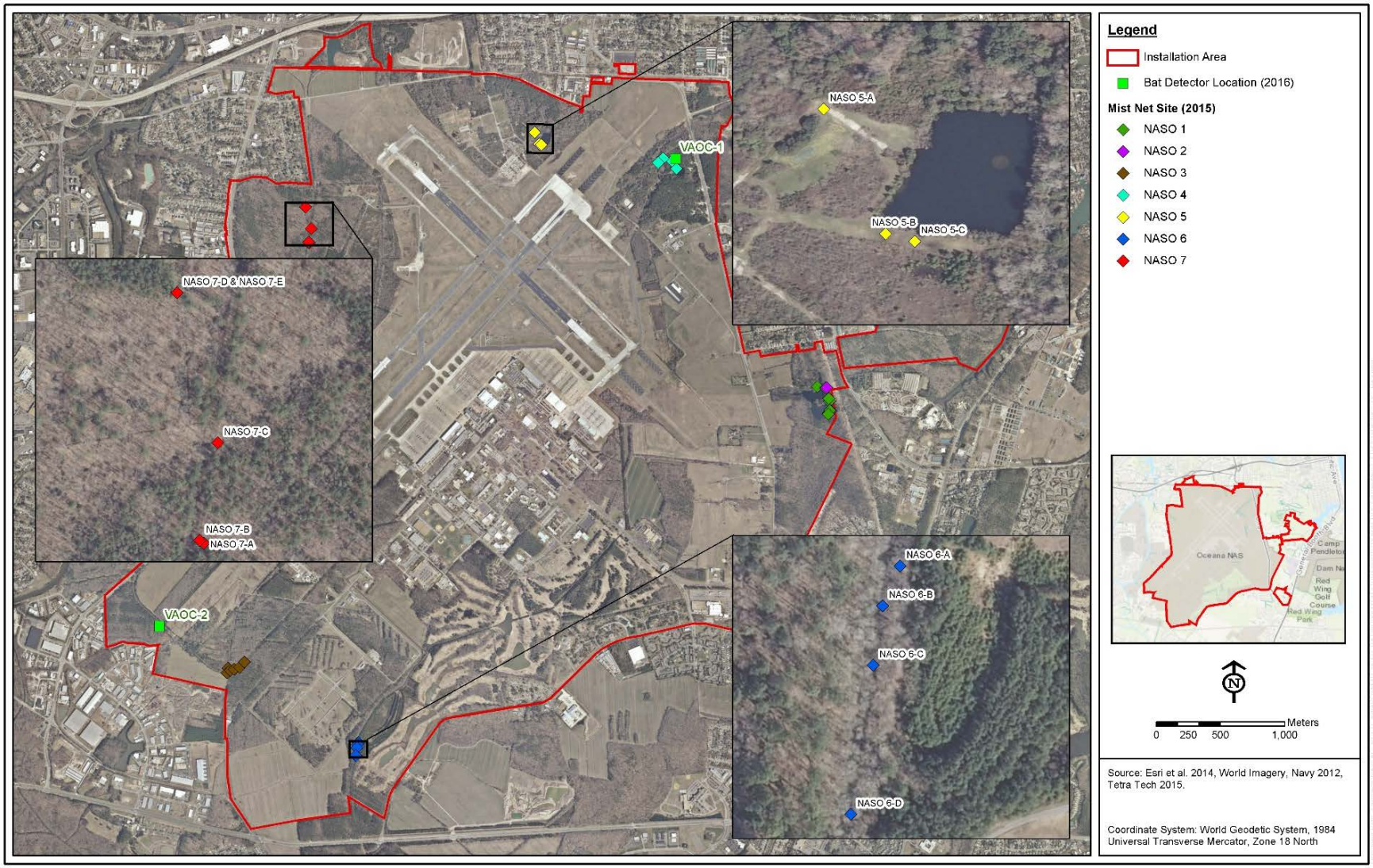

Figure 1-2. Regional Setting and Mist Netting Locations of NAS Oceana, Virginia.

The final 4(d) rule prohibits all *purposeful take*[1] within the range of NLEB except removal of NLEB from human structures, defense of human health (disease monitoring), or removal of hazardous trees for the protection of human life and property. All take incidental to otherwise lawful activities is allowed outside of the WNS zone. The WNS zone includes all counties affected by WNS and an additional 241 kilometer (150-mile) buffer around these counties which includes the Installation (USFWS 2016b). For areas within the WNS zone, *incidental take*[2] is prohibited only if it occurs within a hibernaculum[3], if tree removal activities occur within a 0.4 kilometer (quarter-mile) of a known, occupied hibernaculum at any time of year or within 46 meters (150 feet) of a known, occupied maternity roost tree from June 1 through July 31 (USFWS 2016a). If a federal project may result in prohibited tree removal described above (or if a project is authorized, funded, or permitted by a federal agency), the final 4(d) rule provides a programmatic biological opinion and optional framework for streamlining section 7 consultations. However, the USFWS may advise federal agencies when project level consultation for NLEB is required (USFWS 2016a).

NLEBs occur throughout forested portions of the northeastern United States and in eastern, central, and northern Canada (79 FR 191). Historically, the species was patchily-distributed, and less common in the southern and western portions of its range (Barbour and Davis 1969). Population density seems to have been highest in the northern portion of the species' range, which includes much of the eastern United States (Harvey 1992). NLEB were first documented in Chesapeake, VA in 2013 (Tetra Tech 2015a). NLEB have been captured during subsequent presence/absence mist-net surveys in southeastern Virginia near the Installation. NLEB were captured in 2014 and 2015 at nearby NSAHR Northwest Annex (8 and 11 NLEB respectively) and in 2015 at NALF Fentress (4 NLEB) (Tetra Tech 2014, 2015b, 2015c).

NLEB are an obligate forest-dwelling species, adapted to gleaning and hawking for insects in the sub-canopy in deciduous and mixed forests. Foraging occurs entirely within forested areas but is not restricted to mature forests. NLEB forage primarily below the canopy in the understory, or in sub-canopy shrub layers. Foraging is often concentrated in forested upland areas, but may also occur in forest clearings, above roadways and trails, or near water (79 FR 191). These habitat requirements and behavioral patterns relate directly to the potential for the Installation to support NLEB.

Summer roosts provide NLEB with a thermally-stable environment, as well as protection from the elements and predators (Owen *et al.* 2002). Day roost selection by NLEB is dependent upon

[1] "Purposeful take is when the reason for the activity or action is to conduct some form of take. For instance, conducting a research project that includes collecting and putting bands on bats is a form of purposeful take. Intentionally killing or harming bats is also purposeful take and is prohibited" (USFWS 2016c).
[2] "Incidental take is defined by the Endangered Species Act as take that is incidental to, and not the purpose of the carrying out of an otherwise lawful activity. For example, harvesting trees can kill bats that are roosting in the trees, but the purpose of the activity is not to kill bats" (USFWS 2016c).
[3] NLEB hibernaculum include caves and abandoned mines with constant, cooler temperatures and high humidity in which they spend the winter in a state of metabolic depression (USFWS 2016c).

the presence of suitable live or dead (snag) trees having cavities, crevices, or exfoliating bark for roosting, although man-made structures and caves may also be used for roosting. Throughout their range, NLEB roost in a variety of tree species, using specific trees based on their suitability to retain bark or provide cavities or crevices. Isolated trees may also be used as roosts, provided they are within 1,000 feet of another suitable roost tree or forested area (USFWS 2014). NLEB roost alone or in small maternity colonies and switch roosts often; on average, lactating females appear to switch roosts every two to five days (Menzel *et al.* 2002; Sasse and Perkins 1996).

Two studies conducted in West Virginia identified black locust (*Robinia pseudoacacia*) as a preferred roost tree for both male and female NLEB, although locust roosts accounted for only 34 percent of potential roosts (Ford *et al.* 2006 and Owen *et al.* 2002). A 2003 study of male NLEB day-roost selection in West Virginia identified 13 roosts in black locust (five snags and eight live trees), one roost in sassafras (*Sassafras albidum*) (snag), and two sugar maple (*Acer saccharum*) (live) (Ford *et al*. 2006). All of the live-tree roosts were medium–large, canopy-dominant trees characterized by substantial amounts of exfoliating bark and numerous broken limbs and cavities. Live-tree roosts tended to be larger than other trees in the vicinity. Roosts located in snags were smaller than the live trees and other snags in the vicinity. It is likely that NLEB exhibit a strong preference for selection of roosts within older forest stands that contain many large trees and snags with exfoliating or plate-like bark or cavities (Ford *et al*. 2006).

In southeastern Virginia, near the Installation, NLEB were radio tracked at both NSAHR Northwest Annex and NALF Fentress to roost sites. All known roosts of the three NLEB tracked at NALF Fentress were in red maple trees, predominantly dead (Tetra Tech 2015b). Four NLEB were tracked at NSAHR Northwest Annex in 2014 and 2015 combined. Of the seven known roosts, five were located in living and dead red maples and a single roost each in a live loblolly pine and live sweet gum tree (Tetra Tech 2014, 2015c).

Unlike true long-distance migratory bats (*Lasiurus* spp. and *Lasionycteris* spp.), NLEB do not undertake long-distance migrations between summer and winter ranges, but do make shorter distance movements between summer roosts and winter hibernacula. NLEB arrive at hibernacula in August or September, begin hibernation in October and November, and leave for summer habitats in March or April (79 FR 191). NLEB hibernate in caves and mines, as well as in man-made structures. The species prefers large hibernacula with large entrances and, although NLEB are often found with other *Myotis* species, they prefer cooler temperatures and higher humidity than little brown bats (*Myotis lucifugus*). Individuals may hibernate in cracks and crevices in hibernacula walls, and may be overlooked during winter surveys. The species has also been found in less traditional hibernacula, including dams and dry wells, and may utilize man-made structures more frequently than previously thought, especially in the northeast (USFWS 2013).

Significant decreases in populations of NLEB have occurred over the last five years, primarily as a result of WNS, a fungal pathogen responsible for unprecedented mortality of hibernating bats, with an estimated 5.7 million bats killed since the discovery of WNS in the United States. WNS was first discovered in eastern New York in February 2006 and has now been documented in at

least 19 states and four Canadian provinces. Precipitous declines have been documented for the NLEB and eastern small-footed bats (*Myotis leibii*) over the last three years with an estimated loss greater than 1 million bats. Other threats to NLEB include loss and fragmentation of forested habitat, alteration to traditional hibernacula, and anthropogenic sources of mortality including wind energy facilities (USFWS 2014).

3.0 METHODS

3.1 CAPTURE

Per USFWS guidelines, mist-net surveys were conducted within the 15 May to 15 August 2015 survey window and were completed over five nights from 11 Jun to 15 Jun 2015 for a total of 42 net-nights. The required federal (TE63633A-3) and state collection permits (VADGIF 051933) were obtained by Tetra Tech's subcontractor, Biodiversity Research Institute (BRI), for completion of these tasks (Appendix A). Safety procedures and precautions are outlined in Appendix B. During the five-night survey window, bats were captured at seven locations (Figures 1-1 and 1-2) within the areas of interest. Mist-net survey sites were typically surrounded by mature trees that potentially provide good roosting habitat and a clear path to foraging areas for bats leaving their roosts.

Site NASO 1 was an old road that had been grown over with grass and the species composition was loblolly pine (*Pinus taeda*), sweet gum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), and switch grass (*Panicum virgatum*). NASO 2 nets were located across an old dirt road and on the banks of a pond with loblolly pine, sweet gum, red maple, and switch grass. NASO 3 nets were set across a dirt road and at the edge of a field with loblolly pine, sweet gum, red maple, and yellow poplar (*Liriodendron tulipifera*) trees. NASO 4 nets were spread across a dirt road, an old grassy road, as well as next to a pond with red maple, green ash (*Fraxinus pennsylvanica*), and loblolly pine. NASO 5 nets were spread across a dirt road and on the edge of a field with loblolly pine, sweet gum, and red maple trees. NASO 6 nets were spread across a water-filled drainage ditch with loblolly pine, sweet gum and red maple trees. Finally, NASO 7 nets were spread across a dirt road and in forest openings with swamp chestnut oak (*Quercus michauxii*), cherry bark oak (*Q. pagoda*), summer sweet (*Clethra alnifolia*), swamp dog laurel (*Leucothoe axillaris*), loblolly pine, sweet gum, red maple and greenbrier (*Smilax sp.*). Photos of each net site and surrounding habitat are available in Appendix C.

Two two-person teams, each operating two to three nets, conducted the mist-netting survey and one USFWS-approved biologist monitored all survey activities. A combination of triple-high (three nets stacked upon another, 7.8 meters height), double-high (two nets stacked upon another, 5.2 meters height), and single-high (2.6 meters height) nets were set up each night (Figure 3-1). Depending on the site, nets varied in length from 6 to 12 meters and were positioned to maximize coverage of flight paths, including suitable travel corridors, foraging areas, and/or drinking areas. These areas are of interest since they act as corridors and funnel bats toward the nets. Nets were set at dusk and monitored until at least 00:15 hours, for a minimum of 5 hours. If bats continued to be captured, nets were left up until as late as 01:30 hours.

Bats were live-caught in mist-nets and released unharmed near the point of capture. Nets were checked at 10-minute intervals and processing was completed within 30 minutes from the time the bat was removed from the net. Biological and morphometric data was recorded for each individual captured (e.g., time of capture, capture net, species, sex, age class, reproductive condition, mass, and forearm length) and provided in Appendix D. A juvenile bat is generally considered less than 1 year old and determined through the observation of a long smooth joint demonstrating incomplete epiphyseal ossification (fusion) of the metacarpal-phalangeal joint that are not present in the ossified knobby adult joints. Bats become reproductively active around 1 year old. Each bat was also banded on the forearm with a unique number for later identification. Wing tissue biopsies and swabs were taken from some big brown (*Eptesicus fuscus*) and little brown bats captured to aid in a USFWS funded WNS research project conducted by Stony Brook University and Grand Valley State University. The research description and protocol that was followed is available in Appendix E. Time, weather, global positioning system location of each net site and hourly weather conditions were also recorded. Data was recorded in Chiro (Aquila Services), an iPad application, for ease of tracking and compiling data and to reduce human error. Female NLEB would have been fitted with a radio transmitter, tracked to day roosts, and emergence counts performed if they had been captured.

Caution was taken during mist-net activities to minimize the potential for transmitting WNS by following the most recent decontamination protocols (USFWS 2008). For example, bats were held in paper bags until processed, and holding bags were disposed of after each use. Bats were evaluated for potential WNS infection following the *Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-nose Syndrome* (Reichard, no date).

Site 1 Net D
Photo Credit: Biodiversity Research Institute

Site 2 Net F
Photo Credit: Biodiversity Research Institute

Figure 3-1. Representative Photos of Net Sites at NAS Oceana, Virginia—2015.

3.2 RADIO-TELEMETRY, HOME RANGE, AND ROOSTS

If captured, female NLEB would have been targeted for attaching transmitters because they form maternity colonies during the summer months (Menzel *et al*. 2002). Male NLEB generally roost solitarily and, therefore, were not a priority for the USFWS from a radio-tracking standpoint. Female NLEB would have been fitted with Advanced Telemetry Solutions (ATS) radio-transmitters (Appendix F). Coordination with Installation tenant commands was required to obtain approval for types of transmitters/receivers and ranges of frequencies that could be utilized on the Installation due to potential conflicts with military communication requirements. The transmitters were the smallest commercially available, weighing only 0.29 grams and representing less than 5 percent of each bat's body mass. Fur would have been removed from between the scapulae and the transmitter would have been attached to the bare skin using Skin Bond surgical cement. The radio transmitter would have been tested for functionality before releasing the bat.

Female NLEB would have been tracked both by vehicle and on foot to facilitate collection of data necessary to determine home range as outlined in the USFWS *Northern Long-Eared Bat Interim Conference and Planning Guidance* (USFWS 2014). Following the night of capture, bat locations would have been identified using the homing technique specified in White and Garrot (1990). ATS R4000 receivers (Advanced Telemetry Systems, Isanti, MN) and Yagi antennas would have been used during radio-tracking efforts (Appendix F). The ATS transmitters have about a 300-meter range of detection. NLEB home ranges would have been estimated using a 3-mile buffer around a capture site if no other information was available for that individual (no radio telemetry), per USFWS guidelines. Home range for NLEB with known capture and roost site information would have been created using a buffer of 1.5 miles surrounding the mapped capture and roost site(s).

NLEB fitted with radio transmitters would have been tracked for six consecutive days post-capture according to the USFWS protocols for identifying roosting sites. If a NLEB roost was found through radio-telemetry, emergence counts would have been conducted using methods outlined in Section 3.3.

3.3 EMERGENCE COUNTS

Roosting sites identified by radio-telemetry would have been monitored for emergence counts following methodologies outlined in the USFWS protocol (USFWS 2014). A minimum of two evening-emergence counts would have been conducted at all roosts located via radio-tracking. A biologist would position themselves at the site of the roost tree around dusk each night (about 30 minutes before sunset) and count the number of bats emerging from the tree until about one hour after sunset or until it was too dark to see emerging bats. The positioning of the biologist(s) conducting the emergence counts would have been in a location suitable for observing emerging bats silhouetted against the sky. Biologists also would have positioned themselves close enough to the roost to observe emerging bats, but not so close as to influence emergence. Therefore, biologists would not have stood directly beneath the roost. Biologists would have minimized

noise and use of artificial light sources (i.e. flashlight) when in the vicinity of the roost. Emergence counts would not have been conducted if during the 30 minutes before and during the observation temperatures were below 50 degrees Fahrenheit, precipitation was occurring for at least 30 minutes or intermittently (including rain or fog), or if wind speeds exceeded 4 meters/second due to reduced activity during these conditions.

3.4 ACOUSTIC SURVEYS

3.4.1 Desktop and Field Habitat Analysis

Prior to conducting field work, a desktop land cover analysis was performed to identify suitable NLEB habitat. Specifically, aerial photography and Google Earth images were reviewed to determine areas that may be used by NLEB for foraging and roosting during the breeding and migration seasons. Determinations were based on forest patch size, proximity to closed-canopy forests, and landscape features that may be used by bats commuting between roosting and foraging habitats (e.g., forested tracts, wetlands, streams). All open water, wetlands, and relatively contiguous forested lands not highly fragmented by residential or commercial developments were considered suitable NLEB habitat, and all densely populated or developed stretches were determined to be unsuitable. The level of effort was determined based on the assumption that suitable habitat within the Installation is non-linear.

Where possible, the following habitat types were targeted in the field in order of descending priority (i.e., detector deployment in openings within interior forests will be prioritized, then within interior closed canopy forests, etc.):

- Interior forest-canopy openings.
- Closed canopy forests.
- Near water sources adjacent to forested habitat.
- Forest edges.
- Linear forested corridors, including corridors connecting forested habitat blocks.

3.4.2 Bat Detectors

Tetra Tech used Wildlife Acoustic Song Meter SM3 Monitoring Systems (bat detectors) for the duration of the acoustic monitoring survey, 6 detector nights from 24 May to 26 May 2016 (Appendix G). The SMM-U1 microphone was attached to the recording unit by a high-quality, low-loss microphone cable. To ensure that the greatest period of bat activity was surveyed, bat detectors were programmed to begin recording one hour before sunset and stop recording approximately one hour after sunrise each day because they were deployed in darker canopied areas.

Two ground-based bat detectors with microphones 1.5 meters from the ground were deployed (Figure 1-1). Sampling locations were based on representative habitats within the Installation, areas with potential for high bat activity, and areas available for access (Figure 3-2). VAOC-1 was

deployed in a small canopy opening (36.832610, -76.013793). The microphone was pointed 140 degrees southeast down a dirt road with semi-closed canopy leading to a pond 40 meters away. The habitat was a mixed forest with pine and oak including black oak (*Quercus velutina*), sweet gum, yellow poplar, wax myrtle (*Morella cerifera*), loblolly pine, and Muscadine grape (*Vitis rotundifolia*). VAOC-2 was located on the northern bank of a small stream closed canopy corridor (36.799427, -76.058382). The microphone was pointed parallel to the stream at 318 degrees northwest. The habitat is mixed forest including loblolly pine, wax myrtle, red maple, sand post oak (*Q. margarettae*), water oak (*Q. nigra*), American sycamore (*Platanus occidentalis*), Muscadine grape, Japanese honeysuckle (*Lonicera japonica*), and sweet gum. Photos of detector locations available in Appendix H.

3.4.3 Bat Pass Analysis

Tetra Tech analyzed the recorded data according to USFWS guidelines (USFWS 2016). First, Tetra Tech used Kaleidoscope Pro v 3.1.4b (Wildlife Acoustics) to convert full spectrum files to zero-crossing using a division ration of 8. Data was then scrubbed to filter noise and analyzed. All recorded data files were filtered to identify data files containing potential bat calls[4] or passes using Kaleidoscope Pro to filter out files without frequencies between 8 and 120 kHz, 2 to 500 millisecond duration, and have a minimum number of pulses of 2. The software analysis, therefore, included only files of suitable quality and duration defined as individual call pulses exhibiting the full spectrum of frequency modulation produced by a bat (i.e. sonogram consisting of sharp, distinct lines) between 8 and 120 kHz with at least two call pulses. The Kaleidoscope classifier was set to include species occurring in or near Virginia Beach, Virginia, and at the "-1 More Sensitive" setting, per USFWS recommendations (USFWS 2015b). This generates a summary of the number of bat passes of each species. Seminole bats (*Lasiurus seminolus*) are acoustically indistinguishable from eastern red bats (*Lasiurus borealis*) and not offered as a classifier within Kaleidoscope Pro. Townsend's big-eared bat (*Corynorhinus townsendii*) and Rafinesque's big-eared bat (*C. rafinesquii*) are also almost identical acoustically, so although Rafinesque's is not a Kaleidoscope Pro classifier, Townsend's is an appropriate proxy and was used as the classifier.

Second, SonoBat 4.0.6 NE (SonoBat, Inc.), with its superior spectrogram platform, was chosen for manual review so classifications could be cross-validated with an additional software program. All passes classified as Myotis were manually reviewed by Tetra Tech in full spectrum format to confirm the automated classifications due to NLEBs status as a federally threatened species. Passes classified as "High Frequency" (frequency center above 40 kHz) or "Low Frequency" (frequency center below 40 kHz) during manual review lacked detail to be identified at the species level (e.g., too far from the microphone or noise interference). Passes that can be identified as a Myotis species, but lacked detail to distinguish species were assigned to the group

[4] Each recorded event including a bat vocalization consists of individual "call pulses" that comprise a "bat call sequence" or "bat passes."

Myotis sp. To positively confirm an NLEB call there must be 3–5 call pulses that exceed 110 kHz that are not broken in the middle or oversaturated. Additionally, Rafinesque's big-eared bat and tri-colored bat (*Perimyotis subflavus*) passes were manually vetted. Results were summarized by site and night.

VAOC-1 VAOC-2

Figure 3-2. Photos of Detector Placement at NAS Oceana, Virginia—2016.

4.0 RESULTS

4.1 CAPTURE

A total of 42 bats representing three species were captured during the 11 June to 15 June 2015, 42-net-night survey conducted within the area of interest at NAS Oceana (Table 4-1, Table 4-2, and Figure 1-1). The majority of bats trapped (81 percent) were big brown bats, eastern red bats (17 percent), and little brown bats (2 percent). One bat escaped before metrics were taken.

All bats processed were adults, of which 73 percent were female and 27 percent were male. Of female bats processed, 77 percent were lactating and 23 percent were non-reproductive. Of male bats processed, 64 percent had descended testes and 36 percent were non-reproductive. No bats exhibited any noticeable wing damage (bats were 0 on Reichard Wind Damage Index).

No NLEB bats were captured during the mist-netting survey and therefore no bats were tagged and tracked to roost sites, and no emergence counts were performed.

Table 4-1. Nightly Summary of Bats Captured at NAS Oceana, Virginia—2015.

Net Site	**NASO 1**	**NASO 2**	**NASO 3**	**NASO 4**	**NASO 5**	**NASO 6**		**NASO 7**		**Total**
Date	**11 June**	**11 June**	**12 June**	**13 June**	**13 June**	**14 June**	**15 June**	**14 June**	**15 June**	
Habitat	Loblolly Pine, Sweet Gum, Red Maple, Switch Grass		Loblolly Pine, Sweet Gum, Red Maple, Yellow Poplar	Red maple, green ash, swamp root, loblolly pine	Loblolly Pine, Sweet Gum, Red Maple			Swamp chestnut, cherry bark oak, summer sweet, swamp dog laurel, loblolly pine, sweet gum, red maple, greenbrier		
Big brown bat	2	2	0	0	0	4	5	10	11	**34**
Eastern red bat	1	0	0	0	0	1	1	2	2	**7**
Little brown bat	0	0	1	0	0	0	0	0	0	**1**
Night Total	**3**	**2**	**1**	**0**	**0**	**5**	**6**	**12**	**13**	**42**
Site Total	**3**	**2**	**1**	**0**	**0**	**11**		**25**		**42**

Table 4-2. Nightly Summary of Bats Captured by Net at NAS Oceana, Virginia—2015

Net Site		NASO 1	NASO 2	NASO 3	NASO 4	NASO 5	NASO 6		NASO 7	
Date		11-Jun	11-Jun	12-Jun	13-Jun	13-Jun	14-Jun	15-Jun	14-Jun	15-Jun
Net A	Big Brown Bat	1					1	1	2	6
	Eastern Red Bat								1	1
Net B	Big Brown Bat	1					2		4	3
	Eastern Red Bat	1					1	1	1	1
Net C	Big Brown Bat		2					3	4	2
Net D	Big Brown Bat						1	1		
Net E	Little Brown Bat			1						

4.2 ACOUSTIC SURVEY

During the 2016 survey, six detector-nights were sampled over the course of three calendar nights from 24 May to 26 May 2016 (Table 4-3). Weather conditions during the survey period met requirements outlined in the *2016 Range-wide Indiana Bat Summer Survey Guidelines* available in Appendix I (USFWS 2016). There was no precipitation during the survey period. 24 May nightly temperatures ranged from 72°F at sunset to a low of 68°F with wind speed up to 8 mph, but predominantly calm. 25 May nightly temperatures ranged from 75°F to 67 °F with wind speed up to 10 mph but predominantly under 5 mph. 26 May nightly temperatures ranged from 81°F to 73°F with wind speeds up to 13 mph.

A total of 650 bat calls were detected acoustically including eight species and three groups (Table 4-3). Six bat passes were auto-classified as NLEB by Kaleidoscope Pro, but manual vetting showed that they did not meet the standards to definitively classify the call as NLEB. All Myotis sp. passes were manually reviewed for false negative NLEB passes and to confirm the presence of little brown bats and southeastern bats (*Myotis austroriparius*). Of the nine southeastern myotis recordings, six were confirmed and three lacked enough detail and were designated as Myotis sp.. Of the 50 little brown bat recordings, six were confirmed and the rest were identified as eastern red bats, high frequency, Myotis sp., and southeastern bat passes. Manual review of all Rafinesque's big-eared bat and tri-colored bat passes were determined to be accurate.

Big brown bats were the most commonly recorded (50 percent of the total calls recorded), followed by silver-haired bats (*Lasionycteris noctivagans*) (24 percent), eastern red bats/ Seminole bats (11 percent), hoary bats (*Lasiurus cinereus*) (4 percent), Myotis sp. bats (4 percent). Species with 2 percent or less of the total calls were little brown bats, southeastern bats, Rafinesque's big-eared bats, evening bats (*Nycticeius humeralis*), tri-colored bats, and high frequency bats, (Table 4-3). Eastern red bats and Seminole bats were placed in the same group because their echolocation calls are indistinguishable from each other.

Activity rates were calculated for each detector and for each species by detector by dividing total bat passes by the number of detector nights (Table 4-3). Average activity rates among all detectors was 217 bat passes/detector night, with the highest rate occurring at VAOC-1, 160 bat passes per night compared to only 57 at VAOC-2.

Maximum Likelihood Estimates (MLEs) were significant (suggesting species presence) for big brown bats, silver-haired bats, eastern red bats, hoary bats, little brown bats, southeastern bats, Rafinesque's big-eared bats, and NLEB (Table 4-4). However, manual vetting is more accurate than MLE determinations and is relied upon for final determinations of species presence. Manual vetting of the four tri-colored bat passes suggests presence of tri-colored bats. Although MLE results suggested presence of NLEB, manual vetting showed that these calls were misclassified and NLEB were not detected at the Installation.

Table 4-3. Summary of bat passes and bat activity rate at NAS Oceana, Virginia—2016.

Bat Species	VAOC-1					VAOC-2					Grand Total	Total Passes/ Night
	24-May	25-May	26-May	Total	Passes/ Night	24-May	25-May	26-May	Total	Passes/ Night		
Rafinesque's Big-eared Bat			7	7	2.33			2	2	0.67	**9**	**3.00**
Big Brown Bat	61	41	140	242	80.67	17	21	42	80	26.67	**322**	**107.33**
Eastern Red/Seminole Bat	29	13	17	59	19.67	3	4	5	12	4.00	**71**	**23.67**
Hoary Bat	7	13	8	28	9.33			1	1	0.33	**29**	**9.67**
Silver-haired Bat	29	36	46	111	37.00	11	13	22	46	15.33	**157**	**52.33**
Southeastern Bat	1	3	2	6	2.00	1	1		2	0.67	**8**	**2.67**
Little Brown Bat				0	0.00	3	2	1	6	2.00	**6**	**2.00**
Myotis Sp.	4	3	3	10	3.33	7	3	6	16	5.33	**26**	**8.67**
Evening Bat	3		1	4	1.33				0	0.00	**4**	**1.33**
Tri-Colored Bat		1	2	3	1.00	1			1	0.33	**4**	**1.33**
High Freq.	3	3	2	8	2.67		1	5	6	2.00	**14**	**4.67**
Total	**137**	**113**	**228**	**478**	**159.33**	**43**	**45**	**84**	**172**	**57.33**	650	**216.67**

Table 4-4. Summary of Maximum Likelihood Estimates (MLEs) for species presence by Kaleidoscope Pro at NAS Oceana, VA.

Site	Date	Rafinesque's Big-eared Bat	Big Brown Bat	Eastern Red/ Seminole Bat	Hoary Bat	Silver-haired bat	Southeastern Bat	Little Brown Bat	Northern Long-eared Bat	Evening Bat	Tri-colored Bat
VAOC-1	**24-May**	1.00	**0.00**	**0.00**	**<0.005**	**0.01**	0.56	**<0.005**	**0.03**	1.00	0.92
	25-May	1.00	**0.00**	**<0.005**	**0.00**	**<0.005**	**0.03**	**<0.005**	0.73	1.00	0.59
	26-May	**<0.005**	**0.00**	**0.00**	**0.01**	**0.05**	**<0.005**	0.09	1.00	1.00	0.22
VAOC-2	**24-May**	1.00	**<0.005**	1.00	1.00	**0.02**	**0.01**	**0.00**	1.00	1.00	0.13
	25-May	1.00	**0.00**	**0.02**	1.00	**0.01**	0.09	**<0.005**	1.00	1.00	1.00
	26-May	**0.04**	**0.00**	0.13	0.93	**<0.005**	1.00	**0.00**	0.14	1.00	1.00

Note: Maximum Likelihood Estimate (MELs) interpretation – values <0.05 indicates there is a 95 percent confidence that the species is present. **Bold** value indicates significance.

5.0 DISCUSSION

This survey documented that the federally threatened NLEB was not detected at the Installation through mist-netting or acoustic recording despite mature forest available on the Installation and in limited surrounding areas. NLEB have been previously captured during presence/absence mist-net surveys in southeastern Virginia near the Installation. NLEB were captured in 2014 and 2015 at nearby NSAHR Northwest Annex (8 and 11 NLEB respectively) and in 2015 at NALF Fentress (4 NLEB) (Tetra Tech 2014, 2015b, 2015c). These two Installations have higher connectivity to large contiguous forest tracks likely attractive to NLEB. However, it is possible that NLEB are present on NAS Oceana, but were not captured in mist-nets or recorded acoustically. The acoustic survey performed was very limited in number of nights surveyed and NLEB could have been foraging and roosting in other areas of the Installation during the acoustic surveys as NLEB often switch roosts and move about the landscape. Long-term acoustic surveys (spring, summer, and fall) are recommended to be able to more accurately depict NLEB's possible use of the Installation because there is suitable NLEB habitat on the Installation and they have been captured at nearby Installations.

All bat species are highly dependent on mature forests for foraging and/or roosting and large portions of the Installation's mature forested area is threatened for removal due to Airfield Height Obstruction concerns associated with Aviation Safety Requirements. NAS Oceana is predominantly surrounded by developed residential, commercial and agricultural areas. Further removal of forest around the airfield will significantly reduce the suitable habitat for bats in the area. Long-term acoustic surveys in these obstruction areas could provide insight into the how often bats are utilizing this suitable habitat and specifically if any of the species struggling with WNS, such as Myotis species, are detected in large numbers possibly indicating maternity roosting.

The majority of bats captured in the mist-nets were big brown bats followed by eastern red bats and little brown bats. It is important to employ two survey types because some quiet bats are more likely to be captured in mist-nets and some high flying species are more likely to be detected acoustically. In addition to the three species captured in mist-nets, Rafinesque's big-eared bat, hoary bat, silver-haired bat, southeastern bat, evening bat, and tri-colored bat were acoustically detected on the Installation. Capture data, however, can provide further information about breeding on the Installation. Including all species captured, there were more females (73 percent) than males and most females were lactating (77 percent), suggesting successful breeding of multiple species in the area.

Big brown bats, eastern red bats, silver-haired bats, and hoary bats had either high capture rates or high activity rates in contrast to low detection of Myotis sp. and tri-colored bats, which is typical for this WNS-affected area. Big brown bats are hibernators, which are most affected by WNS. Big brown bats are less affected by WNS than Myotis species, however, possibly because they are larger and thus go into hibernation later and emerge earlier in the season, giving the fungus less time to affect them. Eastern red bats, silver-haired bats, and hoary bats are migratory

and generally do not come into contact with *Pseudogymnoascus destructans* that causes WNS because they are not using hibernacula, which harbors the fungus.

Acoustic survey results did show habitat differences between the two detectors. VAOC-1 was placed near open water and had a higher species diversity with eight species detected and a higher overall activity rate (159 bat passes per detector night). The pond could be the closest large water source for bats inhabiting many different habitats. Bats, particularly reproductive females, spend the day in roosts with high temperatures causing them to lose water during the hot summer months (Johnson and Gates 2008). Species require drinking water to replenish evaporated water in addition to water provided in their insect prey (Hayes 2003). Proximity to water is often associated with better foraging habitat and therefore more frequent bat use (Carter *et al.* 2003, Grindal *et al.* 1999). Therefore, a large water source may have drawn in many different species and at high activity rates.

The forest flyway detector, VAOC-2, detected six species and had only 57 bat passes per detector night. However, this detector had the only detection of little brown bats and higher activity rates of Myotis sp. This detector was placed deeper into the forest within a closed canopy flyway that would attract Myotis species which are highly maneuverable and prefer foraging in the protected forest. This habitat is less likely to attract open area flyers that fly quickly and are less maneuverable such as hoary and silver-haired bats.

6.0 RECOMMENDATIONS

Even though NLEB were not detected in this survey they may occasionally utilize the installation or may not have been detected by the survey and are actually present. Depending on the nature and extent of activities within the areas of interest, there is the potential to directly impact NLEB summer habitat by removing forested areas or potential individual roost trees. Below are several recommendations to protect NLEB habitat as well as suggestions of ways to gain more information about potential NLEB utilization of the Installation.

1) Avoiding activity such as cutting trees during the pup season (01 June–31 July), can prevent NLEB take and curtail adverse effect. However, tree removal is prohibited under the final 4(d) rule only if it occurs within 46 meters (150 feet) of a known maternity roost tree from 1 June through 31 July (USFWS 2016)

2) Make sure snags are left during cutting or, if the area is lacking snags, girdle trees to create snags. Snags can create roosting opportunities like peeling bark and cavities for species such as NLEB. Prescribed fire may also increase the number of snags. Fire also increases the canopy gaps and therefore solar radiation reaching roosts, which can increase maximum roosting temperatures (Johnson et al. 2009). Increased roosting temperatures are associated with rapid development of young (Boyles and Aubrey 2006). However, prescribed fire may reduce roosting opportunities for foliage roosting bats such as hoary bats

3) Construct or place bat houses around the Installation to create roosting habitat

4) Each bat species has a preferred habitat for foraging, so maintaining multiple habitats on base is important. Many species prefer to feed over open water; thus protecting wetlands and both the forest around them and corridors that connect with other forest patches is vital. The larger species prefer to forage in open meadow areas and along forest edges that tend to collect insects. Finally, many species, such as NLEB, prefer to forage in forested areas that tend to be wetter and breed more insects. Forested corridors that connect the forest patches or run along streams is important to provide a sheltered environment that bats can use to move around the landscape.

5) Conduct acoustic monitoring during an entire season, spanning early spring to late fall to:

    a. Determine when bats are arriving and when bats are leaving the base. This will pertain both to bats migrating from distant areas and individuals arriving from local hibernacula. If swarms are detected in late fall they may indicate a hibernacula is nearby.

    b. Provide more opportunities to acoustically detect NLEB. The six detector night presence/absence surveys may not be long enough to accurately assess if NLEB are using the installation. NLEB may not be in the detector areas for those few days.

    c. Better assess how often bats are utilizing the large portions of the Installation's mature forested area that is threatened for removal due to Airfield Height Obstruction concerns associated with Aviation Safety Requirements. In particular, if any of the species struggling with WNS, such as Myotis species, are detected in large numbers that may indicate maternity roosting.

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APPENDIX A

RESUMES AND PERMITS FOR FIELD CREWS

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RECEIVED
APR 16 2015
By

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
Endangered Species Permit Office
1875 Century Boulevard, Suite 200
Atlanta, GA 30345
permitsR4ES@fws.gov

FEDERAL FISH AND WILDLIFE PERMIT

1. PERMITTEE

BIODIVERSITY RESEARCH INSTITUTE
652 MAIN STREET
GORHAM, ME 04038
U.S.A.

2. AUTHORITY-STATUTES
16 USC 1539(a)

REGULATIONS
50 CFR 17.22

50 CFR 13

3. NUMBER
TE63633A-3 AMENDMENT

4. RENEWABLE
☒ YES
☐ NO

5. MAY COPY
☒ YES
☐ NO

6. EFFECTIVE
04/09/2015

7. EXPIRES
04/09/2018

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*
DAVID C EVERS
EXECUTIVE DIRECTOR

9. TYPE OF PERMIT
NATIVE ENDANGERED SP. RECOVERY - E WILDLIFE

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
Alabama, Georgia, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia

11. CONDITIONS AND AUTHORIZATIONS

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

C. 1. Continued: the following individuals are authorized to conduct activities as authorized by this permit: Carl Anderson, Timothy Divoll, Shaylyn Hatch, Dustin Meattey, David Yates, and for Indiana bats only: Jonathan Fiely.

Trained assistants not named on this permit may work on permitted bat activities under the direct and on-site supervision of the individuals named above. However, trained assistants may not work independently at a site. Trained assistants are individuals who are considered qualified by the permitted biologist(s) to select sampling sites, deploy sampling equipment and nets, and handle bats in the field.

D. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE UNDERSTANDS AND AGREES TO ABIDE BY THE TERMS OF THIS PERMIT AND ALL SECTIONS OF TITLE 50 CODE OF FEDERAL REGULATIONS, PARTS 13 AND 17, PERTINENT TO ISSUED PERMITS. SECTION 11 OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, PROVIDES FOR CIVIL AND CRIMINAL PENALTIES FOR FAILURE TO COMPLY WITH PERMIT CONDITIONS.

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS
Annual reports are due by Januaty 31 following each year this permit is in effect

ISSUED BY	TITLE	DATE
Roxanna Hinzman Chief, Division of Environmental Review	CHIEF, DIVISION OF ENVIRONMENTAL REVIEW	04/09/2015

E. PERMITTEE IS AUTHORIZED TO TAKE (ENTER HIBERNACULA OR MATERNITY ROOST CAVES, SALVAGE DEAD BATS, CAPTURE WITH MIST NETS OR HARP TRAPS, HANDLE, IDENTIFY, COLLECT HAIR SAMPLES, BAND, RADIO TAG, LIGHT-TAG, AND WING-PUNCH) INDIANA BATS (Myotis sodalis), GRAY BATS (Myotis grisescens), AND NORTHERN LONG-EARED BATS (Myotis septentrionalis), FOR SCIENTIFIC RESEARCH AIMED AT RECOVERY OF THE SPECIES, SUCH AS: PRESENCE/ABSENCE SURVEYS, STUDIES TO DOCUMENT HABITAT USE, POPULATION MONITORING, AND TO EVALUATE POTENTIAL IMPACTS OF WHITE-NOSE SYNDROME OR OTHER THREATS AS CONDITIONED BELOW.

F. Activities at the following locations require written site-specific approval from the USFWS Field Supervisor in the State(s) where the project will occur (as outlined in Condition G):

F.1. Locations within Region 3 of the USFWS: Illinois, Indiana, Missouri, Minnesota, and Ohio

F.2. Locations within Region 4 of the USFWS: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Louisiana, South Carolina, and Tennessee

F.3. Locations within Region 5 of the USFWS: Massachusetts, New Jersey, New York, Pennsylvania, Virginia and West Virginia

G. Permittee shall notify the USFWS Field Supervisor for the State in which activities are proposed to occur at least 15 days prior to conducting any activities. Contact information is in Condition P., below. Your request for this site-specific approval must be in writing and must indicate:

G.1. The purpose and a description of the activities proposed (e.g., surveys, radio telemetry studies, etc.).

G.2. Location of proposed activities, including project site (legal description and lat/long), county, and state.

G.3. Dates when the project is proposed to take place.

G.4. You may proceed with activities only upon receipt of written concurrence from the applicable USFWS Field Supervisor. *Your concurrence letter must be carried with this permit to authorize site-specific activities.*

H. Permittee shall adhere to the following conditions involving capture and handling of bats:

H.1. Federally listed bats may be captured (e.g., mist-nets and harp traps) following the protocol(s) provided by the USFWS, when available. Permittees must contact the USFWS FO in the State(s) in which activities are proposed to ensure correct protocol(s) are used. For example, the current Range-wide Indiana Bat Summer Survey Guidelines are available at: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html. The monitoring interval for mist nets is once every 10 minutes. Harp traps must be continually monitored.

H.2. Captured bats may be held for a maximum of 30 minutes, unless injured. If an exception is required to this prohibition, permittee must receive prior written approval from the USFWS Field Supervisor for the State in which the activities are proposed to occur.

H.3. Permittees shall carry out non-intrusive measurements on all captured bats. Data shall be recorded for all bats captured and include, but not be limited to, the data requested in any automated or species specific data form provided by the USFWS (e.g., INDIANA BAT SURVEY AND BANDING DATA form). Handling should be limited to the maximum extent practicable and should cease immediately at signs of undue stress (e.g., bat becoming unresponsive, etc.). Bats that appear stressed from handling should be placed in a dark, quiet location away from activity where it can safely fly away after recovery, and should be checked to ensure successful

recovery before leaving the study site. Photographs of the identifying characteristics for each individual federally listed species captured are encouraged. The permittee may be requested to provide individual photographs after submittal of annual reporting data.

H.4. If bands are applied, these must be lipped metal bands having a unique identifier. Bands should be applied to the forearm of captured bats prior to release. No more than one band per bat may be used. Position the band on the wing so that when the bat is hanging upside down, the band numbers are right-side up. A single band should be placed on the right forearm of each male and the left forearm of each female bat.

H.5. Radio transmitters may be applied during spring, summer, and fall roosting and migration periods via nontoxic skin bond adhesive. The total weight of the transmitter may not exceed 5% of the bat's body weight and the total weight of the package (transmitter and adhesive) may not exceed 6% of the bat's body weight. The lightest package (both transmitter and adhesive) capable of accomplishing the required task should be used, especially with pregnant females and newly volant juveniles. Bats carrying transmitters must be monitored daily for at least five days, or until the transmitter falls off, whichever occurs first.

H.6. No capture activities shall occur within 20 meters of a known or potential summer or winter roost site, either natural or artificial, of a federally listed bat. If an exception is required to this prohibition, permittee must receive prior written approval from the USFWS Field Supervisor for the State in which the activities are proposed to occur.

H.7. Permittee may collect dorsal hair samples, wing biopsy tissue samples, fungal lift tape and swab samples from captured bats for scientific study. Hair samples shall be obtained via clipping fur from between scapula from females and juvenile males. The clipped area is the same area frequently clipped for radio transmitter attachment. Wing tissue samples may be taken using a new, sterile biopsy punch (2mm) for each endangered bat sampled. No more than two samples, one from each wing, may be obtained per individual. All boards and equipment used to obtain samples must be disinfected according to the protocol cited in Condition H.9.

H.8. Cyalume light tags may be affixed to the back of unmarked bats during summer roosting period via non-toxic skin bond adhesive to aid in identification of individuals for echolocation recordings. Light tags shall not be affixed to bats carrying radio transmitters. Light tag cannot exceed 2 cm in length or 0.15 g in weight. The light tag must be resistant to tooth puncture and sealed to prevent bats from ingesting cyalume compound. Any light tag that has the potential to expose bats to the cyalume compound is prohibited; the compound is known to be toxic to bats.

H.9. Equipment used to capture and handle bats shall be cleaned and decontaminated, including personal gear such as boots and gloves, using products cited in decontamination guidelines and in compliance with label directions. The most recent decontamination guidance is found on the web at: http://whitenosesyndrome.org/

H.10. Caves, mines, or other suitable hibernation sites may be quietly searched in a manner that minimizes disturbance by utilizing the minimum number of people and time required to complete the survey. Surveys of known hibernacula conducted during the winter hibernation season shall follow the guidelines established in the recovery plans for each federally listed bat species with regards to how often a site may be visited and other species-specific requirements related to entering hibernaculum (for example, for Indiana bats, winter surveys should not be repeated more often than once every other year in any given hibernaculum; for gray bats, winter surveys should not be repeated more often than once every three years in any given hibernaculum), unless authorized by the appropriate Service Recovery Lead identified in Condition O (below).

Under no circumstances should multiple trips to the hibernation area occur within the same year without written approval of the USFWS Field Supervisor for the state in which activities are proposed.

Bats may be handled during winter surveys in order to collect band information and confirm the identification of

listed species. When possible, bands should be read without touching the bat. Banded bats should only be handled if easily accessible and removal of the bat does not disturb a large number of additional bats and is unlikely to result in injury to the bat. Detailed photographs should be taken to document the presence of listed species in previously undocumented hibernaculum. Where hibernacula area and safety conditions allow, individuals entering hibernacula are recommended to utilize night vision goggles or red-filtered light and to remain in the site no more than 90 minutes to complete the work.

H.11. Surveys of gray bat maternity roosts and their other known summer roost sites shall be conducted by observing the bats with night vision equipment and/or infrared light sources (e.g., thermal infrared) as they emerge from their roosts to avoid any possible disturbance to these bats. At previously undocumented sites for these species, the accepted method to determine if they are present is to carefully and slowly enter the potential roost site to check for evidence of presence/use, such as visual observation of bats, significant quantities or a strong smell of guano, or the audible sounds produced by bats roosting at the site. As soon as any evidence is obtained that the roost site is being used by a federally-listed bat species, survey team members shall immediately exit the roost site and make further observations from outside the entrance to the roost. All further observations shall be made from the entrance during the evening emergence.

I. Upon determination that endangered bats are present, permittee shall notify the following offices immediately (not to exceed 1 business day): the appropriate USFWS Regional Office (Condition N.), and the USFWS Field Office within the geographic location of study areas (Condition P.).

J. Permittee must carry a copy of this permit at all times when conducting the authorized activities. Shipments of collected biological materials should also be accompanied by a copy of this permit. NOTE: This permit is limited to the above activities and identified species.

K. Issuance of this permit does not constitute permission to conduct these activities on National Wildlife Refuges or any other public or private lands; such permission must be obtained separately from the appropriate landowner or land manager before beginning these authorized activities. This permit, neither directly nor by implication, grants the right of trespass.

L. Accidental mortality may not exceed one specimen. In the event that an accidental mortality occurs, cease all activities until consulting with the USFWS. Any bat mortality or serious injury must be reported immediately (not to exceed 1 business day) to the applicable office listed in condition N. and to the appropriate Field Office identified in Condition P. The USFWS will work with you to determine the cause of injury or mortality and whether such could be avoided should activities be allowed to proceed. Dead or moribund bats may be retained for further study only with the written permission of the USFWS. Any bats that are not authorized for retention are to be chilled and promptly transferred to the USFWS for potential necropsy and/or for scientific or educational purposes.

Upon locating a dead, injured, or sick bat, or any other threatened or endangered species, under circumstances not addressed in this authorization, initial notification must be made immediately (not to exceed 1 business day) to the appropriate USFWS Office identified in condition N., below, including a description of the circumstances, location information, and photo documentation. Notification should also be made at the same time to the appropriate USFWS Field Office identified in condition P., below. Care should be taken in handling sick, injured, or dead specimens to ensure effective treatment or to preserve biological materials for later analysis. In conjunction with the care of sick or injured threatened or endangered species, and the preservation of biological materials from a dead animal, the permittee should take responsible steps to ensure that the site is not unnecessarily disturbed. Prior to collecting the specimen(s), you must photograph the specimen(s) to document the conditions in which they were found. You may preserve the specimen(s) by freezing them or other suitable method to allow scientific study. Disposition of collected specimen(s) shall be determined by the USFWS Field Office.

M. Reports are due on January 31 following each year this permit is in effect. At a minimum, your report shall include:

M.1. The date, time, geographic locations (including datum and projection information).

M.2. All locations surveyed (regardless of whether federally listed bats were captured/observed).

M.3. Band numbers of all bats banded and all bats recovered/observed.

M.4. Information on any injuries and/or mortalities and disposition of specimens.

M.5. Location and characteristics of roost trees and bat colonies.

M.6. Copies of any separate reports and/or publications resulting from work conducted under the authority of this permit.

M.7. Data shall be submitted for all bats captured and include, but not be limited to, the data requested in any automated or species-specific data form provided by the USFWS (e.g., INDIANA BAT SURVEY AND BANDING DATA forms, the data collection forms found in the current Rangewide Indiana Bat Summer Survey Guidelines cited in Condition H.1., or other species specific forms). Photographs of the identifying characteristics for each individual federally-listed species captured are encouraged. The Permittee may be requested to provide individual photographs after submittal of annual reporting data.

M.8. Copies of all site specific authorization letters required under Condition G.

If no activities occurred over the course of the year, indication of such shall be submitted as an annual report.

N. Copies of your reports shall be sent to the offices listed below. When possible, electronic copies shall be submitted in lieu of hard copies in MS Word, Portable Document Format, Rich Text Format, or other file format that is compatible with the receiving office.

N.1
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Midwest Region (Region 3)
Ecological Services - Endangered Species
5600 American Blvd. W., Suite 990
Bloomington, Minnesota 55437-1458
(612/713-5343; fax 612/713-5292)
permitsR3ES@fws.gov

N.2.
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Southeast Region (Region 4)
1875 Century Boulevard, Suite 200
Atlanta, Georgia 30345-3301
(404/679-7101; fax 404/679-7081)
permitsR4ES@fws.gov

N.3.
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Northeast Region (Region 5)
Endangered Species Division

300 Westgate Center Drive
Hadley, Massachusetts 01035-9589
(703/358-2402; fax 413/253-8482)
permitsR5ES@fws.gov

O. Additionally, based on species, reports and publications shall be submitted to the following:

O.1. For Studies involving Indiana Bats:

Lori Pruitt
U.S. Fish and Wildlife Service
Indiana Ecological Services Field Office
620 S. Walker Street
Bloomington, Indiana 47403-2121
(812/334-4261 x1213; fax 812/334-4273)

O.2. For Studies involving Gray Bats:

Shauna Marquardt
U.S. Fish and Wildlife Service
Missouri Ecological Services Field Office
101 Park De Ville Drive, Suite A
Columbia, Missouri 65203
(573/234-2132 x174; fax 573/234-2181)

O.3. For Studies involving Northern Long-eared Bats:

Jill Utrup
U.S. Fish and Wildlife Service
Twin Cities Ecological Services Field Office
4104 American Blvd. E
Bloomington, Minnesota 55425
(612/725-3548 x207; fax 612/725-3609)

P. Additionally, based on geographic area, reports and publications shall be submitted to the following:

P.1. For studies conducted in Alabama:

Field Supervisor
Alabama Ecological Services Field Office
1208-B Main Street
Daphne, Alabama 36526-4419
(251) 441-5181

P.2. For studies conducted in Georgia:

Field Supervisor
Georgia Ecological Services Field Office
105 Westpark Drive, Suite D
Athens, GA 30606-3175
(706) 613-9493; fax 706/613-6059

P.3. For studies conducted in Illinois:

P.3.a.
Kristen Lundh
Endangered Species Coordinator for Illinois/Iowa
U.S. Fish and Wildlife Service
Ecological Services Field Office
1511 47th Ave.
Moline, Illinois 61265
(309/757-5800, x215; fax 309/757-5807)

P.3.b.
Joe Kath
Endangered Species Coordinator
Illinois Department of Natural Resources
Division of Natural Heritage
One Natural Resource Way
Springfield, Illinois 62702-1271
(217/785-8764; fax 217/785-2438)

P.4. For studies conducted in Indiana:

P.4.a.
Lori Pruitt
Endangered Species Coordinator for Indiana
Indiana Ecological Services Field Office
620 S. Walker Street
Bloomington, Indiana 47403-2121
(812/334-4261 x1213; fax 812/334-4273)

P.4.b.
Scott Johnson
Indiana Department of Natural Resources
5596 East State Road 46
Bloomington, IN 47401
(812/334-1137, ext. 3400)

P.5. For studies conducted in Kentucky:

Field Supervisor
Frankfort Ecological Services Field Office
J C Watts Federal Bldg., Rm 265
330 West Broadway
Frankfort, KY 40601-8670
(502) 695-0468

P.6. For studies conducted in Louisiana

Field Supervisor

Louisiana Ecological Service Field Office

646 Cajundome Boulevard, Suite 400

Lafayette, LA 70506

(337) 291-3100

P.7. For studies conducted in Massachusetts:

Field Supervisor
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301
(603) 223-2541

P.8. For studies conducted in Minnesota and Wisconsin:

P.8.a.
Phil Delphey
Endangered Species Coordinator for Minnesota and Wisconsin
U.S. Fish and Wildlife Service
Ecological Services Field Office
4101 American Blvd E.
Bloomington, Minnesota 55425
(612/725-3548 x2206; fax 612/725-3609)

P.8.b.
Richard Baker
Minnesota Endangered Species Coordinator
Division of Ecological and Water Resources
Minnesota Department of Natural Resources
500 Lafayette Rd., Box 25
St. Paul, MN 55155
Phone: 651/259-5073
richard.baker@state.mn.us <mailto:richard.baker@dnr.state.mn.us>

P.9. For studies conducted in Mississippi:

Field Supervisor
Mississippi Ecological Services Field Office
6578 Dogwood View Pkwy, Ste A
Jackson, MS 39213-7856
(601) 321-1122

P.10. For studies conducted in Missouri:

P.10.a.
Field Supervisor
U.S. Fish and Wildlife Service
Missouri Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-2132

(573/234-2132; fax 573/234-2181)

P.10.b.
Tara Jennings
Scientific Collecting Permit Coordinator
Missouri Department of Conservation
Endangered Species and Natural History Division
2901 W. Truman Blvd., P.O. Box 180
Jefferson City, Missouri 65102-0180
(573/522-4115 ext. 3322; fax 573/751-4864)

P.11. For studies conducted in New Jersey:

Field Supervisor
New Jersey Ecological Services Field Office
927 N. Main Street, Building D
Pleasantville, NJ 08232-1454
(609) 646-9310

P.12. For studies conducted in New York:

Field Supervisor
New York Ecological Services Field Office
3817 Luker Road
Cortland, NY 13045
(607) 753-9334

P.13. For studies conducted in North Carolina:

Field Supervisor
Asheville Ecological Services Field Office
160 Zillicoa Street
Asheville, NC 28801-1082
(828) 258-3939

P.14. For studies conducted in Ohio:

P.14.a.
Angela Boyer
Endangered Species Coordinator for Ohio
U.S. Fish and Wildlife Service
Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614/416-8993, x22; fax 614/416-8994)

P.14.b.
Endangered Species Coordinator
Ohio Department of Natural Resources
Division of Wildlife
2045 Morse Road, Building G
Columbus, Ohio 43229-6693

(614-265-6329; fax 614/262-1143)

P.15. For studies conducted in Pennsylvania:

Field Supervisor
Pennsylvania Ecological Services Field Office
315 So. Allen Street, Suite 322
State College, PA 16801-4850
(814) 234-4090

P.16. For studies conducted in South Carolina:

P. 16.a.
Field Supervisor
South Carolina Ecological Services Field Office
176 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558
(843) 727-4707 x227

P. 16.b.
Mary Bunch
Biologist/Preserve Manager
South Carolina Department of Natural Resources
311 Natural Resources Drive
Clemson, SC 29631
(864) 654-6738 x15
Fax: (864) 654-9168
bunchm@dnr.sc.gov

P.17. For studies conducted in Tennessee:

P. 17. a.
Field Supervisor
Cookeville Ecological Services Field Office
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501-4027
(931) 528-6481

P. 17.b.
Brian Flock
Bat Coordinator
Tennessee Wildlife Resources Agency
P.O. Box 40747
Nashville, TN 37204
(615) 781-6569

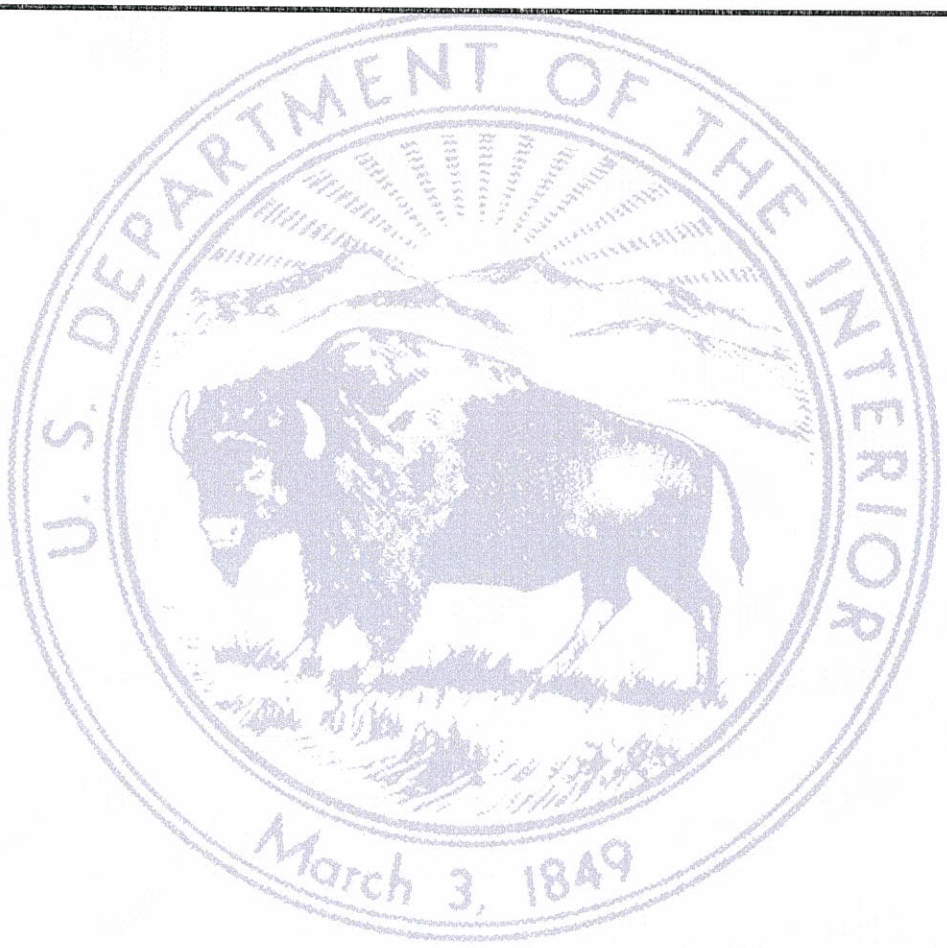
P.18. For studies conducted in Virginia:

Field Supervisor
Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061

(804) 693-6694

P.19. For studies conducted in West Virginia:

Field Supervisor
West Virginia Ecological Services Field Office
694 Beverly Pike
Elkins, WV 26241
(304) 636-6586



Virginia Department of Game and Inland Fisheries

4010 West Broad Street, P.O. Box 11104, Richmond, VA 23230-1104
(804) 367-1000 (V/TDD)
Under Authority of § 29.1-412, § 29.1-417, & § 29.1-418 of the Code of Virginia

Scientific Collection Permit

Permit Type: **New** Fee Paid: **$40.00** VADGIF Permit No. **051933**

Permittee: **Dave Yates**
Address: **Biodiversity Research Institute**
19 Flaggy Meadow Road
Gorham, ME 04038

Office: **(207) 839-7600**
City/County: **Out of State**

Contract Species Surveys

Authorized Collection Methods: Harp Traps for Bats/Terrestrial Mist Nets (Bats/Birds)
Authorized Waterbodies: N/A
Authorized Marking Techniques: N/A

PERMIT AMENDMENT 5/18/2015: This amendment adds the following:
Authorized Subpermittees: Amanda Bailey/Morgan Ingalls/Caroliine Byrnes/Chelsea Vosburgh
Authorized Locations: Naval Properties: Yorktown/Northwest/Norfolk/Oceana/Fentress/Fort Story/Dam Neck/Fort Eustis/Langley

Permittee MUST notify VDGIF a minimum of 7 days prior to each sampling event. Notification must be made via email to: collectionpermits@dgif.virginia.gov

Report Due: 31 January 2015, 31 January 2016

ALL PERMIT REPORTS MUST CONTAIN COORDINATES; PERMITTEE CAN USE THE VIRGINIA FISH AND WILDLIFE INFORMATION SERVICE (VAFWIS) TO OBTAIN COORDINATES BY VISITING: HTTPS://FWISWEB1.DGIF.VIRGINIA.GOV/FWIS/INDEX.HTML

STANDARD CONDITIONS ATTACHED APPLY TO THIS PERMIT.

Authorized Counties / Cities:
York
Norfolk

Authorized Species:

Description	ID Number	Scientific Name
Bats		

Annual Report Due End of Each Year

Authorized Sub-Permittees:
See Attached Sheet

Approved by: *James E. Husband*

Applicants may appeal permit decisions within 60 days of issuance. The appeal must be in writing to the Director, Department of Game and Inland Fisheries.

Title: **James E. Husband - Permits Manager** **Date:** **5/18/2015**

20 Permit Effective **7/28/2014** through **12/31/2015** **15**

Virginia Department of Game and Inland Fisheries

4010 West Broad Street, P.O. Box 11104, Richmond, VA 23230-1104
(804) 367-1000 (V/TDD)

Under Authority of § 29.1-412, § 29.1-417, & § 29.1-418 of the Code of Virginia

Scientific Collection Permit

Permit Type: **New**	FeePaid:	**$40.00**	VADGIF Permit No.	**051933**

Authorized Sub-Permittees:

Tim Divoll, Biodiversity Research Institute
Dustin Meattey, Biodiversity Research Institute
Carl Anderson, Biodiversity Research Institute
Lauren Gilpatrick, Biodiversity Research Institute
Amanda Bailey, Biodiversity Research Institute
Morgan Ingalls, Biodiversity Research Institute
Caroline Byrne, Biodiversity Research Institute
Chelsea Vosburgh, Biodiversity Research Institute

Wildlife Collection License

North Carolina Wildlife Resources Commission
Division of Wildlife Management
MSC 1722
Raleigh, NC 27699-1722

Phone: (919) 707-0060
Fax: (919) 707-0067

AUTHORITY

STATUTES

GS 113-261 & GS 113-272.4

RULES

15A NCAC 10B .0119

PERMITTEE/LICENSEE

DAVID YATES
19 FLAGGY MEADOW RD
GORHAM, ME 04038

PERMIT NUMBER

15-SC00949

EFFECTIVE	EXPIRES
02/10/2015	**12/31/2015**

COUNTY	DISTRICT

This license authorizes the collection of the following species:

Print Date: **02/11/2015**

-Bats

CONDITIONS AND AUTHORIZATIONS

This license authorizes the capture and temporary possession of the listed species.

Methods Authorized: Mist Netting

All species captured must be immediately released unharmed at the site of capture upon completion of data collection.

Must follow all current USFWS white-nose syndrome decontamination protocols and advisories and adhere to the North Carolina White-Nose Syndrome Surveillance and Response Plan.

Must coordinate with the appropriate Wildlife Diversity Biologist at least 48 hours prior to collecting activity commencing.

The licensee must maintain a copy of this license in their possession at all times during authorized collection activities.

Issuance of this license does not constitute permission to conduct collection activities on any public or private lands; such permission must be obtained separately from the appropriate landowner or land manager before beginning authorized collection activities.

This license neither directly nor by implication grants right of trespass.

A complete report is due at the time of renewal to be eligible for renewal. The report must be submitted through the online reporting system (https://ncpaws.org/paws/). Failure to submit the report may result in the license not being renewed.

Collection Location Authorized: STATEWIDE

This permit/license is non-transferable and expires at midnight on the above specified expiration date.

ISSUED BY: Daron K. Barnes

TITLE: **Permits Supervisor**

DAVID YATES

719 Moosehead Lake Rd
Greenville, ME 04441
(207) 491-4707

EDUCATION:

Bachelor of Science, Wildlife Biology and Management
Unity College, Unity, ME
Graduated May 1999

M.Sc., Conservation Biology
Antioch University New England
Graduated May 2006

SKILLS:

- Proficient in animal tagging and release methods
- Ability to identify bats of N. and C. America in and QIBS by USFWS and PA State
- HERO training
- Collected and prepared blood samples for contaminant analyses.
- Current DEA drug license
- Analyzed water quality of ponds, rivers and streams
- Experience using tranquilizers/sedatives
- B3 and HUET certificates for low level flights
- HAZWOPR training
- Trained in CPR and First Aid

EXPERIENCE:

Biodiversity Research Institute – *Research Biologist/Mammal Director*, Gorham, ME January 1998 -present

- Certified Indiana Bat Identifier for the state of PA and USFWS
- Project Manager for Acadia National Park bat survey and tracking study
- Project manager and conducted bat surveys for US Navy in VA and NJ
- Lead Biologist Indiana bat surveys for Gas fracking and pipelines in PA
- Project Manager/Lead Biologist for Maine IF&W Eco-region Surveys for bats for 5 years
- Project Manager/Lead Biologists for bat mercury studies at superfund sites from VA to Maine involving U.S.F.&W.S.
- Project Manager/Lead Biologist at 4 U.S. Fish and Wildlife NRDAR sites for bats and furbearers
- Project Manager bat surveys at multiple National Wildlife Refuges in the northeast
- Telemetry Coordinator Gulf Oil Spill Project for USFWS NRDAR bird injury assessment
- Developed Scope of Work for USFWS NRDAR Gulf Oil Spill bird injury assessment
- Coordinated aerial and ground tracking of more than 400 birds using multiple airplanes and satellite technology
- Project Manager/Lead Biologist for FPL Maine Hydro. Beaver, muskrat, otter, and mink telemetry study
- Project Manager/Lead Biologist for live trapping mink and otter study in Maine for state DEP (Master's thesis)
- Project Manager/Lead Biologist for live trapping mink and otter study in Massachusetts for EPA and other superfund studies
- Project Manager for Maine IF&W Ecoregion for three areas in Maine, birds and small mammals
- Project Manager for common loon monitoring in northern and western Maine
- Project Manager/Lead Biologist for National Park Service survey of small and large mammals of Appalachian Trail in Maine
- Winter large carnivore tracking surveys for NPS and private landowner
- Administered schedule III drugs for mink and otter study (Ketemine & Metetomidine)
- DEA Schedule II-III license
- Researched recent trends of mercury and lead contaminants in the North American piscivorous bird's mammals.
- Captured, banded and gathered mercury and lead level data in piscivorous birds.
- Entered banding data into database for Biodiversity Research Institute data analysis.
- Compiled banding data into official banding schedules for U.S. Fish & Wildlife Services.
- Supervised banding of Common Loons, Eagles, Kingfishers and various other species.
- Surveyed reservoirs and lakes for Common Loons, Kingfishers and other piscivorous birds.
- Presented Mammal, Bat and Common Loon slide show to various organizations for educational purposes
- Wrote reports for Loon productivity on Reservoirs for state and private agencies.
- Proposed, designed and organized a mink and otter study for Maine Department of Environmental Protection.

Publications and Reports:

Yates, David E., Evan M. Adams, Sofia E. Angelo, David C. Evers, John Schmerfeld, Marianne S. Moore, Thomas H. Kunz et al. Mercury in bats from the northeastern United States. Ecotoxicology 23, no. 1 (2014): 45-55.

Nam, D.-H., Yates, D., Ardapple, P., Evers, D. C., Schmerfeld, J., & Basu, N. 2012. Elevated mercury exposure and neurochemical alterations in little brown bats (Myotis lucifugus) from a site with historical mercury contamination. Ecotoxicology, 12(4), 1094–1101

Yates, D., K. Taylor, and C. Niven. 2008. Effects of Water Levels on Muskrat (Ondatra zibethicus) Populations within the West Grand Lake Project, Maine. Report BRI 2008-25 submitted to BIA and OA System Corporation, Amarillo, Texas. BioDiversity Research Institute, Gorham, Maine.

Wada, H., D. Yates, D. Evers, R. Taylor, W. Hopkins. 2010. Tissue mercury concentrations and adrenocortical responses of female big brown bats (Eptesicus fuscus) near a contaminated river. Ecotox. 19:7 1277-84.

Yates, D., S. Angelo, T. Divoll and D.C. Evers, 2009. Assessment of mercury exposure to bats at Onondaga Lake, New York. Report BRI 2010-11 submitted to U.S. Fish and Wildlife Service, Cortland, NY. BioDiversity Research Institute, Gorham, Maine, 44 pp.

T. Divoll, D. Yates, D.C. Evers, 2008. Pilot assessment of mercury exposure to bats at Onondaga Lake, New York. Report BRI 2009-10 submitted to U.S. Fish and Wildlife Service, Cortland, NY. BioDiversity Research Institute, Gorham, Maine, 44 pp.

Yates, D., S.E. Angelo, M.W. Goodale and D.C. Evers. 2011. Bat Mercury Study Examining Footprint Area and Downstream: South River, Virginia - 2009. Report BRI 2009-10 submitted to DuPont Corporate Remediation Group, Newark, Delaware and the U.S. Fish Wildl. Serv., Gloucester, Virginia. BioDiversity Research Institute, Gorham, ME. 57pp.

Yates, D., M. Moore, T. Kunz, and D.C. Evers 2008. Pilot assessment of methlymercury availability to bats on the South River, Virginia - 2008. Report BRI 2009-16 submitted to DuPont Corporate Remediation Group, Newark, Delaware and the U.S. Fish Wildl. Serv., Gloucester, Virginia.BioDiversity Research Institute, Gorham, ME. 47pp.

Yates, D., D.C. Evers, and D. Meattey. 2008. Pilot assessment of methlymercury availability to muskrat and shrews on the South Fork River, Virginia - 2008. Report BRI 2009-21 submitted to the U.S. Fish Wildl. Serv., Gloucester,Virginia.BioDiversity Research Institute, Gorham, ME.

Yates, D., W. Goodale, M. Holden, and D. Evers. 2008. Home ranges size in relation to water level fluctuations in river otter, muskrat, mink and beaver on Brassua Lake and surrounding waterbodies. Report BRI 2008-18 submitted to FPL Energy Maine Hydro. BioDiversity Research Institute, Gorham, Maine.

Yates, D. and D.C. Evers. 2007-6. Small Mammals and Bat Inventory of the Appalachian Trail in Maine-2006. Report BRI 2007-6 submitted to the Maine Natural Areas Program and NPS. BioDiversity Research Institute, Gorham, ME.

Yates, D., H. Wada , M. Moore, B. Hopkins, T. Kunz, and D.C. Evers 2007. Pilot assessment of methlymercury availability to bats on the South River, Virginia - 2007. Report BRI 2008-08 submitted to DuPont Corporate Remediation Group, Newark, Delaware and the U.S. Fish Wildl. Serv., Gloucester, Virginia. BioDiversity Research Institute, Gorham, ME. 42pp.

Yates, D., D.C. Evers, and L. Savoy. 2004. Developing a mercury exposure profile for mink and river otter in Maine. Report BRI 2004-09 submitted to Maine Department of Environmental Protection and Maine Inland Fisheries and Wildlife. BioDiversity Research Institute, Gorham, Maine.

Yates, D. E., D.T. Mayack, K. Munney, D.C. Evers, A. Major, T. Kaur, and R.J. Taylor. 2005. Mercury levels in mink (*Mustela vison*) and river otter *(Lontra canadensis*) from northeastern North America. Ecotoxicology 14:263-274.

Yates and D.C. Evers. 2007. Pilot assessment of methlymercury availability to furbearers on the North Fork of the Holston River, Virginia - 2005. Report BRI 2007-10 submitted to the U.S. Fish Wildl. Serv., Gloucester, Virginia. BioDiversity Research Institute, Gorham, ME.

Yates, D., and D.C. Evers. 2006. Assessment of bats for mercury contamination on the North Fork of the Holston River, VA- 2005. Report BRI 2006-9. BioDiversity Research Institute, Gorham, ME.

Yates, D.E. and D. Evers. 2005. An overall assessment of the loon population at Lake Umbagog National Wildlife Refuge: Investigations into individual-specific demographics and assessment of individual and population health. Report BRI 2004-13 BioDiversity Research Institute, Gorham, Maine. 17pp.

Yates, D., D.C. Evers, and W. Goodale. 2006. Monitoring of breeding Common Loons: West Branch of the Penobscot River area - 2005. Report BRI 2006-05. BioDiversity Research Institute, Gorham, ME. pp.30

Yates, D., D.C. Evers, W. Goodale, and W. MacCabe. 2005. Monitoring of breeding Common Loons: West Branch of the Penobscot River area - 2004. Report BRI 2005-10. BioDiversity Research Institute, Gorham, ME. 27 pp.

Yates, D., L. Savoy, D. Evers, C. DeSorbo, W. Goodale, L. Attix, A. Paul, C. Niven, E. Saxson, and M. Nelson. 2005. Documentation of the reproductive success of the Common Loon on selected lakes in the Rangeley Lakes and Eagle Lake Regions in 2004. Report BRI 2005-06 submitted to the New England Forestry Foundation. BioDiversity Research Institute, Gorham, ME. 60p.

Morgan K. Ingalls

367 Rice Farm Road
Dummerston, VT. 05301
(802) 254-2988
morgan.ingalls@briloon.org

Education:

Antioch University New England
Keene, NH
Master of Science in Environmental Studies/Conservation Biology, 2014
Thesis Title: *Estimating Little Brown Bat Winter Mortality Rates from White-Nose Syndrome at Aeolus Cave in Dorset, Vermont using PIT Tag Technology*

Marlboro College
Marlboro, VT
Bachelor of Science in Biochemistry, 2010
Thesis Title: *Mysterious Mortalities: A study of White-Nose Syndrome and G. destructans from a molecular biology perspective*

Skill Sets:

- ***Supervisory Skills:*** Teaching and overseeing others in both laboratory and field settings
- ***Animal Handling Skills:*** Removal of bats from net; Species identification and biometrics; Attachment of bands; Collection of blood samples, wing punches, hair samples, etc.
- ***Radio Telemetry Skills:*** Attachment of radio transmitters to animals; Programming of receivers; Interpretation of radio telemetry signals in difficult terrain
- ***Data Management and Analysis Skills:*** Appropriate use of statistical tests; Large data set management; Geographical Information Systems; Laboratory analysis of molecular products
- ***Project Design Skills:*** Co-designed study investigating RNA regulation in cells exposed to *Pseudogymnoascus destructans*; Co-designed study to assess over-winter survivorship of Little Brown bats at Vermont's largest hibernaculum
- ***Leadership Skills:*** Group management and logistics; Collaborative planning; Communication
- ***Caving and Outdoor Skills:*** National Cave Rescue Commission Level 1 Certification; Six years of caving experience; Familiarity with single rope technique
- ***Computer Skills:*** Familiarity with Microsoft Office, ArcGIS, JMP, and Sonobat

Relevant Work Experience:

Wildlife Biologist May 2015 - Present
Biodiversity Research Institute
Portland, ME

- Oversee field staff
- Supervise and participate in live capture of bats
- Supervise and participate in radio tracking of bats
- Analyze data and write/contribute to reports

Bat Technician July 2014 – October 2014
Biodiversity Research Institute
Portland, ME

- Set up and broke down mist-nets, removed bats from nets
- Species ID and biometrics, attachment of radio transmitters to animals
- Used radio telemetry to determine day roosts and foraging areas for target species
- Managed the data that was gathered from the project

Intern Summer 2012 – Summer 2013
Biodiversity Research Institute
Portland, ME

- Participated in several bat banding projects at Great Bay NWR, Parker River NWR, and Acadia National Park
- Identified bats by species, determined sex, age, and reproductive status, and measured hind foot, ear, tragus, and forearm
- Used radio telemetry to determine day roosts of *Myotis leibii* and *Myotis septentrionalis*
- Analysis and writing of report

Volunteer Winter 2010, 2011, & 2014
New York Department of Environmental Conservation
Albany, NY

- Helped conduct bat counts in Merlin's Cave, Dragon Bones Cave, Surprise Cave, and Haile's Cave

Volunteer Winter 2009, 2010, 2011, & 2014
Massachusetts Division of Fisheries and Wildlife
Dalton, MA

- Helped conduct bat counts in Bat's Den, Crystal Pool, and Red Bat Caves

Freshman Orientation Program Trip Leader Fall 2008, 2009, & 2010
Marlboro College
Marlboro, VT

- Designed and co-led six to nine day wilderness trips for six to eight incoming students
- Took part in extensive leadership and logistics training prior to running trips
- Led or co-led day long caving trips for students during the school year

Laboratory Assistant Fall 2008 – Summer 2010
Marlboro College
Marlboro, VT

- Helped with chemical inventory and organization of MSDS
- Assisted with general laboratory organization and upkeep
- Assisted with preparation and running of General Biology Laboratory and General Chemistry Laboratory
- Helped to implement changes to laboratory safety procedures

Research Assistant to Prof. Todd Smith, PhD. Summer 2008 & Summer 2010
Marlboro College
Marlboro, VT

- Research on anti-freeze glycoprotiens in Atlantic Cod
- Analyzed cod serum samples using SDS-PAGE
- Quantified samples using a BSA protein assay

Office Manager and Production Coordinator 2007 – 2008
Yellow Barn Music School & Festival
Putney, VT

- Processed and organized student applications
- Organized and implemented mailings
- Organized audio archives

APPENDIX B

SAFETY PLANS

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Unfortunately, not many health care providers are accustomed to dealing with rabies exposures in individuals who have the pre-exposure vaccination. We recommend you bring the following table with you if you need to seek treatment.

Table 1. Rabies post-exposure prophylaxis schedule – United States, 2008 (CDC 2008, 2010)

Vaccination Status	Treatment	Regime*
Not previously vaccinated	Wound cleansing	All post-exposure prophylaxis should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as povidine-iodine solution should be used to irrigate the wounds.
	Rabies immune globulin (RIG)	Administer 20 IU/kg body weight. If anatomically feasible, the full dose should be infiltrated around the wound(s) and any remaining volume should be administered intramuscularly (IM) at an anatomical site distant from the vaccine administration. Also, RIG should not be administered in the same syringe as the vaccine. Because RIG might partially suppress active production of antibody, no more than the recommended does should be given.
	Vaccine	Human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV) 1.0 mL, IM (deltoid area[§]), on each day of days 0[¶], 3, 7, 14, and 29.
Previously vaccinated **	Wound cleansing	All post-exposure prophylaxis should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as providine-iodine solution should be used to irrigate the wounds.
	RIG	RIG should not be administered.
	Vaccine	HDCV or PCECV 1.0 mL, IM (deltoid area[§]), one each on days 0[¶]and 3.

* These regimes are applicable for all age groups, including children.
** Any person with a history of a complete pre-exposure or post-exposure vaccination regime w/HDCV, PCECV, or rabies vaccine adsorbed, or previously vaccination with any other type of rabies vaccine and a documented history of antibody response to the prior vaccination.
§ The deltoid area is the only acceptable site of vaccination for adults and older children. For younger children, the outer aspect of the thigh can be used. Vaccine should never be administered in the gluteal area.
¶ Day 0 is the day the first dose of the vaccine is administered.

RABIES SPECIMEN SUBMISSION

General Information

The purpose of this appendix is to provide BRI field staff with a guideline of how to prepare and ship a suspected rabies specimen to a local laboratory for testing. Each laboratory and/or state is likely to have specific protocols, which can be addressed by asking the following questions.

- Normal business hours
- Telephone number
- Do they use a specific courier

It is extremely unlikely that a live animal will be accepted by the laboratory.

Necropsy

- The animal should be humanely euthanized without damage to the head.
    - Exception: if the suspected animal is a listed species.
        - Call the nearest U.S. Fish and Wildlife Service office.
        - Turn the LIVE animal over to them for handling.
    - Only BRI employees experienced with this procedure should perform euthanasia.
        - Contact your supervisor if you need help.
- The head must be removed from the body and submitted intact for necropsy.
    - Exception: entire body of small mammals, such as bats, mice, and squirrels may be submitted as whole carcasses for testing.

Packaging and Shipping

- A laboratory submission form may be required – ask.
    - Fill it out completely.
    - Make a copy or scan the form for BRI's records.
- All materials collected for rabies diagnosis are considered to be infectious.
    - Appropriate handling and shipping precautions should be taken in order to ensure the safety of the collector/submitter, transportation carriers, laboratory staff and the public at large in accordance with 49 CFR Department of Transportation Regulations.
- Submit specimens to the laboratory promptly and cold to reduce decomposition of the animal.
    - Use frozen cold packs only.
    - Do not use "wet" ice as it may leak through the container; leaking containers are often rejected.
    - DO NOT FREEZE the specimen as this will delay the testing and possibly alter the results.
- All specimens should be sprayed or dusted for fleas and ticks with a pesticide before packaging.
- Wear disposable gloves while packaging a rabies sample.
- Clearly label the sample with:
    - Health Department or Animal Control internal tracking number (if provided)
    - Animal Species
- Triple package the specimen:
    - Primary Container
        - Ziploc bag or heavy-duty garbage bag appropriately sized for the specimen with an absorbent material (absorbent pads, paper towels, etc.) placed in the bag to prevent blood and body fluid from leaking.

- If sharp objects protrude from the specimen, such as a shattered bone, wrap the specimen in several layers of newspaper.
- Always tightly seal or fasten the primary container to contain the specimen.
- Label this container.

- Secondary Container
  - Use a metal can, heavy plastic pail with a lid or a heavy-duty plastic garbage bag as the secondary container.
  - Seal secondary container to help prevent leakage of blood or body fluid.
  - Label this container.
- Rigid Outer Shipping Container
  - Use a cooler or thick-walled Styrofoam container with or without an exterior fiber board liner.
  - "Rabies" should be clearly labeled with permanent marker.
  - Place the secondary container inside the shipping container with sufficient frozen cool packs and cushion materials to prevent damage to the specimen during transport.
  - Clean the outside of the Outer Shipping Container with a disinfectant
  - 10% bleach (9 parts water, 2 parts household bleach)
  - Secure the lid of the container (tape) for transport
  - Place the address on the container

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APPENDIX C

MIST-NET SITES PHOTO LOG

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Base: Oceana	**Site #** 1	**Net #** A	**Lat:** 36.81673	**Long:** -76.00125

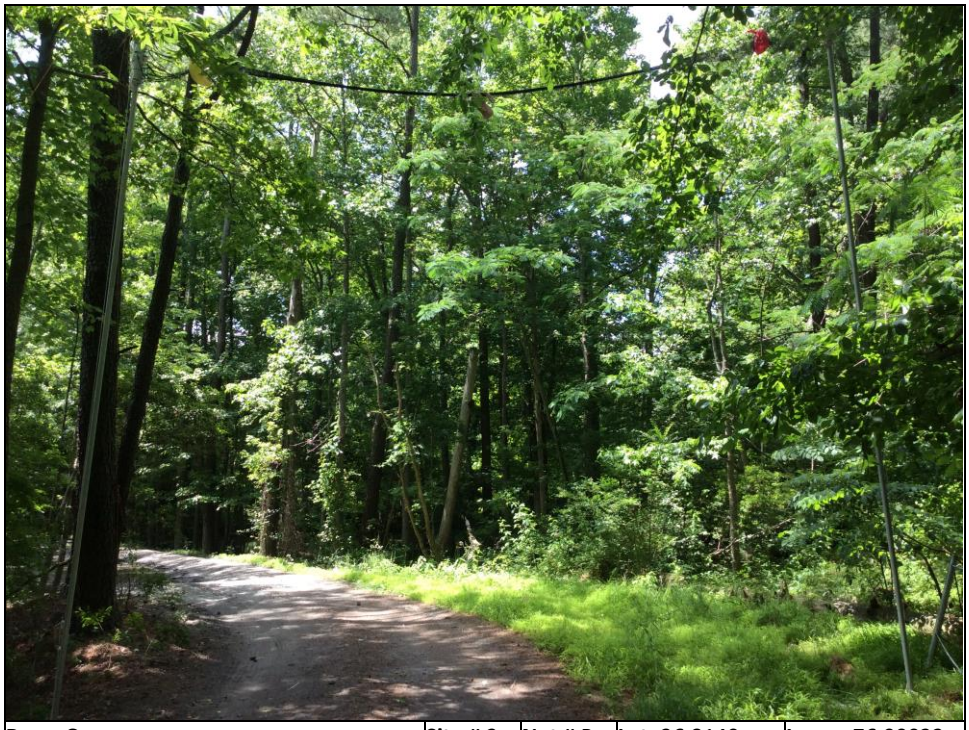
Base: Oceana	**Site #** 1	**Net #** B	**Lat:** 36.81667	**Long:** -76.00053

Base: Oceana	**Site #** 1	**Net #** C	**Lat:** 36.81571	**Long:** -76.00014

Base: Oceana	**Site #** 1	**Net #** D	**Lat:** 36.81506	**Long:** -76.00012

Base: Oceana	**Site #** 1	**Net #** E	**Lat:** 36.8159	**Long:** -76.00022

Base: Oceana	**Site #** 2	**Net #** A	**Lat:** 36.81482	**Long:** -76.00027



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Base: Oceana	**Site #** 2	**Net #** C	**Lat:** 36.81506	**Long:** -76.000012

Base: Oceana	**Site #** 2	**Net #** D	**Lat:** 36.81667	**Long:** -76.00043

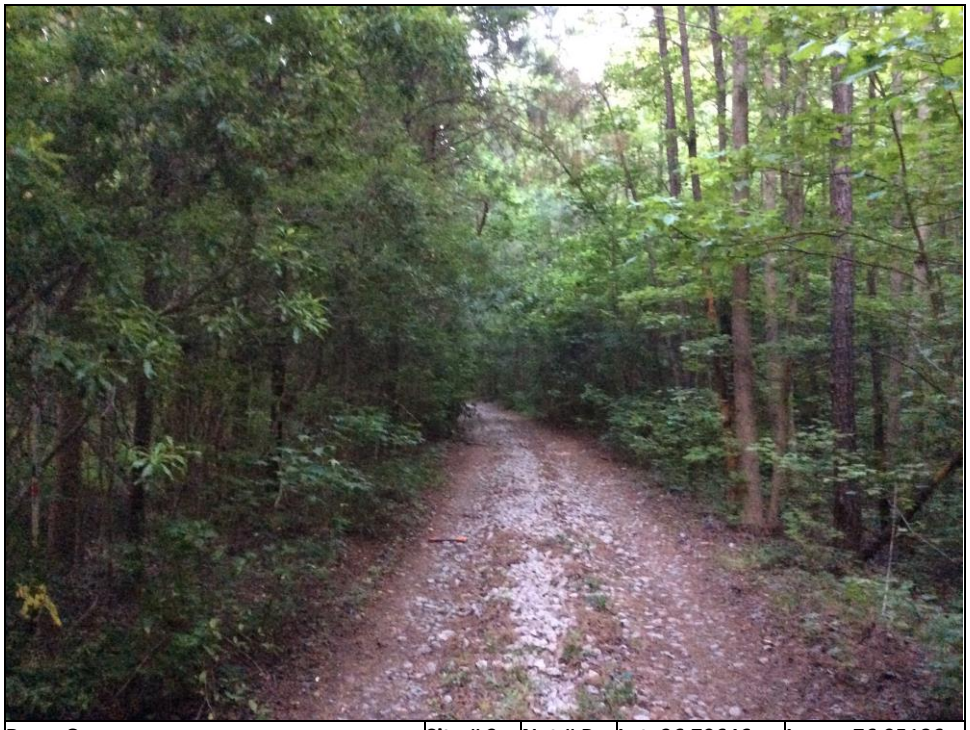
Base: Oceana	**Site #** 2	**Net #** E	**Lat:** 36.59586	**Long:** -76.24871

Base: Oceana	**Site #** 2	**Net #** F	**Lat:** 36.81482	**Long:** -76.00027

Base: Oceana	**Site #** 3	**Net #** A	**Lat:** 36.79655	**Long:** -76.05238

Base: Oceana	**Site #** 3	**Net #** B	**Lat:** 36.79621	**Long:** -76.05247

Base: Oceana	**Site #** 3	**Net #** C	**Lat:** 36.7964	**Long:** -76.05219



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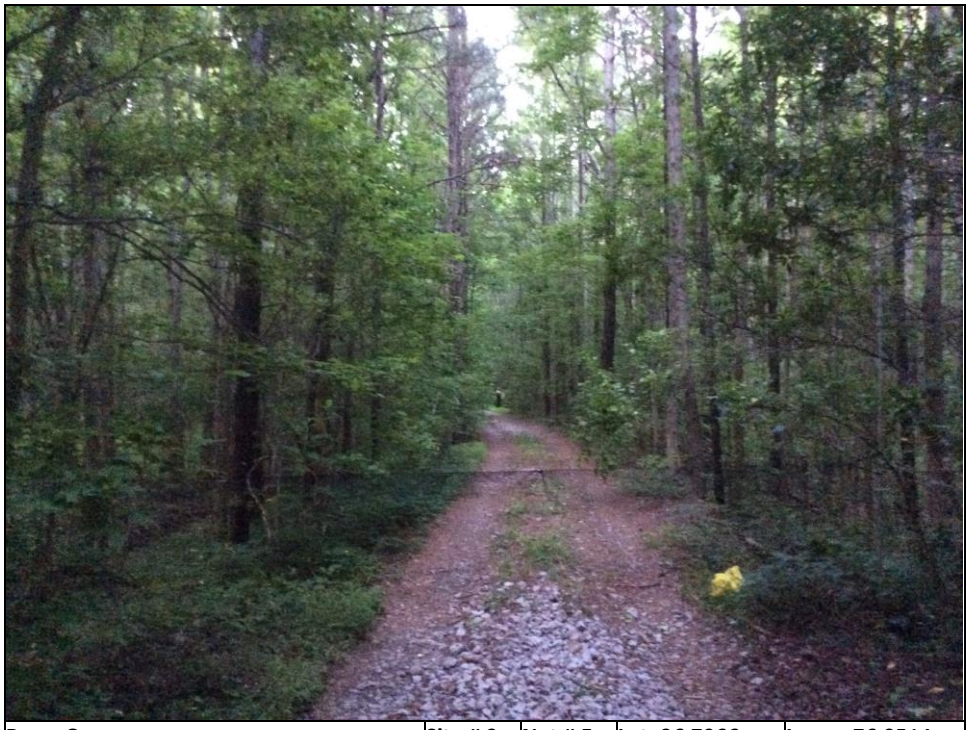


Base: Oceana	**Site #** 3	**Net #** E	**Lat:** 36.7966	**Long:** -76.0514

Base: Oceana	**Site #** 3	**Net #** F	**Lat:** 36.79699	**Long:** -76.05095

Base: Oceana	**Site #** 4	**Net #** A	**Lat:** 36.831907	**Long:** -76.01374

Base: Oceana	**Site #** 4	**Net #** B	**Lat:** 36.832457	**Long:** -76.014142

Base: Oceana	**Site #** 4	**Net #** C	**Lat:** 36.832627	**Long:** -76.0149

Base: Oceana	**Site #** 4	**Net #** D	**Lat:** 36.832305	**Long:** -76.01533

Base: Oceana	**Site #** 5	**Net #** A	**Lat:** 36.83435	**Long:** -76.02614

Base: Oceana	**Site #** 5	**Net #** B	**Lat:** 36.83353	**Long:** -76.02573

Base: Oceana	**Site #** 5	**Net #** C	**Lat:** 36.83348	**Long:** -76.02554

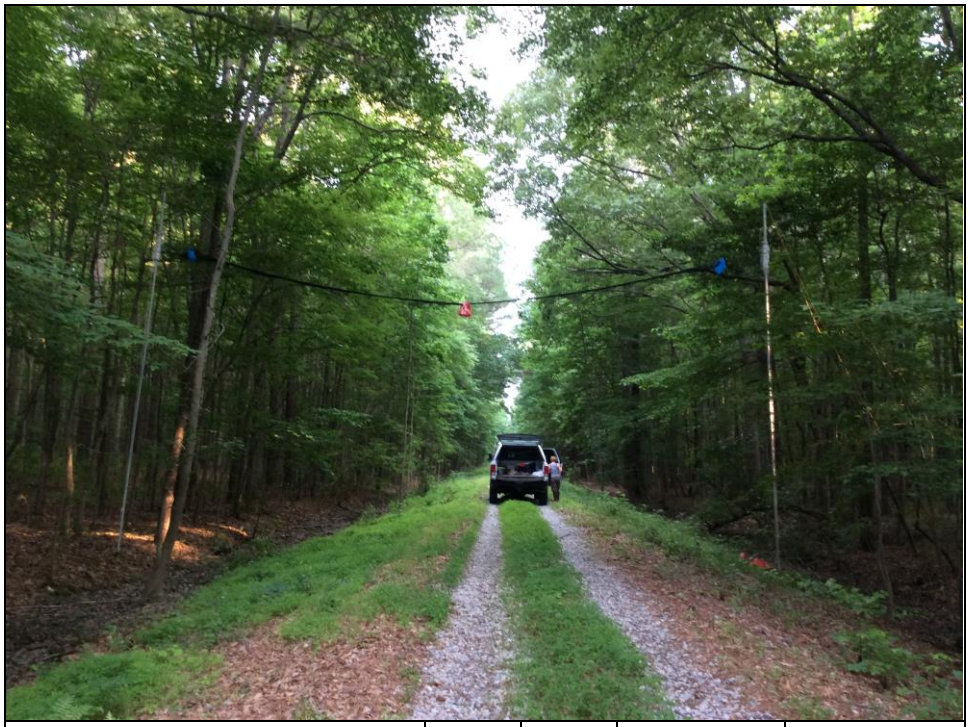
Base: Oceana	**Site #** 6	**Net #** A	**Lat:** 36.791432	**Long:** -76.040935

Base: Oceana	**Site #** 6	**Net #** B	**Lat:** 36.791283	**Long:** -76.041014

Base: Oceana	**Site #** 6	**Net #** C	**Lat:** 36.791062	**Long:** -76.041054

Base: Oceana	**Site #** 6	**Net #** D	**Lat:** 36.790507	**Long:** -76.041149

Base: Oceana	**Site #** 7	**Net #** A	**Lat:** 36.826449	**Long:** -76.045693



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Base: Oceana	**Site #** 7	**Net #** D	**Lat:** 36.828927	**Long:** -76.046055

Base: Oceana	**Site #** 7	**Net #** E	**Lat:** 36.828927	**Long:** -76.046055

APPENDIX D

BAT CAPTURE DATA

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Site Name	Net Name	Date	Start Time	Start Temp	End Time	End Temp	% Clouds	Wind (mph)	Precip	% Moon	Time	Species	Age	Sex	Reproductive Status	RFA (mm)	Mass (g)	Ear (mm)	RS	Band	Notes
NASO 1	B	6/11/2015	20:30	89	1:30	80	15	0	none	22	21:38	LABO	A	M	Non-reproductive	37	7.3	10	0	DEY1073	
NASO 1	B	6/11/2015	20:30	89	1:30	80	15	0	none	22	21:56	EPFU	A	F	Lactating	45.9	12.7	15	0	DEY1075	
NASO 1	A	6/11/2015	20:30	89	1:30	80	15	0	none	22	22:56	EPFU	A	F	Pregnant	47.6	21.5	15.5	0	DEY1077	
NASO 2	C	6/11/2015	20:30	89	1:30	80	15	0	none	22	21:30	EPFU	A	F	Lactating	45	13.4	14	0	DEY1074	
NASO 2	C	6/11/2015	20:30	89	1:30	80	15	0	none	22	21:30	EPFU	A	F	Lactating	47.3	14.9	14	0	DEY1076	
NASO 3	E	6/12/2015	20:30	86	1:30	80	50	(8-12)	none	15	23:21	MYLU	A	F	Lactating	38	5.4	13	0	DEY4749	
NASO 4		6/13/2015	20:30	88	1:30	77	50	0	none	8	NO BATS										
NASO 5		6/13/2015	20:30	84	1:30	77	25	(4-7)	none	7.9	NO BATS										
NASO 6	B	6/14/2015	20:36	82	1:36	75	50	(1-3)	Drizzle around 22:30, ending around 23:00	2.9	21:20	LABO	A	F	Pregnant	38.9	10.7	8	0	DEY1081	
NASO 6	A	6/14/2015	20:36	82	1:36	75	50	(1-3)	Drizzle around 22:30, ending around 23:00	2.9	21:43	EPFU	A	M	Testes descended	43.6	10.7	15	0	DEY1082	
NASO 6	D	6/14/2015	20:36	82	1:36	75	50	(1-3)	Drizzle around 22:30, ending around 23:00	2.9	23:11	EPFU	A	F	Pregnant	46.1	15.2	13	0	DEY1083	
NASO 6	B	6/14/2015	20:36	82	1:36	75	50	(1-3)	Drizzle around 22:30, ending around 23:00	2.9	0:25	EPFU	A	F	Lactating	42.7	13	10	0	DEY1084	

Site Name	Net Name	Date	Start Time	Start Temp	End Time	End Temp	% Clouds	Wind (mph)	Precip	% Moon	Time	Species	Age	Sex	Reproductive Status	RFA (mm)	Mass (g)	Ear (mm)	RS	Band	Notes
NASO 6	B	6/14/2015	20:36	82	1:36	75	50	(1-3)	Drizzle around 22:30, ending around 23:00	2.9	0:20	EPFU	A	F	Lactating	UNK	UNK	UNK	UNK		Escaped
NASO 6	B	6/15/2015	20:30	86	1:30	79	50	0	none	0.5	20:45	LABO	A	F	Lactating	40.8	11	8	0	DEY1429	
NASO 6	A	6/15/2015	20:30	86	1:30	79	50	0	none	0.5	21:50	EPFU	A	F	Lactating	47.1	16.6	13	0	DEY1430	
NASO 6	D	6/15/2015	20:30	86	1:30	79	50	0	none	0.5	22:40	EPFU	A	F	Lactating	45.7	18.7	14.5	0	DEY1432	
NASO 6	C	6/15/2015	20:30	86	1:30	79	50	0	none	0.5	22:45	EPFU	A	F	Lactating	48.2	20.2	14	0	DEY1431	
NASO 6	C	6/15/2015	20:30	86	1:30	79	50	0	none	0.5	1:55	EPFU	A	F	Lactating	47.9	20.7	15	0	DEY1433	
NASO 6	C	6/15/2015	20:30	86	1:30	79	50	0	none	0.5	1:55	EPFU	A	F	Lactating	47.6	19.8	14	0	DEY1434	
NASO 7	C	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	21:55	EPFU	A	M	Testes descended	43.8	13.9	14	0	DEY1416	
NASO 7	B	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	22:15	EPFU	A	F	Lactating	48.4	17.1	12	0	DEY1419	DEY1418 not used because it was bent.
NASO 7	B	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	22:20	LABO	A	F	Lactating	39.5	12.5	8	0	DEY1417	
NASO 7	A	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	22:20	EPFU	A	F	Lactating	38.4	19.1	12	0	DEY1420	

Site Name	Net Name	Date	Start Time	Start Temp	End Time	End Temp	% Clouds	Wind (mph)	Precip	% Moon	Time	Species	Age	Sex	Reproductive Status	RFA (mm)	Mass (g)	Ear (mm)	RS	Band	Notes
NASO 7	B	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	23:00	EPFU	A	F	Pregnant	44.6	21.3	12	0	DEY1421	
NASO 7	B	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	23:05	EPFU	A	M	Testes descended	48.1	14	14	0	DEY1422	
NASO 7	A	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	23:30	EPFU	A	M	Testes descended	46.5	16.7	14	0	DEY1423	
NASO 7	C	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	23:45	EPFU	A	F	Lactating	48.8	19.6	10	0	DEY1424	
NASO 7	C	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	23:45	EPFU	A	M	Testes descended	45.3	15.8	12	0	DEY1425	
NASO 7	C	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	23:45	EPFU	A	M	Testes descended	45.2	15.6	13	0	DEY1426	

Site Name	Net Name	Date	Start Time	Start Temp	End Time	End Temp	% Clouds	Wind (mph)	Precip	% Moon	Time	Species	Age	Sex	Reproductive Status	RFA (mm)	Mass (g)	Ear (mm)	RS	Band	Notes
NASO 7	B	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	0:30	EPFU	A	F	Lactating	50	20.2	14	0	DEY1427	
NASO 7	A	6/14/2015	20:30	80	1:30	77	10	0	Drizzle around 22:30, ending around 23:00	2.9	1:20	LABO	A	M	Testes descended	36.9	11.9	7	0	DEY1428	
NASO 7	C	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	22:04	EPFU	A	F	Lactating	46.5	13.4	14	0	DEY1085	baldness on back of neck
NASO 7	A	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	22:33	EPFU	A	M	non-reproductive	42.6	8.6	14	0	DEY1086	
NASO 7	B	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	21:55	EPFU	A	F	Lactating	UNK	UNK	UNK			Some blood on forearm, released
NASO 7	A	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	22:47	EPFU	A	F	Lactating	43.8	10.9	16	0	DEY1087	
NASO 7	B	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	23:02	EPFU	A	F	Lactating	49	17	13	0	DEY1088	
NASO 7	B	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	23:01	EPFU	A	F	Pregnant	46.3	18.4	UNK	0		Not banded -- escaped
NASO 7	B	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	23:22	LABO	UNK	UNK	UNK	UNK	UNK	UNK	UNK		Escaped when lowering net
NASO 7	A	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	23:39	EPFU	A	F	Pregnant	45.6	16.4	14	0	DEY1089	
NASO 7	A	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	23:40	EPFU	A	M	non-reproductive	45.5	13.8	16	0	DEY1090	
NASO 7	A	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	0:03	EPFU	A	F	Pregnant	47.4	16.4	17	0	DEY1091	Note; potential recapture
NASO 7	A	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	0:38	EPFU	A	F	Lactating	46.3	9.3	15	0	DEY1092	
NASO 7	C	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	0:54	EPFU	UNK	M	non-reproductive	43.2	15.1	14	0	DEY1093	
NASO 7	A	6/15/2015	20:30	86	1:30	79	100	0	none	0.5	1:14	LABO	A	F	Lactating	37.5	8.6	11	0	DEY1094	

Site Name	NASO 1	NASO 2	NASO 3	NASO 4	NASO 5	NASO 6	NASO 7
Date	6/11/2015	6/11/2015	6/12/2015	6/13/2015	6/13/2015	6/14/2015	6/14/2015
Datum	WGS84	WGS84	WGS84	WGS84	WGS84	WGS84	WGS84
Net A Lat	36.81673	36.81482	36.79655	36.831907	36.83435	36.79143233	36.82644917
Net A Long	-76.00125	-76.0003	-76.05238	-76.01374	-76.02614	-76.0409355	-76.04569317
Net B lat	36.81667	36.8149	36.79621	36.832457	36.83353	36.79128333	36.82647533
Net B Long	-76.00053	-76.0002	-76.05247	-76.014142	-76.02573	-76.041014	-76.0457455
Net C Lat	36.81571	36.81506	36.7964	36.832627	36.83348	36.7910625	36.82744583
Net C Long	-76.00014	-76	-76.05219	-76.0149	-76.02554	-76.04105483	-76.04553367
Net D Lat	36.81506	36.81667	36.79646	36.832305	-	36.79050767	36.82892733
Net D Long	-76.00012	-76.0004	-76.05186	-76.01533	-	-76.0411495	-76.04605583
Net E Lat	36.8159	36.59586	36.7966	-	-	-	36.82892733
Net E Long	-76.00022	-76.2487	-76.0514	-	-	-	-76.04605583
Net F Lat	36.81482	-	36.79699		-	-	-
Net F Long	-76.00027	-	-76.05095		-	-	-
Capture Technique	1, 6m double high; 2 6m triple highs; 3, 12m single highs	1, 9m triple high; 2, 6m triple highs; 2, 6m single highs	1, 12m triple high; 1, 6m triple high, 4, 6m single highs	3, 6m triple highs; 1, 6m single high	1, 9m triple high, 2, 6m triple highs	3, 6m triple highs, 1, 6m single high	3, 12m triple highs; 1, 12m single high; 1, 9m single high
Net nights	6	5	6	4	3	4	5
Habitat	Loblolly Pine, Sweet Gum, Red Maple, Switch Grass	Loblolly Pine, Sweet Gum, Red Maple, Switch Grass	Loblolly Pine, Sweet Gum, Red Maple, Yellow Poplar	Red maple, green ash, swamp root, loblolly pine	Loblolly Pine, Sweet Gum, Red Maple	Loblolly Pine, Sweet Gum, Red Maple	Swamp chestnut, cherry bark oak, summersweet, swamp dog laural, loblolly pine, sweet gum, red maple, greenbrier

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APPENDIX E

WNS RESEARCH DESCRIPTION AND PROTOCOL

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WHITE-NOSE SYNDROME RESEARCH GROUP
FUNDED THROUGH THE
US FISH AND WILDLIFE SERVICE
REQUESTS YOUR ASSISTANCE

In 2014, our research group (Stony Brook University, NY and Grand Valley State University, MI) secured an award through the USFWS to conduct white-nose syndrome (WNS) research that will help describe the nature of remnant populations in the WNS-affected region and investigate a potential mitigation for controlling the spread of WNS. To meet the goals of this important work we must include samples from bats captured in any state east of the Rocky Mountains. We have been working with many researchers across state, federal, consulting, and non-profit agencies and from academic institutions to acquire the necessary samples for this study, but we seek additional assistance to complete our collections in 2015. We only request assistance from researchers already conducting planned surveys or other projects in the field during the active season of 2015, and for whom the collection of wing biopsies from bats is already permitted. From any participant, we request that wing tissue biopsies be collected from active season bats and from up to 10 individuals of each of the species included in our study that you encounter and are permitted to handle and collect samples from (Species included: *Corynorhinus townsendii virginianus*, *Eptesicus fuscus, Myotis austroriparius*, *M. grisescens*, and *M. lucifugus*). If you are interested in participating in this study, we will provide all necessary supplies required for the tissue collections and will pay for you to return the samples. Below is a more detailed summary of our project goals should you be interested in reading further. Please contact Marianne Moore (marianne.moore@stonybrook.edu) if you are interested in participating and/or have questions.

We sincerely thank you for considering our request.

~Marianne Moore, Liliana Dávalos & Amy Russell

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Stony Brook University
650 Life Sciences Building
Stony Brook, NY 11794-5245
Email: marianne.moore@stonybrook.edu

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Stony Brook, NY 11794-5245
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Amy L. Russell, PhD (Co-PI)
Biology Department
Grand Valley State University
212 Henry Hall
1 Campus Dr.
Allendale, MI 49401
Email: russelam@gvsu.edu

PROJECT TITLE: Uncovering skin immune proteins as predictors of resistance against WNS

Objectives: Our central aim is to test the hypothesis that the composition of bat skin immune proteins predicts resistance to white-nose syndrome (WNS) within and among species. Our goal is to discover the mechanisms underlying the survival of remnant populations in the WNS-affected area. To this end, we will characterize the diversity and relative abundance of skin immune proteins of five bat species that vary in observed rates of WNS-associated mortality, including the little brown myotis (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), southeastern myotis (*M. austroriparius*), gray bat (*M. grisescens*), and Virginia (VA) big-eared bat (*Corynorhinus townsendii virginianus*). We will use high throughput protein sequencing (proteomics) to isolate, identify, and quantify skin immune proteins. Proteomic repertoires will then be compared across species to test the prediction that certain proteins related to anti-fungal responses are more prevalent in species that appear to suffer less from the effects of WNS, such as the gray bat and the VA big-eared bat. The little brown myotis and big brown bat will be more extensively sampled both within and outside of the WNS-affected area and their protein profiles will be compared across sites to test the prediction that proteins prevalent in survivors of more highly susceptible species are similar to those found in resistant species. Microsatellite genotyping will also be used to quantify levels of relatedness among sampled individuals, and this will allow for functional and adaptive similarity in immunological proteins to be differentiated from similarity due to common descent. We will focus on a set of proteins known as antimicrobial peptides (AMPs), which are known to kill or inhibit the growth of invading microorganisms such as fungi, but our analyses will also capture all other skin immune proteins. Our secondary aim is to investigate the potential for using host derived anti-fungal AMPs to mitigate WNS. To this end, we will select AMPs identified in resistant species, and in surviving populations of susceptible species, and will use growth-inhibition assays with cultured *Pseudogymnoascus destructans* (*Pd*) to test the ability of AMPs to kill the WNS etiologic agent.

Strengths: We focus on the skin because *Pd* invades and destroys this organ. Effective immune responses against *Pd* must be initiated in this organ. AMPs have been selected as a primary focus because, unlike effectors of the adaptive immune system, they are constitutively expressed and likely to remain functional during hibernation. Many AMPs also have direct anti-fungal properties. These peptides are associated with resistance to chytridiomycosis in amphibians and have shown therapeutic potential against human fungal skin infections. Proteomics provides an efficient method to identify all expressed proteins in skin including those that are unique to a population and/or species. By genotyping all individuals, we will be able to account for genetic relatedness when modeling the effect of the proteomic composition of the skin on survivorship. We will use a relatively non-invasive method of tissue sample collection (i.e., small wing biopsies) that will allow us to study the endangered gray and VA big-eared bats, which may provide important clues to the nature of remnant populations, but cannot be studied using the invasive methods often required for immunological studies. Furthermore, biopsies will be collected during the active season when wound healing is maximal and can be collected by other researchers in combination with sampling for other studies. This approach will protect sensitive hibernating populations, significantly reduce the total number of bats handled, and make the proposed fieldwork more cost-efficient. Our team is particularly well equipped to conduct this study. Previous research by PI Moore demonstrated that the little brown myotis attempts immunological resistance against *Pd* and that big brown bats are relatively more resistant to infection by *Pd* compared to little brown myotis. Co-PI Russell has demonstrated that a small number of microsatellite markers can successfully characterize the variation of populations of the little brown myotis. Finally, co-PI Dávalos has demonstrated the use of proteomics with very small starting samples and its application to uncovering immune responses in mammals.

Implications for Management: This study will directly relate to priorities identified in the WNS National Plan by (1) improving our understanding of why some species succumb to the disease while other appear completely resistant to the effects of WNS, and (2) by investigating anti-fungal skin proteins as a potential control method. Our approach will provide the perfect synergy between research and management since our findings will elucidate mechanisms underlying the differential impacts of WNS within and between species and help direct management efforts, while at the same time investigating a potential mitigation strategy to directly control the effects and spread of this devastating disease.

Sample Collection Protocol
Moore/Dávalos/Russell -- WNS Skin Immune Protein Study – 2014 (revised 25 July 2014)

This protocol describes steps for collecting samples that will be used in our investigation into how skin immune proteins may confer resistance to WNS in relatively resistant species (e.g. *Myotis grisescens*) and in some individuals of highly susceptible species (e.g. *Myotis lucifugus*). Please refer to our proposal or ask Marianne for details on study goals and species included. We are extremely grateful for your participation in helping us acquire the appropriate samples for this study and welcome feedback based on your experience in the field. Thank you!

Please direct any questions to Marianne at:
Email – marianne.moore@stonybrook.edu
Cell Phone – 617-259-0349
Office Phone – 631-632-1530

Once a bat is in hand, all supplies necessary for this collection protocol are provided, including:

- vials in Ziploc bags labeled with sample type and vial contents
  - -blue silica gel beads for wing biopsies
  - -RNALater for wing swab
- vial box
- sample identification labels
- nitrile gloves (S, M, L, XL)
- sterile water in 50mL conical vial labeled “Dipping Vial”
- sterile alcohol preps
- paper towels soaked in Envirocide
- Lysol wipes
- paper towels
- applicator swabs
- biopsy punches (2mm and 3mm)
- cutting surface (stainless steel sheet)
- tweezers
- Scotch tape
- protocol, data sheets (2 types with layouts for each sample category) & labels
- sharpie & pencil

There will be two categories of bats sampled for this study:

One category is bats sampled for genotyping only, and in this case you should follow instructions in (1). These samples can be collected from adults or juveniles.

The second category is bats sampled for qPCR, proteomes and genotyping simultaneously, and in this case you should follow instructions in (2) and (3). Samples in this group should be collected from **adults** with intact, non-damaged, wing membranes with no scarring.

Approximate numbers of each type of sample to be collected by your group should be determined with Marianne prior to your field trip.

For all bats sampled, fill out all available life history data requested in data sheet.

Wear nitrile gloves for each type of collection. You can wear a handling glove on one hand and nitrile on another, or preferably, have one person holding bat with handling gloves and another person wearing nitrile gloves collecting tissues. Change gloves between each bat sampled.

"GENOTYPE ONLY" SAMPLING:

(1) *Tissue Biopsy Collection for Genotyping*

****If you are sampling a bat for genotyping only (most of our samples fall into this category), this is the only sample type that needs to be collected from that individual.*

1- Prepare and clean cutting surface using alcohol prep.
2- Remove 1.8mL storage tube with blue silica gel beads from Ziploc bag and label with unique ID tag. Cover ID with Scotch tape. Vial should be ½ to ¾ full of silica gel beads and have a small piece of Kim Wipe at the top. Silica gel beads should be bright blue. If one or several beads are violet, it is ok to continue using this vial, however if most or all of the beads are violet, discard and use another vial with bright blue beads.
3- Place the matching label (there are duplicates of each) on data sheet in the row corresponding to this bat.
4- Clean ventral and dorsal sides of one wing membrane using a sterile alcohol prep. Clean on and around the area to be biopsied and allowing ethanol to evaporate from the wing.
5- Open package containing sterile 3mm biopsy punch.
6- Gently extend wing so that membrane is taut and place wing surface directly on stainless steel cutting surface.
7- Collect biopsy of wing membrane using 3mm biopsy punch. Biopsy collection should be located in the plagiopatagium away from the edge of the wing and between large muscle/elastic fibers (visible network appearing as crossed lines throughout wing). Avoid collecting biopsies across blood vessels. See white circle in Figure 1 A for suggested placement of single biopsy.
8- Use tweezers to retrieve biopsy from cutting surface, or possibly from inside of punch.
9- Insert tissue sample into uniquely labeled vial by setting it carefully inside of Kim Wipe using tweezers; screw cap on tightly.
10- Put vial into storage box.
11- Record life history data.
12- Dispose of biopsy punch after sampling each bat. An empty water bottle makes a good field sharps container. Dispose of contents safely in your institutional sharps disposal.

"PROTEIN, GENOTYPE, qPCR" SAMPLING:
(2) *qPCR Swab to Identify Presence of PD DNA*

****You only need to swab bats that are going to be sampled for proteomes.*

As soon as a bat is in hand and with as little handling as possible:

1- Remove 1.8mL storage tube labeled "Swab" from Ziploc bag and label with unique ID tag. Cover label with Scotch tape.
2- Place the matching label on the data sheet in the "qPCR ID #" field corresponding to this bat.
3- Remove swab from sterile packaging.
4- Dip swab in sterile water to moisten tip using water in vial labeled "Dipping Vial".
5- Firmly rub the swab 10 times across the ventral side of one wing membrane (back/forth=1x) twirling the swab as you move it across the membrane.
6- Repeat the procedure on the dorsal side of the same membrane and on each side of the other wing. (You will use only one swab for this whole process.)
7- Insert swab head into "Swab" vial. Break applicator handle off so that only the polyester tip remains in the vial. Close and tightly lock lid.
8- Place vial in storage box.

(3) *Tissue Biopsy Collection for Proteomics & Genotyping*

****Make sure to swab bat for qPCR before collecting biopsies.*

1- Remove four 1.8mL storage tubes with blue silica gel beads from Ziploc bag and label each with unique ID tags.
2- Place the matching labels on data sheet in the "Biopsy ID #" fields corresponding to this bat.
3- Prepare and clean cutting surface using Envirocide-soaked paper towel.
4- Clean ventral and dorsal sides of one wing membrane using a sterile alcohol prep. Clean on and around the area to be biopsied and allowing ethanol to evaporate from the wing.
5- Open package containing sterile 2mm biopsy punch.
6- Gently extend wing so that membrane is taut and place wing surface directly on cutting surface.
7- Locate an area of wing where tissues appear intact, not damaged, not inflamed and not scarred. Collect 4 biopsies using 2mm biopsy punch. Locate the biopsy collections in plagiopatagium, space biopsies apart by at least ~3cm and locate away from edge of wing. Biopsies can be collected across both wings. See white circles in Figure 1 B for suggested placement of biopsies in the case that multiple biopsies are collected from a single wing.
8- Individually retrieve biopsies with tweezers, place each one in a separate uniquely labeled vial; use tweezers to carefully place biopsies inside pieces of Kim Wipe. Screw caps on tightly.
9- Put vials into storage box.
10- Fill out life history data for individual sampled.
11- Dispose of biopsy punch after sampling each bat.

(4) *Storage and Shipment Procedures*

1- Label the top of each storage box with:
   Site name
   Collector's name and contact info
   Number of bats sampled for genotyping only
   Number of bats sampled for proteomics/qPCR/genotyping
   Range of unique IDs contained within (e.g. SIP_NY_a_001-030)
2- Store biopsy samples in Ziploc bag at ambient conditions.
3- Store box with swab samples in a refrigerator until shipment.
4- Return biopsy samples to box prior to shipment.
5- Place box in 2 Ziploc bags (double bagged).
6- Samples can be sent at ambient temperatures using 2nd day delivery to:
   Marianne Moore
   Department of Ecology and Evolution
   Stony Brook University
   650 Life Sciences Building
   Stony Brook, NY 11794-5245
7- Use our UPS shipping account: F0767F
8- Please return data sheets and any unused supplies in package with collected samples.

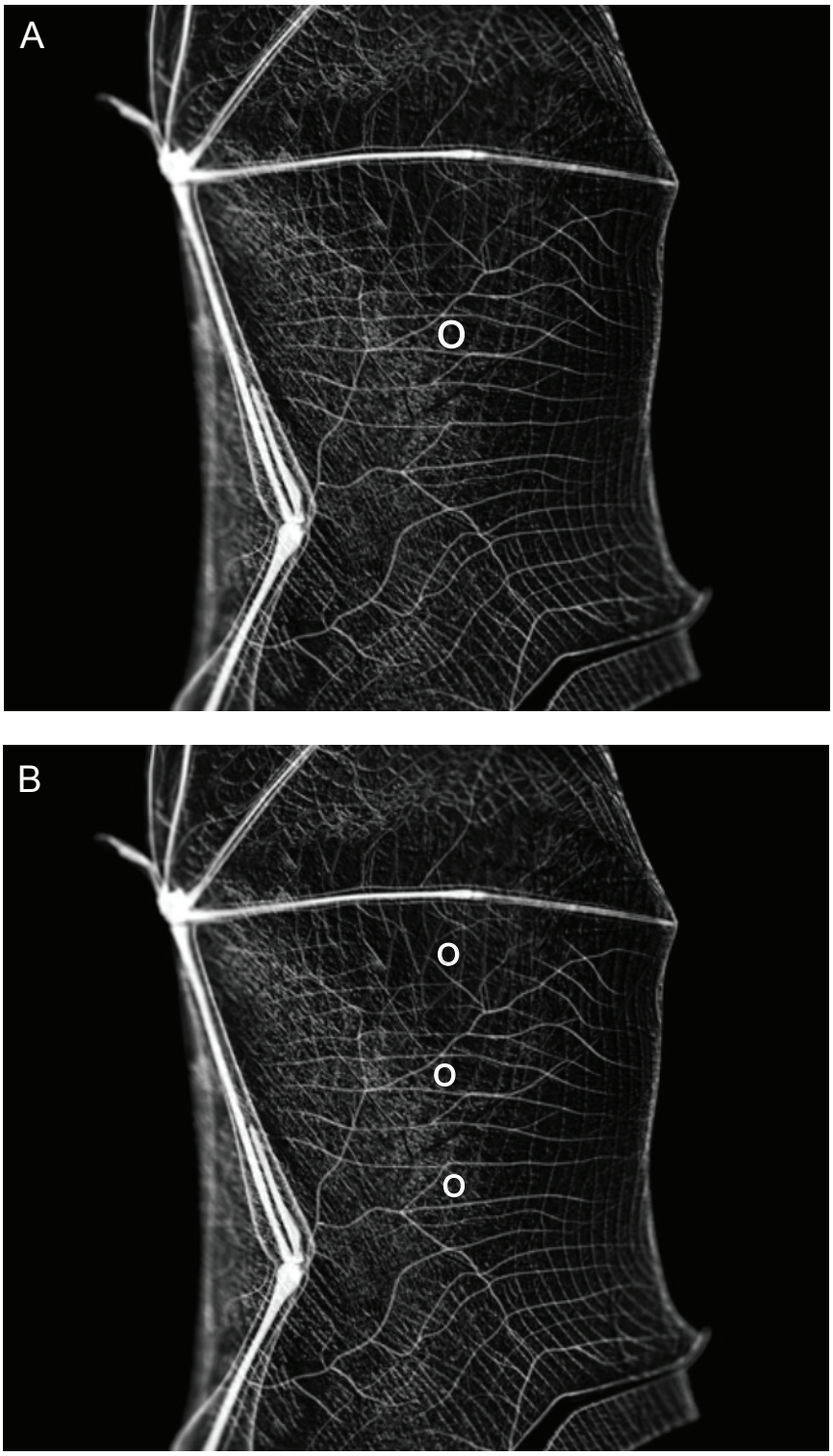

Fig 1. Bat wing membrane showing placement of biopsies in the plagiopatagium as indicated by white circles. A. Suggested location when collecting one 3mm biopsy. B. Suggested locations when collecting multiple 2mm biopsies from one wing. White lines in membrane are visible muscle and elastic fiber bundles along which blood vessels may also run. These lines should be avoided, as should areas lacking pigment, showing scarring or showing tissue damage.

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APPENDIX F

RECEIVER AND TRANSMITTER SPECIFICATIONS

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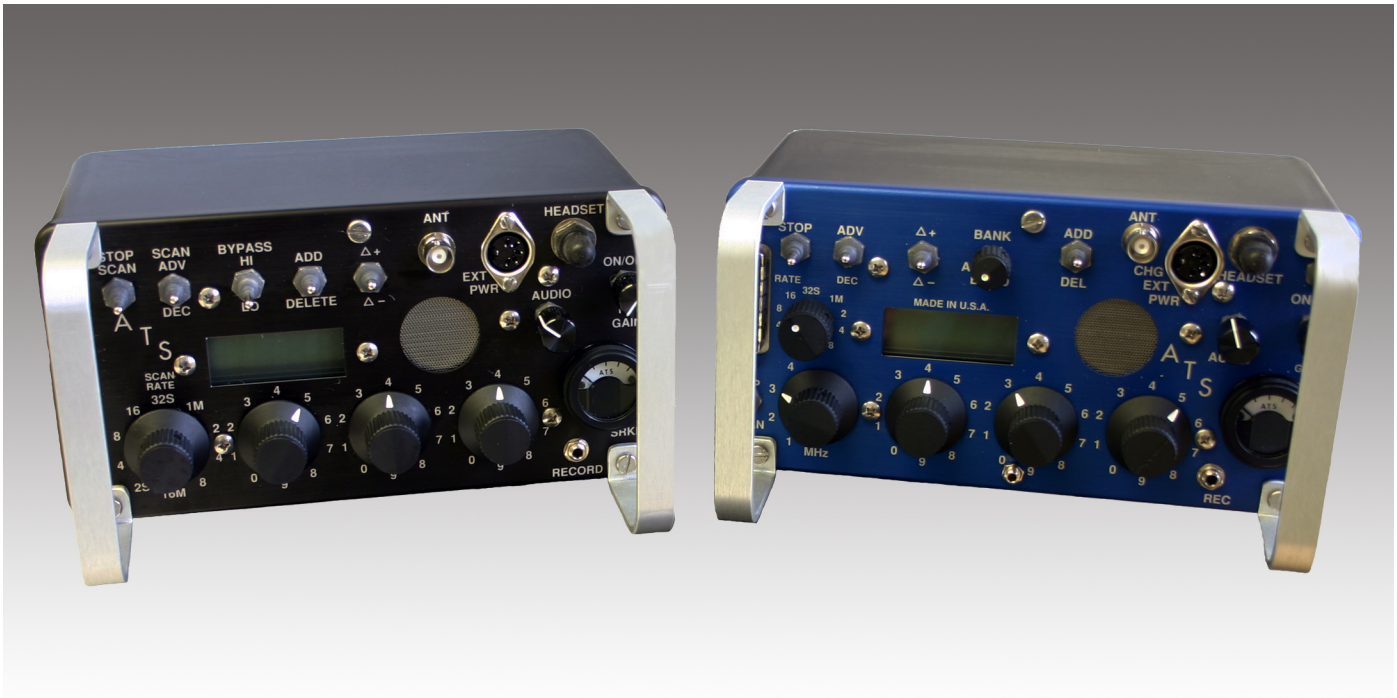
ATS R2000 / R4000 Scientific Receivers

Finding Solutions. Delivering Results.



With performance features and proven reliability, these receivers are an exceptional value.

ATS models R2000 and R4000 are excellent receivers for most aerial, terrestrial and aquatic studies. They offer leading edge technology and outstanding performance.

Both models feature programmable, automatic or manual scanning over a 2 MHz or 4 MHz frequency range. Their 1 kHz channel spacing tracks up to 200 or 400 targets. The user-friendly front panel gives the operator full control over all functions including scan rate, add/delete frequencies, RF gain, audio level, tone decoder threshold, and more. Both units feature state-of-the-art circuitry for exceptional sensitivity, frequency stability, and low noise.

Both receivers are designed for easy field operation. Their large 1/2" LCD display is backlit for night use. A padded Nylon case, battery charger, power cord and detailed operation manual are included with each receiver.

The R2000 and R4000 are lightweight, compact and ruggedly built to withstand heavy field use and extreme environmental conditions. Each can be powered by an external 12 volt DC battery or its own built-in NiCad battery pack for up to 8 hours of use.

ATS R2000 and R4000 receivers offer high performance with high value.

- 2 or 4 MHz Frequency Range
- 1 kHz Channel Spacing
- Improved RF Gain Control For More Precise Direction Finding
- Excellent Frequency Stability
- High Sensitivity/Low Noise
- Sensitive Signal Meter
- Ruggedly Built For Field Use
- Easy Operation
- 4 Distinct Memory Banks (R4000)
- Built-in Computer Interface (R4000)
- Delta Tune Drift Compensation
- Rechargeable NiCad Batteries
- Separate RF Gain And Audio Level Controls
- Battery-Backed Memory
- Auto-Shut Off On Low Battery For Longer Battery Life

WWW.ATSTRACK.COM
MINNESOTA. 763-444-9267
SALES@ATSTRACK.COM

Finding Solutions.
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763-444-9267 • 763-444-9384 fax
email:sales@atstrack.com • www.atstrack.com

ATS R2000 / R4000 Scientific Receivers

GENERAL

• **Frequency range:**	R2000 Any Specified 2 MHz range from 30 to 220 MHz R4000 Any Specified 4 MHz range from 140 to 220 MHz
• **Channel spacing:**	1 kHz
• **Input impedance:**	50 ohms
• **Minimum discernible signal (MDS):**	-150 dBm (0.007 uv into 50 ohms)
• **Noise figure:**	3 dB maximum
• **Speaker:**	8 ohms
• **Tone decoder detection range:**	± 2 kHz (Model R4000)
• **Tone decoder detection level:**	-120 dBm minimum (Model R4000)
• **Frequency stability:**	± 1 kHz -20°C to +50°C
• **Delta tune:**	+4 kHz; -4 kHz
• **IF frequency:**	10.7 MHz
• **IF bandwidth:**	6 dB ± 2 kHz; 80 dB ± 7 kHz
• **Image rejection:**	>150 dB
• **RF gain control range:**	>130 dB
• **Operating voltage range:**	9 to 18 volts DC
• **Dwell time (scan rate):**	Selectable, 2 sec. to 16 min. (10 positions)

CONTROLS

- Frequency selectors (4)
- Audio level
- Delta tune
- RF gain
- Increment frequency up/down
- Tone decoder threshold (R4000)
- Memory bank select (R4000)
- Auto scan/memory bypass
- Receiver on/off
- Dwell time (scan rate)
- Add-delete to memory
- Stop scan

MEMORY

- All frequencies programmable in each bank
- Four distinct banks (R4000)
- Sequentially scanned
- Battery backed
- Delete all frequencies in each bank
- Delete frequencies individually with single switch while scanning or on standby

DISPLAYS

• **Selected frequency:**	LCD (0.5" digits) with backlight for night use
• **Memory status:**	Colon in display indicates frequency stored in memory
• **Battery status:**	"Lo Bat" indicator flashes when battery voltage is low
• **Signal detection:**	"+" present in display indicates detection by tone decoder (R4000)
• **Signal level:**	0-1 mA meter

CONNECTIONS

• **Antenna:**	BNC - female
• **Headset:**	Receptacle for 0.25" phone plug
• **Signal level:**	0.125" phone receptacle for external 0.1 mA current meter
• **External power/recharge receptacle:**	5-pin DIN
• **Computer interface (R4000):**	25-pin D-sub filtered connection (socket)

POWER

• **12 volts DC nominal:**	130 mA drain nominal
• **Internal:**	1.2 amp-hour NiCad battery pack; 8-hour nominal operating time
• **External:**	9 to 18 volts, negative ground; switches automatically to external power

COMPUTER INTERFACE (R4000)

- 4 digits BCD (active high)
- Computer control select
- 5 volt DC regulated (5 mA max.)
- 12 volt DC unregulated
- Tone decoder output (active low)
- Signal strength

PHYSICAL

• Size:	11 cm wide x 21 cm long x 18 cm high (4.3" x 8.3" x 7")
• Weight:	2.3 kg (5 lbs)
• Accessories (included):	External power cord, battery charger, padded nylon case, instruction manual
• Accessories (optional):	David Clark aviation-grade headset, DC-DC charger, external battery pack

ENVIRONMENTAL

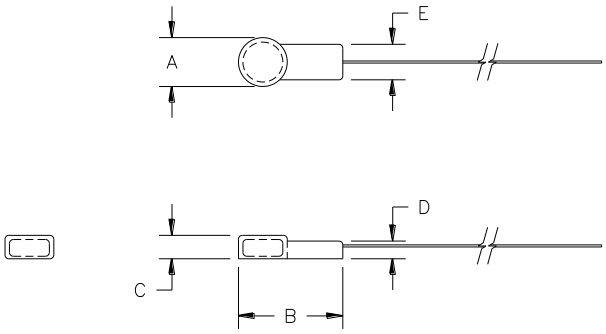
• Operating temperature:	-20°C to +50°C
• Storage temperature:	-70°C to +60°C
• Humidity:	95% non-condensing

WARRANTY

- One year parts and labor on materials and workmanship

AVIAN GLUE ON

Series A2405



Technical Specifications

Transmitter type:	Crystal controlled 2-stage
Calibration tolerance:	±2.5kHz
Frequency stability:	±2.5kHz, -20ºC to 40ºC
Pulse rate and width:	Typical on time 15ms, off time 1.5-4.0sec (controlled by astable circuit)
Pulse rate variation:	5%/volt, ± 20% for temperatures -20ºC to +40ºC
Battery:	Silver Oxide
Activation:	By removing magnet
Encapsulation:	Electrical resin, water-proof, specific gravity: 1.12

MODEL	BATTERY	BATTERY CAPACITY (days)				DIMENSIONS (mm)					WEIGHT (grams)	PRICE GROUP
	1.5V	15 ppm	24 ppm	30 ppm	40 ppm	A	B	C	D	E		
A2412	410	22	15	12	9	5	12	1.5	2.5	4	0.20	F
A2414	337	45	30	24	18	5	12	3	2.5	4	0.30	C
A2415	337	45	30	24	18	5	13	3	4	5	0.50	A
A2426	317	68	45	36	28	6	14	3	4	5	0.65	A
A2435	319	90	60	48	37	6	14	4	4	5	0.75	A
A2445	377	135	89	72	55	7	15	4	4	5	0.90	A
A2455	392	216	143	116	88	8	16	5	4	5	1.20	A

Above models available only in 48.00-50.66MHz, 144.06-151.98MHz, and 164.00-167.99MHz ranges.

Warranty life is 50% of battery capacity.

470 First Ave. No., Box 398 • Isanti, MN 55040
763.444.9267 • fax:763.444.9384 • sales@atstrack.com • www.atstrack.com

04/05/12

Model A2405 Compliance to FCC Part 15 Regulations

This note certifies that Advanced Telemetry Systems, Inc. series A2405 transmitters in frequency range 048.00 – 167.999 comply with regulations under FCC Part15.231 for periodic operation. Periodic operation describes the pulsing mode these units use. The attached antenna may not be altered or the unit may no longer be in compliance.

Regulations under Part 15.5 also apply making them exempt from FCC licensing requirements. These in general state that these devices are secondary users and as such must accept possible interference from other authorized users of the frequency.

Regarding the power output for these transmitters: the power output is less than one milliwatt. (-0.5dBm) when operational with the magnet removed.

Larry B. Kuechle

Engineer
Advanced Telemetry Systems, Inc.
470 1st Avenue North
Isanti, MN 55040

APPENDIX G

ACOUSTIC DETECTOR SPECIFICATIONS

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Quick Specs

Full specifications can be found at wildlifeacoustics.com

Song Meter SM4BAT FS
Song Meter SM4BAT ZC

Recording Technology:

FS: Single-channel 16-bit .wav

ZC: Single-channel Zero-Crossing

Sample Rate:

256kHz on one channel
384kHz on one channel
500kHz on one channel

Run Time:

Alkaline batteries:

30 to 50 ten-hour nights

External power via optional SM3/SM4 Power Cable

Storage:

2 SDXC/SDHC flash card slots (Class 4 or greater)

More than 1 terabyte total capacity using 2 512GB SDXC cards

Dimensions:

Height: 8.6"/21.8 cm
Width: 5.9"/ 15.0 cm
Depth: 2.8"/7.1 cm

Weight:

1.4 lbs./.64kg without batteries
2.7 lbs./1.2kg with batteries

Enclosure Material:

Molded Polycarbonate

Operating Temperature:

-4°F to +122°F or -20°C to 50°C

Warranty:

3 years

Song Meter SM3BAT

Recording Technology:

16-bit PCM .wav or optional .wac proprietary lossless compressed format as well as zero crossing

Sample Rates:

192kHz
256kHz
384kHz (on 1 channel only)

Run Time:

Alkaline batteries:

1 channel full-spectrum:
18 ten-hour nights

1 channel zero-crossing:
20 ten-hour nights

External power via optional SM3/SM4 Power Cable

Storage:

4 SDXC/SDHC flash card slots (Class 4 or greater)

More than 2 terabytes total capacity using 4 512GB SDXC cards

Dimensions:

Height: 12.8"/32.4 cm
Width: 7.9"/ 20.0 cm
Depth: 2.5"/6.5 cm

Weight:

5.5 lbs./2.5kg without batteries
7.0 lbs./3.2kg with batteries

Enclosure Material:

Diecast Aluminum

Operating Temperature:

-4°F to +122°F or -20°C to 50°C

Warranty:

3 years

Echo Meter Touch

Device iOS Device Compatibility:

iPad:
Pro, Air, Air 2, mini 2/3/4, 4th generation
iPhone:
6s Plus, 6s, 6 Plus, 6, 5s, 5c, 5
iPod touch:
6th generation

Sample Rate:

256kHz

Run Time:*

iPad: Up to 13 hours
iPad Mini: Up to 8 hours
iPhone: Up to 4 hours
iPod touch: Up to 3 hours

Sensor Type:

Weather Resistant and Omnidirectional FG

Recording Format:

Full-spectrum

Ultrasonic Module Dimensions:

1.9"/47.6 mm wide
1.8"/46.0 mm long
2.1"/53.1 mm with lightning
.48"/12.1 mm thick

Ultrasonic Module Weight:

1.1oz/31.2g

Enclosure Material:

Anodized Aluminum

Warranty:

1 year

*Results will vary depending upon device settings like brightness and GPS.

Made for iPod iPhone iPad

Microphones & Accessories

wildlife ACOUSTICS

Song Meter SM4BAT FS and SM4BAT ZC

SMM-U1 Ultrasonic Microphone (included)

SMX Horn Attachment

GPS Accessory

SM3/SM4 Power Adapter Cable

Ultrasonic Calibrator

Cables (3m-50m lengths)

Song Meter SM3BAT

SMM-U1 Ultrasonic Microphone

SMM-A1 Acoustic Microphone

SMX Horn Attachment

SM3 Security Housing

SM3/SM4 Power Adapter Cable

SM3 GPS Option

Ultrasonic Calibrator

Cables (3m-50m lengths)

APPENDIX H

ACOUSTIC DETECTOR LOCATION PHOTO LOG

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VAOC-1_1 Facing southeast and pointing in the same direction as the microphone from a small canopy gap along a dirt road leading to a pond.

VAOC-1_2 Photo taken looking north at the detector across the dirt road in the middle of the small canopy gap

VAOC-1_3 Photo taken looking northeast perpendicular to microphone into the canopy gap

VAOC-1_4 Photo of pond 40 m from detector at the end of the flyway being surveyed

VAOC-1_5 Photo taken looking northwest along the dirt road flyway with the detector in the background

VAOC-2_1 Photo facing northwest in the direction the microphone is pointing, parallel with the stream corridor flyway

VAOC-2_2 Photo taken facing southeast in the opposite direction of microphone along the stream corridor flyway

VAOC-2_3 Photo facing southwest perpendicular to microphone to open understory forest across the stream

APPENDIX I

2016 RANGE-WIDE INDIANA BAT SUMMER SURVEY GUIDELINES

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2016
RANGE-WIDE INDIANA BAT SUMMER SURVEY GUIDELINES
April 2016

(changes from the 2015 guidelines are in **blue**)

INTRODUCTION

The Indiana bat (*Myotis sodalis*) was originally listed as being in danger of extinction under the Endangered Species Preservation Act of 1966 (32 FR 4001, March 11, 1967), and is currently listed as endangered under the Endangered Species Act (ESA) of 1973, as amended. This survey protocol provides the U.S. Fish and Wildlife Service's (USFWS) recommended guidance on survey methodology and outlines additional reporting requirements for surveyors.

The following guidance is designed to determine whether Indiana bats are present[1] or likely absent at a given site during the summer (May 15 to August 15). The phased-approach, which includes coordination with the USFWS[2], habitat assessments, and acoustic, mist-net, radio-tracking, and emergence surveys, supersedes all prior summer survey guidance. Future changes to this guidance may occur and will be posted on the USFWS Indiana bat summer survey guidance website (http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html). Please check this website to ensure use of the most current version of the guidance.

These protocols may be different from those designed for general bat monitoring as part of the North American Bat Monitoring Program (NABat)[3]. NABat surveys may be thought of as similar to breeding bird surveys and are not project-specific surveys in most cases. Information from NABat surveys can be considered as part of "best available" information when assessing whether there is already some existing information on presence of Indiana bats in the vicinity of a given project. We recommend following these guidelines for presence/probable absence surveys.

NOTE: These protocols can also be used for northern long-eared bat (NLEB) presence/probable absence surveys for the 2016 field season. The only difference is our definition of suitable summer habitat for NLEBs and a weather-related exception in the northern portion of its range.

OBJECTIVES

The objectives of Indiana bat summer survey guidelines are to (1) standardize range-wide survey procedures; (2) maximize the potential for detection/capture of Indiana bats at a minimum

[1] The guidance are not intended to be rigorous enough to provide sufficient data to fully determine population size or structure.

[2] Coordinate with the appropriate state natural resource agencies and any involved federal agency(ies) whenever "USFWS" coordination is listed. USFWS FO(s) may direct project sponsors to state agencies for existing occurrence information. Coordinate with your local USFWS FO(s) to understand the process for their area of jurisdiction.

[3] Loeb et al. 2015 available at https://www.fort.usgs.gov/products/23886

acceptable level of effort;(3) make accurate presence/absence determinations; and (4) aid in conservation efforts for the species by identifying areas where the species is present.

BACKGROUND

In 2011, the USFWS developed a multi-agency team to determine whether improvements could be made to the 2007 Indiana Bat Mist-Net Protocols. The team included members of the four USFWS regions (Midwest, Northeast, Southeast, and Southwest) where Indiana bats are known to occur, representatives of state natural resource agencies from three of those four regions (Midwest, Northeast, and Southeast), and representatives from three federal agencies (U.S. Geological Survey (USGS), Department of Defense, and U.S. Forest Service). We obtained informal peer review of the draft guidelines in February 2012, gathered additional information in 2012, and made a revised version available for public comment in 2013 [78 FR 1879, January 9, 2013, and 78 FR 9409, February 8, 2013]. The USFWS implemented revised guidance in 2014. The USGS conducted initial independent testing of automated acoustic software programs during the winter of 2014-15 and continues to test new versions of available software. The USFWS made some additional revisions to the guidelines in 2015.

We considered the best available information for all aspects of the guidance. For example, please see our white paper[4] outlining the methodologies used to determine the minimum level of survey effort. The USFWS continues to work with local, State, and Federal biologists; scientific and academic institutions; commercial organizations; and other interested parties to collect additional data on the distribution, ecology, and biology of the Indiana bat and looks forward to receiving any additional pertinent information.

GENERAL PROCESS

Indiana bat surveys for some proposed projects will require modification (or clarification) of this guidance through coordination with the USFWS FO(s) responsible for the state(s) in which the project occurs[5]. If not already required by federal permit, federal action agencies and surveyors should develop a proposed survey study plan in coordination with the USFWS FO(s) so that all parties fully understand which methods will be deployed, what assumptions will be made, and what the various outcomes would be based on the results of each step. Project proponents may stop survey work at any point once an assumption or documentation of Indiana bat presence occurs. Pre-survey coordination typically will preclude the need for subsequent reviews of intermediate steps by USFWS FO(s) during the busy field season. An online directory of USFWS FO(s) is available at http://www.fws.gov/offices/. Unless otherwise agreed to by the USFWS, negative presence/probable absence survey results obtained using this guidance are

[4] Available at http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html

[5] For example, project sponsors for large acreage and/or landscape-scale projects that do not result in permanent habitat loss and would not pose an ongoing threat of lethal take, especially those proposed by land management agencies, may work with local USFWS FOs to apply different scales of surveys (broad vs. project-level) or different types of surveys, such as long-term monitoring results (e.g., forest-wide acoustic transect data) and/or targeted survey efforts (e.g., sub-sampling of large project areas), to address P/A concerns.

valid for a minimum of two years[6] from the completion of the survey unless new information (e.g., other nearby surveys) suggest otherwise. If not already required by federal permit, please submit all results (negative or positive) from any phase to the USFWS FO(s). We strongly encourage this coordination as it improves the USFWS' understanding of (1) the level of survey effort underway and (2) the distribution of the species. A single report can be submitted at the end of all phases conducted for a given project.

USFWS FO(s) level coordination is also important during the survey planning process. The USFWS recognizes that there may be project-specific habitat conditions that do not lend themselves to surveying with either acoustic detectors or mist-nets even though it met the definition of suitable Indiana bat summer habitat. The guidelines that are described in this document are designed to be implemented in habitats conducive to each technique described. We strongly encourage coordination with the FO(s) prior to implementation of methodologies that may not be appropriate for site-specific habitat conditions.

Because Indiana bat surveys may result in take, such surveys should only be conducted by a qualified biologist[7]. Generally, a recovery permit for the Indiana bat authorizes the capture of bats for identification, and handling of bats for measurements, photography, and radio transmitter attachment. Following this guidance will meet standard USFWS requirements; however, surveyors also need to ensure they meet all applicable state permitting and reporting requirements. Failure to follow the survey guidance, as written, and/or failure to follow a study plan which has received concurrence from the local USFWS FO(s), may result in USFWS FO recommendations for additional survey effort.

The following provides a step-by-step outline of how Indiana bat summer surveys should be conducted in 2016. Some of these steps can occur concurrently.

PHASE 1 – INITIAL PROJECT SCREENING

Step 1. Coordinate with the U.S. Fish and Wildlife Service Field Office(s)[8] regarding existing Indiana bat summer occurrence information.
[*Projects located within known Indiana bat summer habitat will not proceed to Phase 2 of this process.*]

a) If a project (located within or outside of a known maternity colony home range) is

[6] The timeframe may be reduced if significant habitat changes have occurred in the area or increased based on local information.
[7] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for Indiana bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to net and handle Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.
[8] Coordinate with the appropriate state natural resource agencies and any involved Federal Action agencies whenever "USFWS" coordination is listed. USFWS FO(s) may direct project sponsors to state agencies for existing occurrence information. Coordinate with your local USFWS FO(s) to understand the process for their area of jurisdiction.

already covered under an existing Endangered Species Act (ESA) incidental take authorization (e.g., HCP, BO), then no further summer surveys are needed, follow the procedures previously authorized by the USFWS FO(s).

b) If there are known Indiana bat summer occurrences (e.g., known roost trees, capture locations, foraging locations) within the project action area[9]; **OR**

if there are no known Indiana bat summer occurrences within the proposed project area itself, but the project area is located within a known maternity colony home range[10]; **OR**

if the project is located outside a known maternity colony home range, but is within the range of the Indiana bat (note this can change over time), then proceed to Step 2.

Step 2. Conduct Habitat Assessment (Desktop or Field-based; see Appendix A).

a) If suitable summer habitat is present within the action area, then proceed to Step 3.

b) If suitable summer habitat is absent within the action area, then no further summer surveys are necessary; however, additional coordination with the USFWS FO(s) will be necessary if Indiana bats may be present during any other season and may be affected by the proposed project.

Step 3. Assess potential for adverse effects to Indiana bats.

a) If the project is not anticipated to result in adverse effects to Indiana bats (as proposed), then no further summer surveys are necessary, coordinate with the USFWS FO(s).

b) If the project may result in adverse effects to Indiana bats but the impacts can be adequately assessed and conservation measures can be designed to minimize those effects without additional presence/absence information (this includes **all** proposed projects within known maternity colony home ranges, but may include other areas as well), then no further summer surveys are necessary, coordinate with the USFWS FO(s) regarding an assessment of the project's potential effects, development of conservation measures, and determination of the need for any ESA incidental take authorization.

c) If the project does not meet the conditions of 3a or 3b, then proceed to **Phase 2**.

[9] The "action area" is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. [50 CFR Section 402.02]

[10] See USFWS Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects (Questions 4 & 5) http://www.fws.gov/midwest/endangered/mammals/inba/WindEnergyGuidance.html

PHASE 2 - PRESENCE/ABSENCE SURVEYS (NETTING OR ACOUSTIC SURVEYS)[11]

During the summer of 2016, presence/probable absence (P/A) of Indiana bats may be determined by conducting either Step 4 (mist-netting; see Appendix B) or Step 5 (acoustics; see Appendix C) as outlined below. It is the project proponent's choice as to which option to use. The summer survey season is from 15 May through 15 August[12] for either survey option. If netting is chosen as the preferred P/A method and an Indiana bat(s) is captured, then surveyors may immediately begin Phase 4/radio-tracking. Project proponents must decide whether they will proceed to Phase 4 in coordination with the USFWS FO before any mist netting occurs. Submit Phase 2 study plans to USFWS FO prior to conducting surveys.

Step 4. Conduct Mist-Netting Surveys following Recovery Unit-based Protocols[13] (see Appendix B)

Northeast and Appalachian Recovery Units (CT, DE, MA, MD, NC, NJ, NY, PA, eastern TN, WV, VA, VT):

Linear projects: a minimum of 6 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 42 net nights per 123 acres (0.5 km^2) of suitable summer habitat.

For example:

- 7 sites, 2 nets/site for 3 calendar nights = 42 net nights
- 7 sites, 3 nets/site for 2 calendar nights = 42 net nights
- 3 sites, 2 nets/site for 7 calendar nights* = 42 net nights

*Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

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[11] Note: acoustic and/or mist-net surveys should be conducted in the best suitable habitat possible for each survey type to increase the likelihood of detecting/capturing Indiana bats. In some cases, the most suitable habitat for effectively conducting surveys may occur outside a project site boundary and may be sampled if landowner permission is available. For projects with multiple survey areas (e.g., >123 acres or >1 km), survey methods may be interchanged. For example, acoustics could be used for one 123-acre survey area and netting could be used for another 123-acre area.

[12] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

[13] The Indiana bat populations in the Northeast and Appalachian Recovery Units have been most heavily impacted by white-nose syndrome to date; therefore, we recommend higher survey effort when compared to the Midwest and Ozark-Central Recovery Units. We have no recommendations for reducing the minimum level of effort required to demonstrate probable absence for projects <123 acres in size. Level of effort is based on detection probabilities and occupancy estimates that were derived from past survey efforts that used the same acreage threshold. Level of effort is designed to reach 90% confidence in negative survey results (see Niver et al. 2013).

a) If no capture of Indiana bats, then no further summer surveys are necessary[14].

b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO.

Midwest and Ozark-Central Recovery Units (AL, AR, IA, IL, IN, GA, KY, MI, MO, MS, OH, OK, central & western TN, and Lee County, VA):

Linear projects: a minimum of 4 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 9 net nights per 123 acres (0.5 km^2) of suitable summer habitat.

For Example:

- 3 sites, 1 nets/site for 3 calendar nights = 9 net nights
- 1 sites, 3 nets/site for 3 calendar nights = 9 net nights

The sampling period for each net shall begin at sunset and continue for at least 5 hours (longer survey periods may also improve success).

*Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are necessary.
b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO.

OR

Step 5. Conduct Acoustic Surveys[15] (see Appendix C)

Linear projects: a minimum of 2 detector nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 4 detector nights per 123 acres (0.5 km^2) of suitable summer habitat.

[14] NOTE: For Phase 2 Presence/Absence Surveys, wherever the phrase "no further summer surveys are necessary" occurs within this document, the USFWS FO(s) is in affect assuming probable absence of Indiana bats.
[15] Acoustic surveys are available as a Presence/Absence option throughout the range (i.e., Northeast, Appalachian, Midwest, and Ozark-Central Recovery Units).

2 detector locations per 123 acre "site" shall be sampled until at least 4 detector nights has been completed over the course of at least 2 calendar nights (may be consecutive).

For example:

- 2 detectors for 2 nights each (can sample the same location or move within the site)
- 1 detector for 4 nights (must sample at least 2 locations)

The acoustic sampling period for each site must begin at sunset[16] and ends at sunrise each night of sampling.

Optional coarse screening - for high frequency (HF) or myotid calls (depending on available filters) or Proceed to Step 6

i) If no positive detection of HF calls (≥35 kHz) or myotid calls, no further summer surveys necessary.

ii) If positive detection of HF or myotid calls, then
(a) proceed to Step 6 for further acoustic analysis; **OR**
(b) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
(c) assume presence and proceed to **Phase 3**.

Step 6. Conduct Automated Acoustic Analyses for each site that had HF or Myotid calls from Step 5 or ALL sites if Step 5 was not conducted.
(NOTE: cannot skip this step and proceed directly to Step 7)

Use **one or more** of the currently available 'approved' acoustic bat ID programs[17] (use most current approved software versions available and manufacturer's recommended settings for Indiana bat P/A surveys). 'Candidate' programs are not yet approved by USFWS for stand-alone use for Indiana bat P/A surveys, but may be used in conjunction with one or more of the approved programs. Include your plans for which specific software program(s) you will use in your survey work plan and submit for USFWS FO(s) review prior to conducting surveys. Beginning with acoustic data from night one at each acoustic site, run each night's data for each site through your chosen ID program(s). Review results by site by night from each acoustic ID program used[18].

[16] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early-flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

[17] Approved and candidate programs are listed at http://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html

[18] The approved acoustic identification programs all have implemented a maximum likelihood estimator (MLE) at this time. If the analysis of collected calls at a given site on a given night results in the probable presence of Indiana bats with high levels of certainty ($P<0.05$), then select one of the options available in Step 6b.

a) If Indiana bat presence is considered unlikely by all of the approved and candidate program(s) used in analysis, then no further summer surveys necessary.

b) If Indiana bat presence is considered likely at one or more sites on one or more nights by any approved or candidate program(s) used in analysis, then

i) proceed to Step 7 for qualitative ID; **OR**
ii) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
iii) assume presence and proceed to **Phase 3**.

Step 7. Conduct Qualitative Analysis of probable Indiana bat calls from Step 6.

At a minimum, for each site/night a program considered Indiana presence likely (MLE results) review all files from that site/night. Qualitative analysis[19] must also include a comparison of the results of each acoustic ID program by site and night (including: number of call files flagged as probable Indiana bats by each tool used; an evaluation of other species identified by the acoustic ID program; individual file level agreements and disagreements on Indiana bats between programs; and a qualitative analysis of ALL probable Indiana bat call sequences to further evaluate that the correct ID has been recommended by the program used).

a) If no visual confirmation of probable Indiana bats, then no further summer surveys necessary.

b) If visual confirmation of probable Indiana bats, then

i) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
ii) assume presence and proceed to **Phase 3**.

PHASE 3. CONDUCT MIST-NETTING SURVEYS TO CAPTURE INDIANA BATS.

If netting was not conducted as the P/A method, then netting may be conducted in Phase 3 to capture and characterize (e.g., sex, age, reproductive condition) the Indiana bats that are present in an area and to facilitate Phase 4 efforts. We encourage working with the FOs to develop Phase 3 netting plans based on best available information (e.g., positive acoustic locations). There are no minimum requirements for this phase as this is not a P/A phase.

a) If no Indiana bats are captured, then coordinate with the USFWS FO.

b) If Indiana bats are captured, then proceed to **Phase 4**.

[19] Qualitative analysis of each acoustic site and night with probable detections of Indiana bats during Step 6 must include the entire night's high-frequency call data and not just those files making it through the acoustic analysis tools as probable Indiana bats.

PHASE 4. CONDUCT RADIO-TRACKING AND EMERGENCE SURVEYS (See Appendices D and E).

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APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Summer habitat assessments are Step 2 of Phase 1- Initial Project Screening. The information below is provided to assist applicants, consultants, and/or project proponents (hereinafter termed the "applicant") in establishing whether summer surveys for Indiana bats should be conducted. As a reminder, the first step for determining presence of Indiana bats at a given site is to determine whether there is any existing occurrence data available for the vicinity of the project from the local USFWS FO. This step can be conducted remotely via a desktop analysis (e.g., use of aerial photography to assess the potential presence of suitable habitat). The applicant is responsible for developing and providing sufficient information as to whether potentially suitable summer Indiana bat habitat exists within a proposed project area. If suitable habitat is present, the applicant should calculate the amount and submit this to the USFWS FO(s) and determine the need for any presence/absence surveys (Phase 2). Note: if Indiana bats are present or assumed to be present during any phase, more detailed habitat information may be necessary to adequately assess the potential for impacts (see attached example Indiana Bat Habitat Assessment Datasheet). If no suitable habitat is present, no surveys are needed to assess risk during the summer. Habitat assessments for Indiana bats can be completed any time of year and applicants are encouraged to submit results and proposed Phase 2 study plans well in advance of the summer survey season.

PERSONNEL

Habitat assessments should be completed by individuals with a natural resource degree or equivalent work experience.

DEFINITION FOR POTENTIALLY SUITABLE INDIANA BAT SUMMER HABITAT

Suitable summer habitat for Indiana bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats[20] such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥5 inches dbh[21] (12.7 centimeter) that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat. We recommend that project proponents or their representatives

[20] Non-forested habitats typically should be excluded from acreages used to establish a minimum level of survey effort for Phase 2 surveys.

[21] While trees <5 inches (<12.7 cm) dbh that have exfoliating bark, cracks, crevices, and/or hollows may have some potential to be male Indiana bat summer roosting habitat, the USFWS does not consider early-successional, even-aged stands of trees <5 inches dbh to be suitable roosting habitat for the purposes of this guidance. Suitable *roosting* habitat is defined as forest patches with trees of 5-inch (12.7 cm) dbh or larger. However, early successional habitat with small diameter trees may be used as foraging habitat by Indiana bats. Therefore, a project that would remove or otherwise adversely affect ≥20 acres of early successional habitat containing trees between 3 and 5 inches (7.6-12.7 cm) dbh would require coordination/consultation with the USFWS FO to ensure that associated impacts would not rise to the level of take. The USFWS may request P/A surveys if >20 acres of early successional habitat were proposed for removal.

coordinate with the appropriate USFWS Field Office to more clearly define suitable habitat for their particular region as some differences in state/regional suitability criteria may be warranted (e.g., high-elevation areas may be excluded as suitable habitat in some states).

Examples of unsuitable habitat:

- Individual trees that are greater than 1,000 feet from forested/wooded areas;
- Trees found in highly-developed urban areas (e.g., street trees, downtown areas); and
- A pure stand of less than 3-inch dbh[22] trees that are not mixed with larger trees.

DEFINITION FOR POTENTIALLY SUITABLE NORTHERN LONG-EARED BAT SUMMER HABITAT

Suitable summer habitat for NLEB consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥3 inches dbh that have exfoliating bark, cracks, crevices, and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit characteristics of suitable roost trees and are within 1,000 feet of other forested/wooded habitat[23]. NLEB has also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat[24]. NLEBs typically occupy their summer habitat from mid-May through mid-August each year[25] and the species may arrive or leave some time before or after this period.

Examples of unsuitable habitat:

- Individual trees that are greater than 1,000 feet from forested/wooded areas;
- Trees found in highly-developed urban areas (e.g., street trees, downtown areas); and
- A pure stand of less than 3-inch dbh trees that are not mixed with larger trees.

[22] Suitable *roosting* habitat is defined as forest patches with trees of 5-inch (12.7 cm) dbh or larger. However, early successional habitat with small diameter trees may be used as foraging habitat by Indiana bats. Therefore, a project that would remove or otherwise adversely affect ≥20 acres of early successional habitat containing trees between 3 and 5 inches (7.6-12.7 cm) dbh would require coordination/consultation with the USFWS FO to ensure that associated impacts would not rise to the level of take. The USFWS may request P/A surveys if >20 acres of early successional habitat were proposed for removal.

[23] This number is based on observations of bat behavior indicating that such an isolated tree (i.e., ≥1000 feet) would be extremely unlikely to be used as a roost. This distance has also been evaluated and vetted for use for the Indiana bat. See the "Indiana bat Section 7 and Section 10 Guidance for wind Energy Projects," question 33, found at: http://www.fws.gov/midwest/endangered/mammals/inba/WindEnergyGuidance.html

[24] Trees found in highly-developed urban areas (e.g., street trees, downtown areas) are extremely unlikely to be suitable habitat.

[25] Exact dates vary by location.

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

SUBMISSION OF HABITAT ASSESSMENT AND PHASE 2 STUDY PLAN (IF NEEDED)

If a proposed project may affect (positively or negatively) Indiana bats and the conditions outlined in Step 3 a or b are not met, a habitat assessment report should be submitted to the appropriate USFWS FO(s) (and/or to the lead Federal Action Agency, such as the USACE, as appropriate) along with a draft study plan for the Phase 2 (acoustic or netting) survey (if suitable habitat is present). Complete reports will include the following:

1. Full names and relevant titles/qualifications of individuals (e.g., John E. Smith, Biologist II, State University, B.S. Wildlife Science 2007) completing the habitat assessment and when the assessment was conducted
2. A map and latitude/longitude or UTM clearly identifying the project location (or approximate center point) and boundaries
3. A detailed project description (if available)
4. Documentation of any known/occupied spring staging, summer, fall swarming, and/or winter habitat for Indiana bats within or near the project area
5. A description of methods used during the habitat assessment
6. A summary of the assessment findings and a completed Indiana Bat Habitat Assessment Datasheet (see attached below; use of this particular datasheet is optional)
7. Other information that may have a bearing on Indiana bat use of the project area (e.g., presence of fall or winter habitat [caves, crevices, fissures, or sinkholes, or abandoned mines of any kind], bridges and other non-tree potential summer roosts.)
8. Any other information requested by the local USFWS FO(s) related to the project

In addition, Phase 2 Study Plans should contain the following:

1. A statement as to which type of P/A surveys will be conducted (i.e., mist netting or acoustic surveys) and how the proposed survey level of effort (i.e., total # of net nights or detector nights) was calculated/determined;
2. A map depicting the proposed number of survey sites (mist netting or acoustic) and their tentative distribution throughout the project area;
3. A tentative list of surveyors names and copies of relevant federal permits (if required in the project State);
4. A tentative survey schedule (e.g., start date, duration, end date);
5. For mist netting surveys with planned Phase 4 radio-tracking – the approximate number and distribution of transmitters (e.g., prioritization of sex/age, maximum

number per site) and a request that bats targeted for tracking may be held for up to 45 minutes[26] to allow for application of transmitters; and

6. For acoustic surveys - information on which specific program(s) will be used and what level of acoustic analyses will be conducted.

[26] Current standard federal Section 10 bat permit conditions require prior written approval from the Field Supervisor in the USFWS FO(s) if capture times may exceed 30 minutes.

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name:_____ Date:_____

Township/Range/Section:_____

Lat Long/UTM/ Zone:_____ Surveyor:_____

Brief Project Description

Project Area				
Project	Total Acres	Forest Acres		Open Acres
Proposed Tree Removal (ac)	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing	

Vegetation Cover Types	
Pre-Project	**Post-Project**

Landscape within 5 mile radius
Flight corridors to other forested areas?
Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

Proximity to Public Land
What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area
A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description
Sample Site No.(s): _____

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
Pools/Ponds (# and size)		Open and accessible to bats?		
Wetlands (approx. ac.)	Permanent	Seasonal		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
Dominant Species of Mature Trees				
% Trees w/ Exfoliating Bark				
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
No. of Suitable Snags				

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? _____

Additional Comments:

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX B
PHASE 2 or 3 MIST-NETTING

Mist-netting can be used as a presence/probable absence method (Phase 2 surveys) or it can be conducted for the purpose of attempting to capture Indiana bats after detection during acoustic presence/probable absence surveys (Phase 3 surveys). The same recommendations (e.g., season, personnel, equipment, net placement, checking nets) apply for either use of mist-netting surveys.

SUMMER MIST-NETTING SEASON: May 15[27] – August 15[28]

Capture of reproductive adult females (i.e., pregnant, lactating, or post-lactating) and/or young of the year during May 15 – August 15 confirms the presence of a maternity colony in the area. Since adult males and non-reproductive females have commonly been found summering with maternity colonies, radio-tracking results will be relied upon to help determine the presence or absence of a maternity colony or large concentrations of bats in the area when only males and/or non-reproductive females are captured.

PERSONNEL

A qualified biologist(s)[29] must (1) select/approve mist-net set-ups in areas that are most suitable for capturing Indiana bats, (2) be physically present at each mist-net site throughout the survey period, and (3) confirm all bat species identifications. This biologist may oversee other biological technicians and manage mist-net set-ups in close proximity to one another as long as the net-check timing (i.e., every 10 minutes) can be maintained while **walking** between nets.

COORDINATION WITH USFWS FO(s)

If not already required by federal permit, we recommend that applicants submit a draft study plan for all survey phases to the USFWS FO(s) for review and approval. Study plans should include a map/aerial photo identifying the proposed project area boundaries, suitable bat habitats and acreages within the project area, and the proposed number and tentative locations of net sites.

EQUIPMENT

Use the finest, lowest visibility mesh mist-nets commercially available, as practicable. Currently, the finest net on the market is 75 denier, 2 ply, denoted 75/2 (Arndt and Schaetz

[27] Due to concerns with transmission of white-nose syndrome, some USFWS FO(s) and state natural resource agencies have delayed the start of the Indiana bat summer field survey season/mist-netting until June 1. Surveyors/applicants should always coordinate with local USFWS FO(s) and state natural resource agencies before beginning surveys.

[28] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

[29] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for Indiana bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to net and handle Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

2009); however, the 50 denier nets are still acceptable for use at this time. The finest mesh size available is approximately 1½ inches (38 millimeters).

No specific hardware is required. There are many suitable systems of ropes and/or poles to hold nets. The system of Gardner et al. (1989) has been widely used. See NET PLACEMENT for minimum net heights, habitats, and other netting requirements that affect the choice of hardware.

To minimize potential for disease transmission, any equipment that comes in contact with bats should be kept clean and disinfected, following approved protocols; this is particularly a concern relative to white-nose syndrome (WNS). Disinfection of equipment to avoid disease transmission (e.g., WNS) is required; protocols are posted at http://www.whitenosesyndrome.org/. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

MINIMUM PRESENCE/ABSENCE MIST-NETTING LEVEL OF EFFORT (PHASE 2)

The number of net sites required for a non-linear project will be dependent upon the overall acreage of suitable habitat proposed to be impacted by the action. To determine the survey effort, quantify the amount of suitable summer habitat within the project area. NOTE: for projects where other impacts are likely (e.g., collision), ensure that presence/probable absence surveys are designed to cover the entire project area and NOT just the locations where tree removal is planned. Additional guidance for linear project is in Appendix F.

Conduct Mist-Netting Surveys following Recovery Unit-based protocols[30]

Northeast and Appalachian Recovery Units (CT, DE, MA, MD, NC, NJ, NY, PA, eastern TN, WV, VA, VT):

Linear projects: a minimum of 6 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 42 net nights per 123 acres[31] (0.5 km^2) of suitable summer habitat.

For example:

- 7 sites[32], 2 nets[33]/site for 3 calendar nights = 42 net nights

[30] The Indiana bat populations in the Northeast and Appalachian Recovery Units have been most heavily impacted by white-nose syndrome; therefore, we recommend higher survey effort when compared to the Midwest and Ozark-Central Recovery Units.
[31] We have no recommendations for reducing the minimum level of effort required to demonstrate probable absence for projects <123 acres in size. Detection probabilities and occupancy estimates were derived from past survey efforts that used the same acreage threshold (see Niver et al. 2013).
[32] A site is defined as a geographic area to be sampled. It can include one or more nets that can be managed by one Qualified Biologist.
[33] A net is defined as any combination of individual panels and poles (e.g., single, double, triple high) to fill the area (e.g., corridor) being sampled.

- 7 sites, 3 nets/site for 2 calendar nights = 42 net nights
- 3 sites, 2 nets/site for 7 calendar nights* = 42 net nights

Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are necessary[34].
b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO(s).

Midwest and Ozark-Central Recovery Units (AL, AR, GA, IA, IL, IN, KY, MI, MO, MS, OH, OK, and central & western TN):

Linear projects: a minimum of 4 net nights per km (0.6 miles) of suitable summer habitat (see Appendix F).

Non-linear projects: a minimum of 9 net nights per 123 acres (0.5 km^2) of suitable summer habitat.

- 3 sites, 1 nets/site for 3 calendar nights = 9 net nights
- 1 sites, 3 nets/site for 3 calendar nights = 9 net nights

Maximum of 3 nights of consecutive netting at any given net location. After 3 consecutive nights of netting at the same location, you must change net locations or wait at least 2 calendar nights before resuming netting at the same location.

a) If no capture of Indiana bats, then no further summer surveys are necessary.
b) If capture of Indiana bat(s), then stop or proceed to **Phase 4** as previously decided in coordination with the FO(s).

MIST-NETTING SURVEYS TO CAPTURE INDIANA BATS AFTER ACOUSTICS WERE USED AS P/A METHOD (PHASE 3)

If netting was not conducted as the P/A method, then netting may be conducted to capture and characterize (e.g., sex, age, reproductive condition) the Indiana bats (documented through the Phase 2 acoustic P/A survey) present in an area and to facilitate radio-tracking (Phase 4) efforts. We encourage working with the FO(s) to develop Phase 3 netting plans based on best available information (e.g., positive acoustic locations). There are no

[34] NOTE: For Phase 2 Presence/Absence Surveys, wherever the phrase "no further summer surveys are necessary" occurs within this document, the USFWS FO(s) is in affect assuming probable absence of Indiana bats during the summer.

minimum requirements for this phase as this is not a P/A phase.

a) If no Indiana bats are captured, then coordinate with the USFWS FO.
b) If Indiana bats are captured, then proceed to **Phase 4** as previously decided in coordination with the FO(s).

NET PLACEMENT

Potential travel corridors (e.g., streams, logging trails) typically are the most effective places to net (although other places may also be productive; see Carroll et al. 2002). Place nets approximately perpendicular across the corridor. Nets should fill the corridor from side to side, extending beyond the corridor boundaries when possible, and from stream (or ground) level up to the overhanging canopy. Nets of varying widths and heights may be used as the situation dictates. A typical set is at least 5 m to 9 m high consisting of two or more nets stacked on top one another and from 6 m to 18 m wide. If netting over water, ensure there is enough space between the net and the water so that captured bats will not get wet.

Occasionally it may be necessary or desirable to net where a suitable corridor is lacking. The typical equipment described in the section above may be inadequate for these situations, requiring innovation on the part of the surveyor (see Humphrey et al. 1968). See Kiser and MacGregor (2005) for additional discussion about net placement.

Although no minimum spacing between mist-nets is being specified, surveyors should attempt to evenly distribute net set-ups throughout suitable habitat and must provide written justification in their report if net set-ups were not distributed throughout suitable habitat (i.e., why were they clumped?). Net set-ups can be repeatedly sampled throughout the project, but generally no more than 2-3 nights at a single location is recommended. In addition, changing locations within a project area may improve capture success (see Robbins et al. 2008; Winhold and Kurta 2008). Photo-document placement of nets.

SURVEY PERIOD

The survey period for each net shall begin at sunset[35] and continue for at least 5 hours (longer survey periods may also improve success).

CHECKING NETS

Each net set-up should be checked approximately every 10 minutes (Gannon et al. 2007). If surveyors monitor nets continuously, take care to minimize noise, lights and movement near the nets. Monitoring the net set-up continuously with a bat detector (ideally using ear phones to avoid alerting bats) can be beneficial: (a) bats can be detected immediately when they are

[35] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early-flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php.

captured, (b) prompt removal from the net decreases stress on the bat and potential for the bat to escape (MacCarthy et al. 2006), and (c) monitoring with a bat detector also allows the biologist to assess the effectiveness of each net placement (i.e., if bats are active near the net set-up but avoiding capture), which may allow for adjustments that will increase netting success on subsequent nights. There should be no other disturbance near the nets, other than to check nets and remove bats. Biologists should be prepared to cut the net if a bat is severely entangled and cannot be safely extracted within 3 or 4 minutes (CCAC 2003; Kunz et al. 2009).

Capture and handling are stressful for bats. Emphasis should be on minimizing handling and holding bats to as short a time as possible to achieve field study objectives. Indiana bats should not be held for more than 30 minutes after capture, unless the individual is targeted for radio-tracking. Bats targeted for radio-tracking should be released as quickly as possible, but no longer than 30 minutes[36] after capture, or as allowed in federal and state permits. See Kunz and Kurta (1988) for general recommendations for holding bats.

WEATHER, LIGHTING, AND OTHER ENVIRONMENTAL CONDITIONS

Severe weather adversely affects capture of bats. Some Indiana bats may remain active despite inclement weather and may still be captured while others in the same area become inactive. Therefore, negative surveys combined with any of the following weather conditions throughout all or most of a sampling period are likely to require an additional night of mist-netting[37]: (a) temperatures that fall below 50°F (10°C)[38]; (b) precipitation, including rain and/or heavy fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/seconds; 3 on Beaufort scale) for 30 or more minutes.

NOTE: Provided that nets are not dripping wet, surveyors can resume netting to meet the minimum 5-hour requirement after short periods of adverse weather. If nets are under good cover, light rain may not alter bat behavior. However, if no bats are being captured during marginal weather, coordinate with the USFWS FO(s).

[36] Current standard federal Section 10 bat permit conditions require prior written approval from the Field Supervisor in the USFWS FO(s) if capture times may exceed 30 minutes.
[37] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.
[38] If using this guidance for NLEB: Overnight survey temperatures may be lower in northern portions of the NLEB range, please coordinate with the local USFWS FO in the northern portion of the range for any variation in temperature requirements.

APPENDIX B
PHASE 2 or 3 MIST-NETTING

It is typically best to place net set-ups under the canopy where they are out of moonlight, particularly when the moon is half-full or greater. Net set-ups illuminated by artificial light sources should also be avoided.

The shining of lights, and noise should be kept to a minimum with no smoking around the survey sites. In addition, the use of radios, campfires, running vehicles, punk sticks, citronella candles and other disturbances will not be permitted within 300 feet of mist nets (or acoustic detectors) during surveys.

DOCUMENTATION OF INDIANA BAT CAPTURES

If an Indiana bat(s) is captured during mist-netting, protocols for radio-tracking and emergence survey requirements, as provided in Appendix D and E, respectively, should be followed. In addition, the appropriate USFWS FO(s) must be notified of the capture within 48 hours (or in accordance with permit conditions), and the sex and reproductive condition of the bat and GPS coordinates of the capture site should be provided.

Several species of bats from the genus *Myotis* share common features which can make identification difficult; Indiana bats and little brown bats (*Myotis lucifugus)* can be particularly difficult to distinguish. Photo-documentation of all bats captured and identified as Indiana bats and the first 10 little brown bats per project are requested to verify the identifications made in the field.

Photo-documentation should include diagnostic characteristics:

- a ¾-view of face showing ear, tragus, and muzzle
- view of calcar showing presence/absence of keel
- a transverse view of toes showing extent of toe hairs

If a bat from the genus *Myotis* is captured during mist netting that cannot be readily identified to the species level, then species verification may be attempted through fecal DNA analysis. Collect one or more fecal pellets (i.e., guano) from the bat in question by placing it temporarily in a holding bag (15 minutes is usually sufficient, no more than 30 minutes is recommended). The pellet (or pellets) collected should be placed in a small vial (e.g., 1.5 ml) with silica gel desiccant; pellets from each individual bat should be stored in separate vials and out of direct light. Fees charged by independent laboratories for sequencing fecal DNA samples is generally inexpensive (approx. $50 per guano sample), however, it has been challenging to identify labs willing to consistently conduct these analyses. Any additional information and a list of available laboratories will be made available on the Indiana bat webpage on the USFWS's Region 3 website (http://www.fws.gov/midwest/Endangered/mammals/inba/index.html).

APPENDIX B
PHASE 2 or 3 MIST-NETTING

SUBMISSION OF MIST-NETTING RESULTS

Provide results of netting surveys to the appropriate USFWS FO(s) in accordance with previously agreed upon[39] timeframes and formats[40]. If Indiana bats are captured, this report should also include the results of subsequent radio-tracking and emergence counts. Reports should include the following:

1. Copy of prior phase reports (if not previously provided).
2. Explanation of any modifications from original survey plan (e.g., altered net locations).[41]
3. Description of net locations (including site diagrams), net set-ups (include net heights), survey dates, duration of surveys, weather conditions, and a summary of findings.
4. Map identifying netting locations and information regarding net set-ups, including lat/long or UTM, individual net placement, net spacing (i.e., include mist-netting equipment in photographs of net locations), and adequate justification if net set-ups are not evenly distributed across suitable habitat within the project area.
5. Full names of mist-netting personnel attending each mist-net site during an operation, including the federally-permitted/qualified biologist present at each mist-net site. Indicate on the field data sheet the full name of person who identified bats each night at each site.
6. Legible copies of all original mist-netting datasheets (see example datasheet below) and a summary table with information on all bats captured during the survey including, but not limited to: capture site, date of capture, time of capture, sex, reproductive condition, age, weight, right forearm measurement, band number and type (if applicable), and Reichard's wing damage index score (Reichard and Kunz. 2009).
7. Photographs of all net set-ups, as well as **all** Indiana bats and the first 10 little brown bats captured from each project, so that the placement of netting equipment and identification of species can be verified. Photographs of bats should include all diagnostic characteristics that resulted in the identification of the bat to the species level.
8. Any other information requested by the local USFWS FO(s) related to the project.

[39] As discussed in the Introduction, we encourage coordination with USFWS FO(s) prior to implementation of any surveys to ensure that all parties agree upon the need for surveys, the methods proposed, and the decisions from various survey results.

[40] In 2016, Region 3 (R3) of the USFWS is conducting a pilot study to help standardize reporting of bat survey data. In addition to a traditional written report, R3 federal permit holders (and other regions/FOs as requested) will be required to submit their survey data using standardized permit reporting spreadsheets available on the R3 Indiana Bat Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).

[41] If the USFWS previously agreed upon the study plan we need to understand whether the revised work still accomplished the agreed upon methods

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APPENDIX B
PHASE 2 or 3 MIST-NETTING

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APPENDIX B
PHASE 2 or 3 MIST-NETTING

Sample Data Sheets for Indiana Bat Surveys

Site No.			Project/Firm:				Date:				
Location:											
County:			State:	Quad:			Quadrant:				
Lat/Long (DMS):	N		W		Zone:		Surveyors:				

#	Time	Species	Age	Sex	Repro. Cond.*	RFA (mm)	Mass (g)	Net/ Ht	Guano/ Hair	Wing Score	Band # Type
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
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25											
26											
27											
28											
29											
30											

Moon Phase:		%
	Rise	Set
Moon:		
Sun:		

Time	Temp	Sky	Wind	# Bats
Avg				

Sky Code	
0	Clear
1	Few Clouds
2	Partly Cloudy
3	Cloudy or overcast
4	Smoke or fog
5	Drizzle or light rain
6	Thunderstorm

Beauford Wind Code	
0	Calm (0 mph)
1	Light wind (1-3 mph)
2	Light breeze (4-7 mph)
3	Gentle breeze (8-12 mph)
4	Moderate breeze (13-18 mph)

*Repro. Cond (Reproductive Condition): (P) pregnant; (L) lactating; (PL) post-lactating; (NR) non-reproductive, (TD) testes descended

APPENDIX B
PHASE 2 or 3 MIST-NETTING

Sample Data Sheets for Indiana Bat Surveys

Net Site Diagram	Dominant Vegetation
	1
	2
	3
	4
	5

Net Site(s) by Habitat				
Habitat	A	B	C	
River				
Stream				
Pond				
Road Rut				
Corridor				
Cave/mine				
Total				

No. of Poles X Net length				
A	=		X	
B	=		X	
C	=		X	
D	=		X	

Other Species:

Comments:

APPENDIX C
PHASE 2 ACOUSTIC SURVEYS

SUMMER ACOUSTIC SURVEY SEASON: May 15 – August 15[42]

PERSONNEL[43]

Overall: Acoustic surveyors should have either completed one or more of the available bat acoustic courses/workshops (e.g., BCI, BCM, AnaBat) or be able to show similar on-the-job or academic experience.

Detector Deployment: Acoustic surveyors should have a working knowledge of the acoustic equipment and Indiana bat ecology. Surveyors should be able to identify appropriate detector placement sites and establish those sites in the areas that are most suitable for recording high-quality Indiana bat calls. Thus, it is highly recommended that all potential acoustic surveyors attend appropriate training and have experience in the proper placement of their field equipment.

Acoustic Analysis: Acoustic surveyors should have a working knowledge of the approved acoustic analysis programs. Thus, it is highly recommended that all potential acoustic surveyors attend appropriate training and have experience in the analysis of acoustic recordings.

Qualitative Analysis: Individuals qualified to conduct qualitative analysis of acoustic bat calls typically have experience: (1) gathering known calls. This provides a valuable resource in understanding how bat calls change and the variation present in them; (2) identifying bat calls recorded in numerous habitat types; (3) familiarity with the species likely to be encountered within the project area; and (4) individuals must have multiple years of experience and must have stayed current with qualitative ID skills. A resume (or similar documentation) must be submitted along with final acoustic survey reports for anyone making final qualitative identifications.

COORDINATION WITH USFWS FO(s)

If not already required by federal permit, we recommend that applicants submit a draft study plan for all survey phases to the USFWS FO(s) for review and approval. Study plans should include a map/aerial photo identifying the proposed project area boundaries, suitable bat habitats and acreages within the project area, the proposed number and tentative locations of acoustic monitoring sites, and the identification of the approved acoustic software program(s) (and version #) used for analysis of calls for the specific project. If a single software program is used for analysis, surveyors will not be allowed to switch programs from what was originally identified in their final study plan.

DETECTOR AND MICROPHONE REQUIRED CHARACTERISTICS

Full-spectrum and/or zero-crossing detectors are suitable for use in this survey protocol.

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[42] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

[43] Coordinate with your local FO regarding any state-specific requirements.

Directional, hemispherical, and omnidirectional microphones are acceptable for acoustic surveys. The use of external microphones on an extension cable is the preferred deployment as it further limits degradation of call quality. Recording without after-market directional horns on hemispherical and omnidirectional microphones is preferred as the addition of these systems may result in some signal degradation and directional microphones are commercially available.

Use recommended manufacturer detector settings for conducting Indiana bat P/A surveys.

ACOUSTIC SAMPLING PROTOCOL

Detector/Microphone Placement

Detector/Microphone placement is critical to the successful isolation of high-quality bat call sequences for later analysis. The following locations are likely to be suitable sites for detectors/microphones, including, but not limited to: (a) forest-canopy openings; (b) near water sources; (c) wooded fence lines that are adjacent to large openings or connect two larger blocks of suitable habitat; (d) blocks of recently logged forest where some potential roost trees remain; (e) road and/or stream corridors with open tree canopies or canopy height of more than 33 feet (10 meters); and (f) woodland edges (Britzke et al. 2010). Of equal importance to acoustic site selection is the surveyor's working knowledge of the sampling volume and area of highest sensitivity within the zone of detection around a given microphone, which helps to ensure that detector placement as well as microphone selection and orientation are best suited for a particular site. Detection distance, placement (e.g., location, orientation, height of microphone), and specific features (e.g., vegetation, water, and other obstructions) at the sample site should dictate whether a directional, hemispherical, or omnidirectional microphone is used. If detectors/microphones are placed in unsuitable locations, effective data analysis may be impossible, and the results of the sampling effort will likely be invalid.

Many features (e.g., vegetation, water, wind turbines, high-tensile power-lines, micro-wave towers) can obstruct and reflect call sequences recorded in the field and thereby reduce the surveyor's ability to record high-quality bat call sequences. The following recommendations are provided to aid surveyors in their selection of acoustic sites (also see Chenger and Tyburec 2014). If surveyors choose acoustic sites outside of these recommendations, then adequate justification for doing so should be provided with the acoustic survey report provided to the USFWS FO(s); otherwise, results from these sites will not be accepted. Surveyors should deploy microphones: (a) at least 10 feet (3 meters) in any direction from vegetation or other obstructions (Hayes 2000; Weller and Zabel 2002; Chenger and Tyburec 2014); (b) in areas without, or with minimal[44], vegetation within 33 feet (10 meters) from the microphone; (c) parallel to woodland edges; and (d) at least 49 feet (15 meters) from known or suitable roosts[45] (e.g., trees/snags, buildings, bridges, bat houses, cave or mine portal entrances).

[44] If necessary, surveyors can remove small amounts of vegetation (e.g., small limbs, saplings) from the estimated detection cone at a site, much like what is done while setting up mist-nets. Deployment of detectors/microphones in closed-canopy locations that typically are good for mist-netting are acceptable as long as the area sampled below the canopy does not restrict the ability of the equipment's detection cone to record high-quality calls (i.e., the vegetation is outside of the detection cone).

[45] If the surveyor discovers a potential roost and wishes to document bat use, please refer to Appendix E for guidance on conducting emergence surveys and contact the USFWS FO(s).

Elevating a detector greater than 3 meters above ground level (AGL) vegetation dramatically improves recording quality. Microphones can be attached horizontally to a pole to listen out into flight space, rather than just listening up from the ground. This will serve to increase the volume of airspace sampled and avoid the distortion effect of recording near the ground.

Surveyors should distribute acoustic sites throughout the project area or adjacent habitats. In most cases, acoustic sites should be at least 656 feet (200 meters) apart. If closer spacing is determined to be necessary or beneficial (e.g., multiple suitable habitats and acoustic sites immediately adjacent to each other), sufficient justification must be provided in the acoustic survey report submitted to USFWS FO(s).

Verification of Deployment Location

It is recommended to temporarily attach GPS units to each detector (according to manufacturer's instructions) to directly record accurate location coordinates for each acoustic site that is paired with the acoustic data files. Regardless of technique used, accurate GPS coordinates must be generated and reported for each acoustic survey site.

Verification of Proper Functioning

It is highly recommended that surveyors ensure acoustic detectors are functioning properly through a periodic verification of performance to factory specifications (a service currently offered or in development by several manufacturers). It may be possible that independent service bureaus would be willing to perform this service, providing that a standard test/adjustment procedure can be developed.

It is also recommended to ensure equipment is working during set-up in the field. This can be done simply by producing ultrasound (e.g., finger rubs, calibrator, or follow the equipment manufacturer's testing recommendations) in front of the microphone at survey start and survey finish. These tests document that the equipment was working when deployed and when picked up (and by assumption throughout the entire period). Detector field settings (e.g., sensitivity, frequency, etc.) should follow the recommendations provided by the manufacturer. Surveyors should also save files produced by detectors (e.g., log files, status files, sensor files) as an excellent way to provide documentation when equipment was functioning within the survey period. Many types of detectors allow for setting timers that initiate and end recording sessions. This saves battery life as well as reducing the number of extraneous noise files recorded. However, if the units are visited when the timer is on (i.e., unit is in standby mode), the surveyor cannot verify that the unit is functioning properly. This is particularly important in areas where no bat activity is recorded for the entire night or during the last portion of the night. In these cases, if the surveyor cannot demonstrate that the detector was indeed functioning properly throughout the survey period, then the site will need to be re-sampled, unless adequate justification can be provided to the USFWS FO(s).

Selection of acoustic sites is similarly important. Suitable set-up of the equipment should result in high-quality call sequences that are adequate for species identification. Nights of sampling at individual sites that produce no bat calls may need to be re-sampled unless adequate justification (e.g., areas with significant bat population declines due to WNS) can be provided to the USFWS

FO(s). Modifications of the equipment (e.g., changing the orientation and/or microphone type) at the same location on subsequent nights may improve quantity and quality of call sequences recorded, which can be determined through daily data downloads. If modifications of the equipment do not improve call identification, then the detectors will need to be moved to a new location.

Orientation

Detectors deployed with directional microphones should be aimed to sample the majority of the identified flight path/zone. Omnidirectional microphones deployed on a pole in the center of the flight path/zone should be oriented horizontally. In some circumstances (e.g., forest openings, understory corridors, etc.), it might be desirable to aim a directional microphone vertically or at an angle between horizontal and vertical. Hemispherical microphones should be aimed vertically, creating a dome-like detection field. Hemispherical microphones are best suited for open areas where deploying at heights greater than 3 meters AGL is problematic because of the lack of structure to hide the microphone and prevent it from becoming a novel item of interest to bats. Vertical orientation, however, precludes the use of weatherproofing for protection of the microphone, since no currently-approved weatherproofing system will adequately protect the microphone of a detector aimed vertically. Once acoustic sites are identified, photographs documenting the orientation, detection cone (i.e., "what the detector is sampling"), and relative position of the microphone should be taken for later submittal to the USFWS FO(s) as part of the acoustic survey report (See Submission of Acoustic Survey Results for additional description).

Weather Conditions

If any of the following weather conditions exist at a survey site during acoustic sampling, note the time and duration of such conditions, and repeat the acoustic sampling effort for that night[46]: (a) temperatures fall below 50°F (10°C) during the first 5 hours of survey period; (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the first 5 hours of the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale) for 30 minutes or more during the first 5 hours of the survey period. At a minimum, nightly weather conditions for survey sites should be checked using the nearest NOAA National Weather Service station and summarized in the survey reports.

Weatherproofing

Most bat detectors are not weatherproof when delivered from the factory. Recording without after-market weatherproofing is preferred as the addition of these systems may result in some signal degradation. **The decision to weatherproof detectors or not should be determined nightly based on the likelihood of precipitation in the survey area.** If necessary, detectors should be placed in after-market weatherproof containers and an external microphone, attached by an extension cable should be deployed greater than 3 meters AGL.

[46] With prior USFWS FO approval, a survey may be completed after August 15 if it was initiated in time to be completed by August 15 and extenuating weather circumstances resulted in delaying completion. Delays as a result of not meeting the acceptable weather requirements are the ONLY valid justification for surveying after August 15.

For directional microphones, the use of a polyvinyl chloride (PVC) tube[47], generally in the form of a 45-degree elbow the same diameter as the microphone (Britzke et al. 2010) is acceptable, if the situation requires the use of after-market weatherproofing. Attach the elbow to a weatherproof box that houses the main portion of the detector. Place the microphone into the enclosed end of the elbow and aim the open end of the elbow approximately 40-degrees below the area to be monitored (Corben & Livengood 2014). Again, the preferred option for weatherproofing detectors is to detach the microphone from the detector so that the detector can be placed in a weatherproof container but the microphone (tethered by a cable) remains unobstructed.

Other after-market weatherproofing systems may become available and approved by the USFWS provided they show that call quality and the number of calls recorded are comparable to those without weatherproofing.

MINIMUM LEVEL OF EFFORT

The number of acoustic survey sites required for a project will be dependent upon the overall acreage of suitable habitat proposed to be impacted by the action. To determine the acoustic survey effort, quantify the amount of suitable summer habitat within the project area. NOTE: for projects where other impacts are likely (e.g., collision), ensure that presence/probable absence surveys are designed to cover the entire project area and NOT just the locations where tree removal is planned.

Linear projects: a minimum of 2 detector nights per km (0.6 miles) of suitable summer habitat (See Appendix F).

At least 1 detector location for at least 2 calendar nights.

Non-linear projects: a minimum of 4 detector nights per 123 acres (0.5 km^2) of suitable summer habitat.

2 detector locations per 123 acre "site" shall be sampled until at least 4 detector nights has been completed over the course of at least 2 calendar nights (may be consecutive).

For example:

- 2 detectors for 2 nights each (can sample the same location or move within the site)
- 1 detector for 4 nights (must sample at least 2 locations)

[47] The PVC option has only been tested with AnaBat detectors and directional microphones. It may not perform as well with other detector microphone combinations.

The acoustic sampling period for each site must begin at sunset[48] and ends at sunrise each night of sampling.

ANALYSIS OF RECORDED ECHOLOCATION CALLS

Step 5. Optional coarse screening - for high frequency (HF) or myotid calls (depending on available filters) or Proceed to Step 6.

a) If no positive detection of HF calls (≥35 kHz) or myotid calls, no further summer surveys necessary.

b) If positive detection of HF or myotid calls, then
   i) proceed to Step 6 for further acoustic analysis; **OR**
   ii) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
   iii) assume presence and proceed to **Phase 3**.

Step 6. Conduct Automated Acoustic Analyses for each site that had HF or Myotid calls from Step 5 or ALL sites if Step 5 was not conducted.

Use **one or more** of the currently available 'approved' acoustic bat ID programs[49] (use most current approved software versions available and manufacturer's recommended settings for Indiana bat P/A surveys). 'Candidate' programs are not yet approved by USFWS for stand-alone use for Indiana bat P/A surveys, but may be used in conjunction with one or more of the approved programs. Include your plans for which specific software program(s) you will use in your survey work plan and submit for USFWS FO(s) review prior to conducting surveys. Beginning with acoustic data from night one at each acoustic site, run each night's data for each site through your chosen ID program(s). Review results by site by night from each acoustic ID program used[50].

a) If Indiana bat presence is considered unlikely by the approved and candidate program(s) used in analysis, then no further summer surveys necessary.

b) If Indiana bat presence is considered likely at one or more sites on one or more nights by any approved or candidate program(s) used in analysis, then
   i) proceed to Step 7 for qualitative ID; **OR**

[48] Surveys may need to start a little earlier or later than official sunset times (i.e., at "dusk") in some settings such as a deep/dark forested valleys or ridge tops to avoid missing early-flying bats or capturing late-flying birds, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

[49] Approved and candidate programs are listed at http://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html

[50] The approved acoustic identification programs all have implemented a maximum likelihood estimator (MLE) at this time. If the analysis of collected calls at a given site on a given night results in the probable presence of Indiana bats with high levels of certainty ($P<0.05$), then select one of the options available in Step 6b.

ii) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
iii) assume presence and proceed to **Phase 3**.

Step 7. Conduct Qualitative Analysis of probable Indiana bat calls from Step 6.

At a minimum, for each site/night a program considered Indiana presence likely, review all files from that site/night. Qualitative analysis[51] must also include and present within a written report a comparison of the results of each acoustic ID program by site and night (including: number of call files flagged as probable Indiana bats by each tool used; an evaluation of other species identified by the acoustic ID program; individual file level agreements and disagreements on Indiana bats between programs; and a qualitative analysis of ALL probable Indiana bat call sequences to further evaluate whether the correct ID has been made by the program(s) used).

a) If no visual confirmation of probable Indiana bats, then no further summer surveys necessary.

b) If visual confirmation of probable Indiana bats, then

i) assume presence of Indiana bats and coordinate with the USFWS FO(s); **OR**
ii) assume presence and proceed to **Phase 3**.

SUBMISSION OF ACOUSTIC SURVEY RESULTS

NOTE: All raw data, including log files, MUST be maintained for a period of 7 years and be made available to the USFWS FO(s), if requested. Failure to do so may result in invalidation of survey results.

Provide results of acoustic surveys to the appropriate USFWS FO(s) within 10 days of completing the survey unless otherwise agreed upon with the local USFWS FO(s)[52]. Each acoustic survey report should include the following[53] (also, see checklist at end of this appendix):

1. Copy of habitat assessment (if not previously provided)

[51] Qualitative analysis of each acoustic site and night with probable detections of Indiana bats during Step 6 should include the entire night's high frequency call data and not just those files making it through the acoustic analysis tools as probable Indiana bats in Step 6.
[52] As discussed in the Introduction, we encourage coordination with USFWS FO(s) prior to implementation of any surveys to ensure that all parties agree upon the need for surveys, the methods proposed, and the decisions from various survey results.
[53] In 2016, Region 3 (R3) of the USFWS is conducting a pilot study to help standardize reporting of bat survey data. In addition to a traditional written report, R3 federal permit holders (and other regions/FOs as requested) will be required to submit their survey data using standardized permit reporting spreadsheets available on the R3 Indiana Bat Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).

2. Explanation of any modifications from original survey plan (e.g., altered site locations)[54]
3. Full names of all personnel conducting acoustic surveys, including those that selected acoustic sites and deployed detectors
4. Full name and resume of individual(s) conducting qualitative acoustic analyses (if applicable)
5. Description of acoustic monitoring sites, survey dates, duration of survey, weather conditions, and a summary of findings
6. Table with information on acoustic monitoring and resulting data, including but not limited to: detector GPS coordinates, survey dates, survey hours
7. Map identifying acoustic monitoring locations and a corresponding table including the GPS coordinates. Include arrow(s) showing direction(s) of microphone(s).
8. Photographs of each acoustic site documenting the location of the detector, the orientation of the detector, and the detection cone (i.e., what the detector sampled). Please include detector and something for scale (e.g., vehicle, person) in photographs of acoustic sites.
9. Description of acoustic detector brand(s) and model(s) used, microphone type, use of weatherproofing, acoustic monitoring equipment settings (e.g., sensitivity, audio and data division ratios), deployment data (i.e., deployment site, habitat, date, time started, time stopped, orientation), and call analysis methods used
10. A description of how proper functioning of bat detectors was verified
11. Discussion of what software program(s) was/were used (including settings).
12. Acoustic analysis software program output/summary results by site by night (i.e., number of calls detected, species composition, MLE results)
13. Discussion for any site/nights with zero bat calls (were additional nights added?, was detector functioning?, was placement appropriate?).
14. If manual vetting was used, discussion of how this was done (e.g., what keys were used?). Detailed analysis and results of any qualitative acoustic analysis conducted on those projects where a program(s) considered Indiana bat presence likely, including justification for rejecting any program MLE results (if applicable).
15. Any other information requested by the local USFWS FO(s) related to the project

REFERENCES

[54] If the USFWS previously agreed upon the study plan we need to understand whether the revised work still accomplished the agreed upon methods.

APPENDIX C
PHASE 2 ACOUSTIC SURVEYS

Britzke, E.R, B.A. Slack, M.P. Armstrong, and S.C. Loeb. 2010. Effects of orientation and weatherproofing on the detection of bat echolocation calls. Journal of Fish and Wildlife Management 1(2):136-141.

Chenger, J.D. and J.D. Tyburec. 2014. Comparing bat detector deployments at different heights, in different orientations, and using different microphone types. Poster presentation at the Southeast Bat Diversity Network Meeting, Nacogdoches, TX. February 2014.

Corben, C., and K. Livengood. 2014. Weather protection for Anabat detectors. Poster presentation at the Southeastern Bat Diversity Network Meeting, Nacogdoches, TX. February 2014.

Hayes, J. P. 2000. Assumption and practical considerations in the design and interpretation of echolocation-monitoring studies. Acta Chiropterologica 2:225-236.

MacKenzie, D.I., and J.A Royle. 2005. Designing occupancy studies: general advice and allocating survey effort. Journal of Applied Ecology 42:1105-1114.

Weller, T. J., and C. J. Zabel. 2002. Variation in bat detections due to detector orientation in a forest. Wildlife Society Bulletin 30:922-930

General Checklist for Acoustic Surveys of Indiana Bats

The following items should be documented and clearly presented within acoustic bat survey reports submitted to the Service

.

ACOUSTIC SURVEY INFO

- ☐ Project Name
- ☐ Site ID No./Name
- ☐ State and County
- ☐ Site Lat./Long. Coordinates (e.g., decimal degrees, NAD83)
- ☐ Approx. accuracy of Lat./Long. Coordinates
- ☐ Survey Date(s)
- ☐ Person who Selected Acoustic Site(s)
- ☐ Person who Deployed Detector(s)
- ☐ Detector Brand & Model
- ☐ Microphone Brand & Model
- ☐ Microphone Type: Directional/Hemispherical/Omnidirectional
- ☐ Type of Weatherproofing (if any)
- ☐ Microphone Height above Ground-level Vegetation(m)
- ☐ Distance from Nearest Vegetation or other Obstruction (m)(apart from veg. on ground)
- ☐ Horizontal Orientation of Microphone (1-360°)
- ☐ Vertical Orientation of Microphone (assuming 0° is parallel with horizon)
- ☐ Photographs of Detector Set-up at each Site
- ☐ Detector Settings (all settings used for each brand/model of detector. For example, sensitivity, gain, data division, 16k high filter, sample rate, min./max. duration, min. trigger freq., trigger level, etc.)
- ☐ Survey Start Time (military)
- ☐ Survey End Time (military)
- ☐ Methods used to Field-test proper Functioning of Detector
- ☐ Were calls collected in Full Spectrum or Zero Crossing?
- ☐ Habitat Type and/or Feature Surveyed
- ☐ Weather Conditions during Survey Period

.

ACOUSTIC ANALYSIS INFO

- ☐ Program used to convert Full Spectrum to Zero Cross (if applicable)?
- ☐ Filter(s) used (if any) and parameters used (e.g., CFRead, noise, bug, etc.)
- ☐ Name of Service-approved Bat ID Software Program(s) and Version(s) used and Candidate program(s)(if used)
- ☐ Program Settings (if applicable):
  - o Min. # of pulses for species ID
  - o Min. # of pulses per group ID
  - o Min. discrim. prob. for species ID
  - o Other relevant settings affecting ID
  - o Suite of species/groups included in program analysis
- ☐ Table summarizing Number of Calls ID'd for each Species/Site/Night/Program (including MLE p-values)
- ☐ If Qualitative Analysis was conducted, include Number of Calls Confirmed through Qualitative ID for each Species/Site/Night
- ☐ Full Name of Person(s) who conducted Qualitative Analysis
- ☐ Additional Survey Reporting Requirements
- ☐ Acoustic Report Appendices:
  - o data sheets and maps,
  - o photographs of detector set-ups,
  - o computer screen captures of representative bat species identified during acoustic analyses, and
  - o resume(s) highlighting relevant qualifications of person(s) who conducted qualitative analysis (e.g., experience visually identifying *Myotis*, certificates of training, publications etc.)

APPENDIX D
PHASE 4 RADIO-TRACKING

PERSONNEL

Transmitter Attachment: A qualified biologist[55] who is experienced in handling Indiana bats and attaching radio transmitters must perform transmitter attachments, as further explained in the protocol below.

Tracking: Biological technicians and/or a qualified biologist who is experienced in tracking transmittered bats must be present and actively involved in all tracking activities for Indiana bats as further explained in the protocol below.

METHODS

If one or more Indiana bats are captured, the following radio-tracking protocols will be applicable:

1. Biologists should coordinate in advance with USFWS FO(s) regarding recommendations for the number and distribution of transmitters (e.g., prioritization of sex/age, maximum number per site) and whether foraging data would be beneficial to collect. Also, professional judgment should be used to determine whether attachment of transmitters could compromise the health of a bat. Since the maximum holding times for Indiana bats targeted for radio-tracking is 30 minutes[56], or as allowed in federal and state permits, surveyors should be prepared to place transmitters on bats immediately following their capture to minimize holding times.

2. The radio transmitter, adhesive, and any other markings (e.g., wing bands) should weigh less than 5% of pre-attachment body weight (Aldridge and Brigham 1988, American Society of Mammalogists 1998), the total weight of the package (transmitter and adhesive) may not exceed 6% of the bat's body weight, and must comply with any USFWS and state permits. In all cases, the lightest transmitters capable of the required task should be used, particularly with pregnant females and volant juveniles. With pregnant bats, biologists should always use the lightest transmitter possible but no more than 5% of their expected non-pregnant weight.

3. Proposed radio telemetry equipment (e.g., receivers, antennas, and transmitters) and frequencies should be coordinated with the appropriate state natural resource agency and USFWS FO(s).

4. The qualified biologist or biological technician(s) should track all radio-tagged bats captured to diurnal roosts in accordance with permit requirements. We generally

[55] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.
[56] Current standard federal Section 10 bat permit conditions require prior written approval from the Field Supervisor in the USFWS FO(s) if capture times may exceed 30 minutes

recommend tracking until the transmitter fails, fall off, or cannot be located for at least 7 days and should conduct a minimum of 2 evening emergence counts at each identified roost (See Appendix E for Emergence Survey Protocols). However, biologists are encouraged to continue radio-tracking efforts for the life of the transmitter. Biologists should contact the USFWS FO(s) immediately if they plan to cease tracking efforts before the 7-day tracking period ends. If landowner access is denied, approximate roost locations (i.e., coordinates) should be determined using triangulation.

5. Daily radio telemetry searches for roosts must be conducted during daylight hours and should be conducted until the bat(s) is located or for a minimum of 4 hours of ground or 1 hour of aerial-searching effort per tagged bat per day for 7 days. However, multiple bats captured at the same net location or nearby may be tracked simultaneously. Once a signal is detected, tracking should continue until the roost is located. At a minimum, biologists should document all ground and aerial-searching effort for all bats not recovered during radio-tracking for submittal with the survey report. For each roost identified during tracking, the biologist should complete a "USFWS Indiana Bat Roost Datasheet".

6. To minimize potential for disease transmission, any equipment that comes in contact with bats should be kept clean and disinfected, following approved protocols; this is particularly a concern relative to WNS. Protocols are posted at http://www.whitenosesyndrome.org/. Federal and state permits may also have specific equipment restrictions and disinfection requirements.

SUBMISSION OF RADIO-TRACKING RESULTS

Phase 4 radio-tracking results should be included with the Phase 2 or 3 mist-netting report and submitted to the appropriate USFWS FO(s). Each report should include the following information related to radio-tracking efforts[57]:

1. Copy of prior phase reports (if not previously provided)
2. Explanation of any modifications from original survey plan (e.g., number of transmitters used, frequency of transmitters changed)[58]
3. Map and narrative detailing all ground and aerial searching effort for all bats not recovered during radio-tracking and relative to the negotiated or agreed effort as determined by the appropriate USFWS FO(s)
4. Map summarizing Indiana bat data collected from summer surveys for the proposed project (e.g., project area boundary and results from the site habitat assessment, acoustic survey, mist-net survey, radio-tracking, and emergence surveys)

[57] In 2016, Region 3 (R3) of the USFWS is conducting a pilot study to help standardize reporting of bat survey data. In addition to a traditional written report, R3 federal permit holders (and other regions/FOs as requested) will be required to submit their survey data using standardized permit reporting spreadsheets available on the R3 Indiana Bat Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).

[58] If the USFWS previously agreed upon the study plan we need to understand whether the revised work still accomplished the agreed upon methods

5. Full names and permit numbers of personnel who attached transmitters to Indiana bats and full names of all personnel conducting radio-tracking efforts
6. Photographs of all roosts identified during radio-tracking
7. Legible copies of all original USFWS Indiana Bat Roost Datasheets
8. Any other information requested by the local USFWS FO(s) where work was conducted

REFERENCES

Aldridge, H., and R.M. Brigham. 1988. Load carrying and maneuverability in an insectivorous bat: a test of the 5% "rule." Journal of Mammalogy 69:379-382.

American Society of Mammalogists. 1998. Guidelines for the capture, handling and care of mammals. Journal of Mammalogy 79:1416-1431.

APPENDIX D
PHASE 4 RADIO-TRACKING

USFWS INDIANA BAT ROOST DATASHEET

Biologists (Full Name):_____ Date:_____

UTM: Zone_____ Easting _____ Northing_____ *OR*

LAT_____ LONG_____

Property Owner:_____ Phone#_____

State_____ County_____ Site #_____

Roost #_____ Roost Name:_____

Roost Tree Data

Species: _____ Live __ Snag __ Other __

(if other, explain) _____

DBH (in or cm)_____ Total Height (ft or m)_____

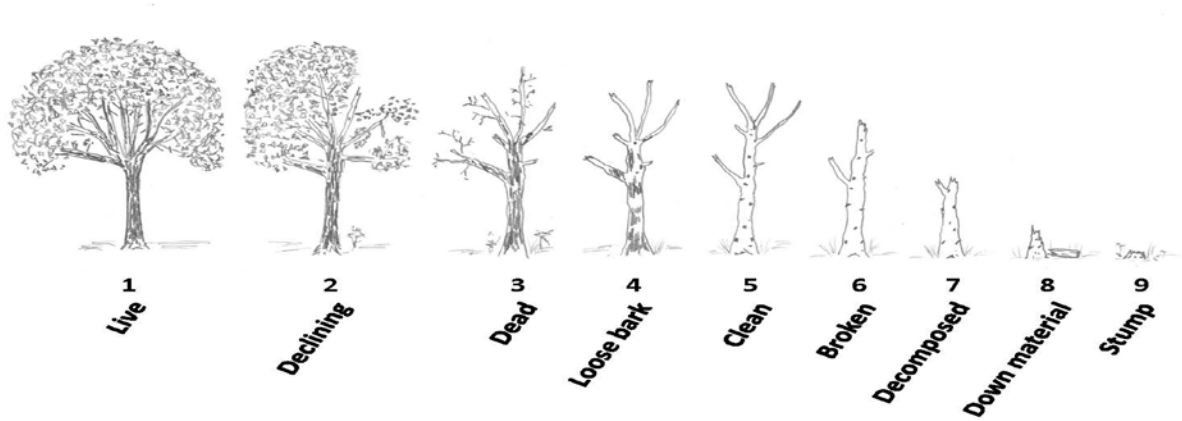
Height of roost area (if known)_____Dist. from capture site_____

Roost position aspect (deg)_____

Exfoliating bark on bole (%)_____ Describe: sloughing __ platy__ tight__

Cavities present? ____ If so, describe:_____

Roost Decay State: 1 2 3 4 5 6 7 8 9 Other



Roost tree or snag canopy position: Dominant __ Co-Dominant __ Suppressed __

Surrounding Habitat Condition

Canopy closure at roost (%) _____

Approximate woodlot size (ac or ha)_____ Distance to non-forest (ft or m)_____

Describe forest/woodlot current condition (mature, partially cut-over, burned, insect damage, etc.)
_____

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Additional Comments_____

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APPENDIX E
PHASE 4 EMERGENCE SURVEYS

PERSONNEL

Qualified biologists[59], biological technicians, and any other individuals deemed qualified by a local USFWS FO may conduct emergence surveys for Indiana bats by following the protocols below.

EMERGENCE SURVEYS FOR KNOWN INDIANA BAT ROOSTS

The following protocols should begin as soon as feasible after identification of a diurnal roost (ideally that night):

1. Bat emergence surveys should begin one half hour before sunset[60] and continue until at least one hour after sunset or until it is otherwise too dark to see emerging bats. The surveyor(s) should be positioned so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. There should be at least one surveyor per roost. Surveyors must be close enough to the roost to observe all exiting bats but not close enough to influence emergence. That is, do not stand directly beneath the roost, do not make noise or carry on a conversation, and minimize use of lights (use a small flashlight or similar to record data, if necessary). Do not shine a light on the roost as this may prevent or delay bats from emerging. Use of an infra-red, night vision, or thermal-imaging video camera or spotting scope is encouraged but not required. Likewise, use of an ultrasonic bat detector may aid in identifying the exact timing of bats emerging and may be used to help differentiate between low- and high-frequency bats species, and therefore, is strongly recommended. If multiple roosts are known within a colony, then simultaneous emergence surveys are encouraged to estimate population size. [Note: If a roost cannot be adequately silhouetted, then the local USFWS FO(s) should be contacted to discuss alternative survey methods].

2. Bat activity is affected by weather; therefore emergence surveys should not be conducted when the following conditions exist: (a) temperatures that fall below 50°F (10°C); (b) precipitation, including rain and/or fog, that exceeds 30 minutes or continues intermittently during the survey period; and (c) sustained wind speeds greater than 9 miles/hour (4 meters/second; 3 on Beaufort scale).

3. Surveyors should use the attached (or similar) “Bat Emergence Survey Datasheet”.

[59] A qualified biologist is an individual who holds a USFWS Recovery Permit (Federal Fish and Wildlife Permit) for federally-listed bats in the state/region in which they are surveying and/or has been authorized by the appropriate state agency to mist-net for Indiana bats. Several USFWS offices maintain lists of qualified bat surveyors, and if working in one of those states with authorizations in lieu of a Recovery Permits, the individual will either need to be on that list or submit qualifications to receive USFWS approval prior to conducting any field work.

[60] Surveys may need to start a little earlier or later than one half hour before official sunset times (i.e., before “dusk”) in some settings such as deep/dark forested valleys or ridge tops, respectively. Sunset tables for the location of survey can be found at: http://aa.usno.navy.mil/data/docs/RS_OneYear.php

4. Surveyors should also complete an "Indiana Bat Roost Datasheet" for each roost known to be used by one or more Indiana bats (see Appendix D for an example).

5. Completed datasheets should be included in reports prepared for the USFWS.

EMERGENCE SURVEYS FOR POTENTIAL INDIANA BAT ROOSTS

In some limited cases (e.g., individual hazard tree removal during the active season), surveyors may have the option of conducting emergence surveys for individual potential Indiana bat roosts to determine use prior to removal. The following protocol applies to these surveys:

1. Consult with the local USFWS FO(s) to determine whether a tree(s) that needs to be felled/ cleared may be potential roosting habitat for Indiana bats and whether conducting an emergence survey is an appropriate means of avoiding take of Indiana bats[61]. In general, the USFWS only approves of conducting emergence surveys as a means of avoiding direct take of bats for projects that only affect a very small number of potential roosts (e.g., less than or equal to 10)[62] in relatively small project areas. An online directory of USFWS offices is available at: http://www.fws.gov/offices/.

2. If the USFWS FO(s) approves/concurs with Step 1, then follow the emergence guidelines for Emergence Surveys for Known Indiana Bat Roosts (above) to determine if any bats are roosting in the tree(s).

3. At the conclusion of the emergence survey:

    a. If **no** bats were observed emerging from the potential roost(s), then it maybe felled immediately. If safety concerns dictate that a tree cannot be felled immediately (i.e., in the dark), then the tree(s) should be felled as soon as possible after sunrise on the following day. If a tree is not felled during the daytime immediately following an emergence survey, then the survey has to be repeated, because bats may switch roosts on a nightly basis. Immediately after the tree is felled, a visual inspection of the downed tree must be completed to ensure that no bats were present, injured, or killed. The USFWS FO(s) should be contacted immediately, if bats are discovered during this inspection.

    b. If **1 or more** bats (regardless of species, because species identification cannot reliably be made during visual emergence counts alone) are observed emerging from the roost, then it should **not** be felled, and the USFWS FO(s) should be contacted the next working day for further guidance.

[61] If a potential bat roost tree poses an imminent threat to human safety or property, then emergency consultation procedures should be followed as appropriate. (50 CFR §402.05). If a hazard tree does not pose an imminent threat, then the USFWS requests that it be felled during the bat's inactive season (i.e., generally from October – March, but contact the FO for specific dates for your area.) When possible, felling of potential roost/hazard trees should be avoided during the primary maternity period (June – July) to avoid potential adverse effects to non-volant pups.
[62] Areas containing >10 hazard trees will be assessed by the USFWS on a case-by-case basis with the project proponent.

APPENDIX E
PHASE 4 EMERGENCE SURVEYS

SUBMISSION OF EMERGENCE SURVEY RESULTS

Emergence survey results should be included with the mist-netting survey report, unless the survey was completed as an evaluation of potential roosts, and should be submitted to the appropriate USFWS FO(s) for review. Each survey report should include the following information related to emergence survey efforts[63]:

1. Copy of prior phase reports (if not previously provided)
2. Explanation of any modifications from the Phase 4 emergence count study plan (e.g., number of potential roosts surveyed), if applicable
3. Summary of roost emergence data
4. Map identifying location of roost(s) identified during radio-tracking and/or emergence surveys for Indiana bat(s) including GPS coordinates
5. Full names of personnel present during emergence survey efforts and who conducted emergence surveys of roosts
6. Photographs of each identified roost
7. Copies of all "Emergence Survey" and "Indiana Bat Roost" datasheets
8. Any other information requested by the local USFWS FO(s) where work was conducted
9. Copy of the pre-approved site-specific written authorization from USFWS and/or state natural resource agency (if required)

[63] In 2016, Region 3 (R3) of the USFWS is conducting a pilot study to help standardize reporting of bat survey data. In addition to a traditional written report, R3 federal permit holders (and other regions/FOs as requested) will be required to submit their survey data using standardized permit reporting spreadsheets available on the R3 Indiana Bat Summer Survey Guidance webpage (http://www.fws.gov/midwest/Endangered/mammals/inba/inbasummersurveyguidance.html).

APPENDIX E
PHASE 4 EMERGENCE SURVEYS

USFWS BAT EMERGENCE SURVEY DATASHEET

Date: _____ Surveyor(s) Full Name:_____

State: _____ County: _____ Project Name: _____

Site Name/#: _____ Roost Name/# _____ Bat #:_____

Lat/Long or UTM of Roost: _____

Description of Roost/Habitat Feature Surveyed: _____

_____

Bat Species Known to be using this Roost/Feature (if not known, leave blank):

_____

Other Suspected Bat Species (explain): _____

Weather Conditions during Survey (temperature, precipitation, wind speed):

_____

Survey Start Time: _____ Time of Sunset: _____ Survey End Time: _____

NOTE: Emergence surveys should begin ½ hour before sunset and continue for a minimum of 1 hour or until it is otherwise too dark to see emerging bats. The surveyor(s) should position him or herself so that emerging bats will be silhouetted against the sky as they exit the roost. Tallies of emerging bats should be recorded every few minutes or as natural breaks in bat activity allow. Please ensure that surveyor(s) are close enough to the roost to observe all exiting/returning bats, but not close enough to influence emergence (i.e., do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights other than a small flashlight to record data, if necessary). Do not shine a light on the roost tree crevice/cave/mine entrance itself as this may prevent or delay bats from emerging. If available, use of an infra-red, night vision, or thermal-imaging video camera or spotting scope and an ultrasonic bat detector are strongly recommended but not required.

Time	Number of Bats Leaving Roost*	Comments / Notes

APPENDIX E
PHASE 4 EMERGENCE SURVEYS

Site Name/#: _____ Roost Name/#: _____

Time	Number of Bats Leaving Roost*	Comments / Notes
Total Number of Bats Observed Emerging from the Roost/Feature During the Survey:		

* If any bats return to the roost during the survey, then they should be subtracted from the tally.

Describe Emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. If a radio-tagged bat was roosting in the tree, at what time did it emerge?

_____

_____

_____

APPENDIX F
LINEAR PROJECT GUIDANCE

For linear projects (e.g., pipelines and roadways), surveyors have the option to use either mist nets or acoustic detectors in any given 1-km segment of suitable habitat. A survey site may also cover other associated linear project facilities (e.g., access roads) that are located within a pre-determined distance of each segment. When possible, surveyors should seek out the best available survey sites located within the footprint of the project alignment, and directly adjacent to, or near, the alignment if no suitable sites are available within the footprint. Because the best survey sites for capturing/detecting bats may fall outside of a project footprint, the surveyor and project proponent should coordinate with the appropriate USFWS FO to establish a project-specific maximum distance from the centerline or project boundary prior to initiating surveys.

Tentative survey site locations along linear projects should be included in a proposed study plan to be reviewed and approved by the USFWS FO. One site should be surveyed within each approximate 1-km segment that contains suitable forested habitat along the proposed workspace. It is not appropriate to cumulatively add up each habitat block crossed until 1km of habitat has been traversed. Segments along a linear project that do not contain suitable habitat should be skipped until the next patch of suitable habitat is encountered (Figure 1). Establishing exactly how many survey sites are needed for presence/absence surveys along a linear project often involves some give and take particularly in fragmented habitat areas (Figure 1, rows B and C). The final number of survey sites could be greater than the minimum number of sites prescribed in the protocol in order to adequately cover the areas of suitable habitat to be impacted. When available, habitat quality and quantity (e.g., size and location of suitable maternity roost trees) from on-the-ground habitat assessments can be used to fine tune and guide the placement of survey sites. In some marginal habitat areas, the quality and quantity of the existing habitat may be low enough to justify skipping some survey segments (e.g., Figure 1, Site 11). Likewise, some isolated woodlots, fencelines or individual trees may be considered too isolated and/or small to independently support bats and may be skipped if the USFWS FO concurs. Habitat suitability in fragmented areas should be assessed on a site-specific basis and consider habitat configuration and connectivity to other suitable habitat patches. In general, we recommend surveying a few more sites for a project than the absolute minimum required.

In instances where a mist netting survey has been proposed, but no suitable mist net sites can be found or accessed within a particular segment, biologists should contact the USFWS FO for further guidance or ideally agree in advance as to how such situations will be handled when encountered in the field (e.g., an acoustic survey may be substituted). Similarly, if an area of forest habitat that seemed suitable from aerial photography appears to be unsuitable or of particularly low quality upon field inspection, then you should coordinate with the USFWS FO to determine if an area may be exempted from surveys. To avoid problems, any significant departures from previously agreed to survey plans should be justified and coordinated with the USFWS FO prior to leaving the field.

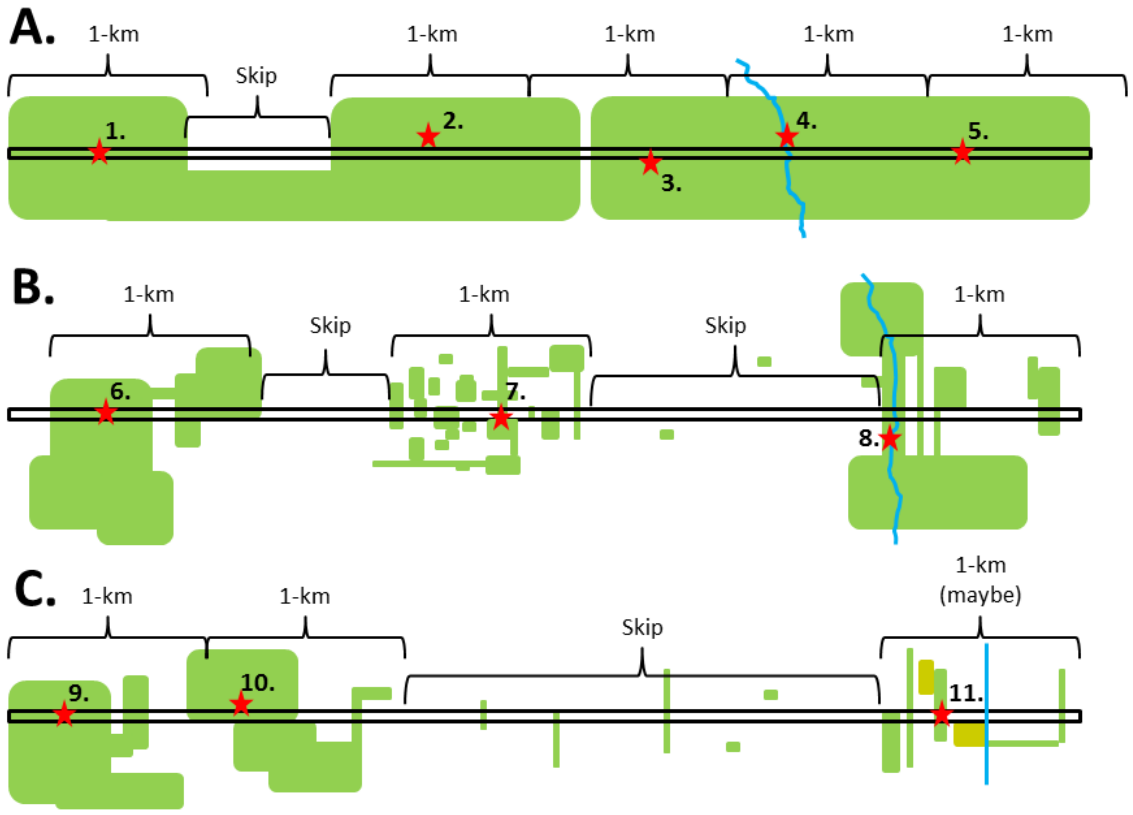

FIGURE 1. Conceptual linear project (black double lines) through relatively contiguous (A.) and fragmented (B. and C.) forested habitats (green patches) delineated into approximate 1-km survey sections. Numbered red stars represent suitable survey sites (1-11) on or near the project boundaries. Blue lines represent natural streams (A. and B.) and a ditch (C.). Yellow-green patches near Site 11 represent low-quality habitat.

NAVFAC Atlantic Biological Resource Services

Contract: N62470-13-D-8016; Task Order: WE07, Option Task 05

Northern Long-Eared Bat Survey Report

Naval Auxiliary Landing Field Fentress
Chesapeake, Virginia

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Norfolk, VA 23511

Prepared by:
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May 2016

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1.0 INTRODUCTION

Tetra Tech, Inc., was contracted to collect information on the federally-threatened northern long-eared bat (*Myotis septentrionalis*) (MYSE) at Naval Auxiliary Landing Field Fentress (NALF Fentress or Installation) near Chesapeake, Virginia. The survey concentrated on areas of interest as identified by the Navy, including forested area threatened for removal due to Airfield Height Obstruction concerns associated with Aviation Safety Requirements (Figure 1-1). In accordance with the work plan (Tetra Tech 2015), the objective of this project was to determine the presence or absence of MYSE following protocols established by the United States Fish and Wildlife Service (USFWS) and detailed in the *Northern Long-Eared Bat Interim Conference and Planning Guidance* (USFWS 2014a) and the *2014 Range-Wide Indiana Bat Summer Survey Guidelines (USFWS 2014b)*. This survey included presence/absence mist-net field capture, radio-tracking, delineating home range or known habitat, and roost emergence surveys.

Mist-netting efforts were concentrated in suitable MYSE habitat within the areas of interest and nets were strategically placed in flight paths, often near drinking water, to maximize chances of catching MYSE. Mist-netting allows both a snapshot of what species, and in what abundance, are utilizing the areas of interest and provides an opportunity to attach radio-transmitters. Species identification through mist-netting is also more reliable then acoustic recording alone.

Female MYSE were targeted for radio-telemetry to discover if these bats were using maternity roosts on the Installation and, if so, to characterize their roost choices. Once the roosts were found, emergence counts were performed to detect the presence of maternity colonies. Maternity colonies are of special interest because they must be protected in white-nose syndrome areas under the threatened species 4(d) rule (USFWS 2016). The compilation of capture sites and multiple roost sites enabled a home range, or known habitat, analysis to determine what areas of the Installation were being utilized by MYSE. Information collected on MYSE presence and range can be used by natural resource managers to make informed land-use decisions on the Installation in areas occupied by this vulnerable species.

2.0 SPECIES BACKGROUND

In July 2011, the USFWS was petitioned to list MYSE and the eastern small-footed bat (*Myotis leibii*) on the federal Endangered Species List as Endangered or Threatened, and to designate critical habitat, under the Endangered Species Act (ESA) of 1973 (76 Federal Register [FR] 125). On 02 October 2013 USFWS released the results of their 12-Month Finding on the 2011 petition, which concluded that listing for the MYSE was warranted, and the species was proposed for federal listing as endangered (79 FR 191). The USFWS published their final listing of MYSE, however, as a threatened species and issued an interim 4(d) rule in the *Federal Register* on 02 April, 2015. The rule went into effect on 04 May, 2015. The interim rule was replaced by the final rule on 14 Jan 2016 (USFWS 2016).

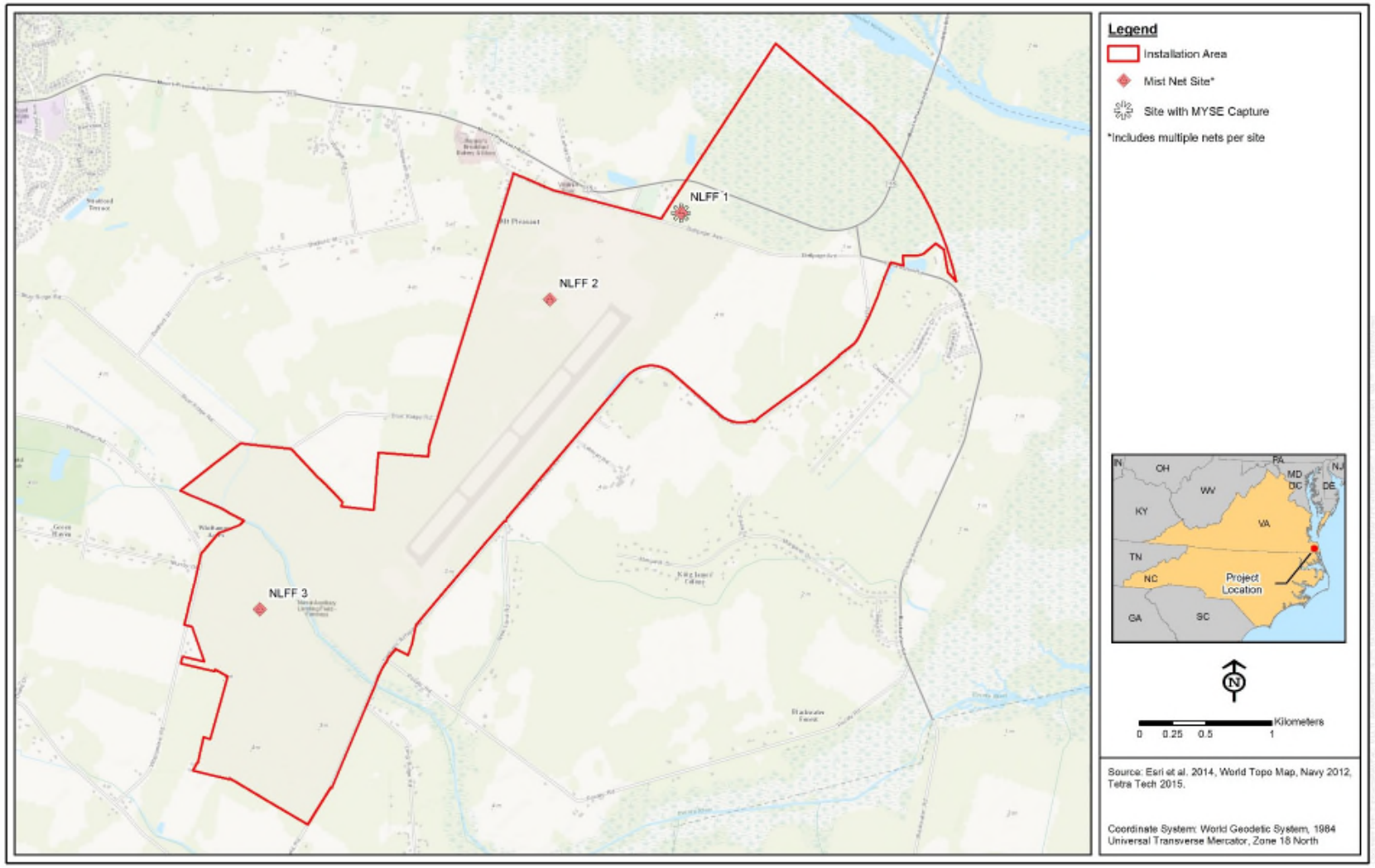


Figure 1-1. Regional Setting and Mist Netting Locations of NALF Fentress, Virginia.

MYSEs occur throughout forested portions of the northeastern United States and in eastern, central, and northern Canada (79 FR 191). Historically, the species was patchily-distributed, and less common in the southern and western portions of its range (Barbour and Davis 1969). Population density seems to have been highest in the northern portion of the species' range, which includes much of the eastern United States (Harvey 1992).

MYSE are an obligate forest-dwelling species, adapted to gleaning and hawking for insects in the sub-canopy in deciduous and mixed forests. Foraging occurs entirely within forested areas but is not restricted to mature forests. MYSE forage primarily below the canopy in the understory, or in sub-canopy shrub layers. Foraging is often concentrated in forested upland areas, but may also occur in forest clearings, above roadways and trails, or near water (79 FR 191). These habitat requirements and behavioral patterns relate directly to the potential for the Installation to support MYSE.

Summer roosts provide MYSE with a thermally-stable environment, as well as protection from the elements and predators (Owen *et al.* 2002). Day roost selection by MYSE is dependent upon the presence of suitable live or dead (snag) trees having cavities, crevices, or exfoliating bark for roosting, although man-made structures and caves may also be used for roosting. Throughout their range, MYSE roost in a variety of tree species, using specific trees based on their suitability to retain bark or provide cavities or crevices. Isolated trees may also be used as roosts, provided they are within 1,000 feet of another suitable roost tree or forested area (USFWS 2014a). MYSE roost alone or in small maternity colonies and switch roosts often; on average, lactating females appear to switch roosts every two to five days (Menzel *et al.* 2002; Sasse and Perkins 1996).

Two studies conducted in West Virginia identified black locust (*Robinia pseudoacacia*) as a preferred roost tree for both male and female MYSE, although locust roosts accounted for only 34% of potential roosts (Ford *et al.* 2006 and Owen *et al.* 2002). A 2003 study of male MYSE day-roost selection in West Virginia identified 13 roosts in black locust (five snags and eight live trees), one roost in sassafras (*Sassafras albidum*) (snag), and two sugar maple (*Acer saccharum*) (live) (Ford *et al*. 2006). All of the live-tree roosts were medium–large, canopy-dominant trees characterized by substantial amounts of exfoliating bark and numerous broken limbs and cavities. Live-tree roosts tended to be larger than other trees in the vicinity. Roosts located in snags were smaller than the live trees and other snags in the vicinity. It is likely that MYSE exhibit a strong preference for selection of roosts within older forest stands that contain many large trees and snags with exfoliating or plate-like bark or cavities (Ford *et al*. 2006).

Unlike true long-distance migratory bats (*Lasiurus* spp. and *Lasionycteris* spp.), MYSE do not undertake long-distance migrations between summer and winter ranges, but do make shorter distance movements between summer roosts and winter hibernacula. MYSE arrive at hibernacula in August or September, begin hibernation in October and November, and leave for

summer habitats in March or April (79 FR 191). MYSE hibernate in caves and mines, as well as in man-made structures. The species prefers large hibernacula with large entrances and, although MYSE are often found with other *Myotis* species, they prefer cooler temperatures and higher humidity than little brown bats (*Myotis lucifugus*). Individuals may hibernate in cracks and crevices in hibernacula walls, and may be overlooked during winter surveys. The species has also been found in less traditional hibernacula, including dams and dry wells, and may utilize man-made structures more frequently than previously thought, especially in the northeast (USFWS 2013).

Significant decreases in populations of MYSE have occurred over the last five years, primarily as a result of White-Nose Syndrome (WNS), a fungal pathogen responsible for unprecedented mortality of hibernating bats, with an estimated 5.7 million bats killed since the discovery of WNS in the United States. WNS was first discovered in eastern New York in February 2006 and has now been documented in at least 19 states and four Canadian provinces. Precipitous declines have been documented for the MYSE and eastern small-footed bats over the last three years with an estimated loss greater than 1 million bats. Other threats to MYSE include loss and fragmentation of forested habitat, alteration to traditional hibernacula, and anthropogenic sources of mortality including wind energy facilities (USFWS 2014a).

3.0 METHODS

3.1 CAPTURE

Per the USFWS Guidelines, mist-net surveys were conducted within the 15 May – 15 August 2015 survey window and were completed over six nights from 18 Jun 2015 to 23 Jun 2015 for a total of 42 net-nights. The required federal (TE63633A-3) and state collection permits (VADGIF 051933) were obtained by Tetra Tech's subcontractor, Biodiversity Research Institute (BRI), for completion of these tasks (Appendix C). During the six-night survey window, bats were captured at three locations within the areas of interest (Figure 1-1). Coordinates for each mist-net are provided in Appendix E and photos in Appendix F. Mist-net survey sites were typically surrounded by mature trees that potentially provide good roosting habitat and a clear path to foraging areas for bats leaving their roosts. Two two-person teams, each operating two to three nets, conducted the mist-netting survey and one USFWS-approved biologist monitored all survey activities.

A combination of triple-high (three nets stacked upon another, 7.8 meters height), double-high (two nets stacked upon another, 5.2 meters height), and single-high (2.6 meters height) nets were set up each night (Figure 3-1). Depending on the site, nets varied in length from 6 to 12 meters and were positioned to maximize coverage of flight paths, including suitable travel corridors, foraging areas, and/or drinking areas. These areas are of interest since they act as corridors and funnel bats toward the nets. Nets were set at dusk and monitored until at least 00:15 hours, for a minimum of 5 hours. If bats continued to be captured, nets were left up until as late as 01:30 hours.

Bats were live-caught in mist-nets and released unharmed near the point of capture. Nets were checked at 10-minute intervals and processing was completed within 30 minutes from the time the bat was removed from the net. Biological and morphometric data was recorded for each individual captured (e.g., time of capture, capture net, species, sex, age class, reproductive condition, mass, and forearm length) and provided in Appendix E. A juvenile bat is generally considered less than 1 year old and determined through the observation of a long smooth joint demonstrating incomplete epiphyseal ossification (fusion) of the metacarpal-phalangeal joint that are not present in the ossified knobby adult joints. Bats become reproductively active around 1 year old. Each bat was also banded on the forearm with a unique number for later identification. Representative photographs of various individuals were taken as per the federal guidelines (2014a) (Figure 3-2) (Appendix G). Time, weather, global positioning system location of each net site and hourly weather conditions were also recorded. Data was recorded in Chiro, an IPad application, for ease of tracking and compiling data and to reduce human error. Captured female MYSE were fitted with a radio transmitter.

Caution was taken during mist-net activities to minimize the potential for transmitting WNS by following the most recent decontamination protocols (USFWS 2008). For example, bats were held in paper bags until processed, and holding bags were disposed of after each use. Bats were evaluated for potential WNS infection following the *Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-nose Syndrome* (Reichard, no date).

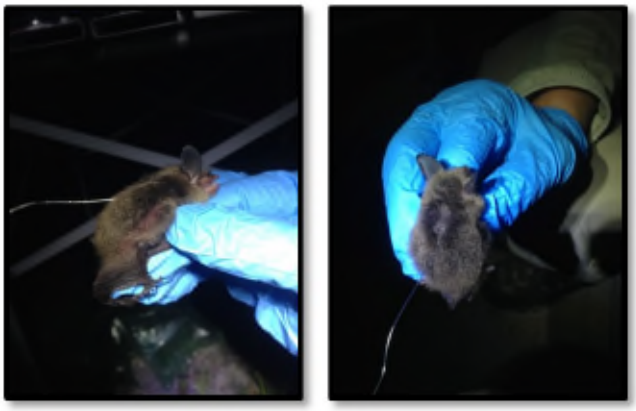
Site 1 Net H - MYSE captured
Photo Credit: Biological Diversity Research Institute

Site 1 Net A
Photo Credit: Biological Diversity Research Institute

Figure 3-1. Representative Photos of Net Sites at NALF Fentress, Virginia– 2015.

Evening bat (*Nycticeius humeralis*) caught 19 June
Photo Credit: Biological Diversity Research Institute

Eastern red bat (*Lasiurus borealis*) caught 19 June
Photo Credit: Biological Diversity Research Institute



Northern long-eared bat (*Myotis septentrionalis*) with radio tag
Photo Credit: Biological Diversity Research Institute

Figure 3-2. Representative Photos of Bat Species Captured at NALF Fentress, Virginia– 2015.

3.2 RADIO-TELEMETRY, HOME RANGE, AND ROOSTS

Female MYSE were targeted for attaching transmitters because they form maternity colonies during the summer months (Menzel *et al*. 2002). Male MYSE generally roost solitarily and, therefore, were not a priority for the USFWS from a radio-tracking standpoint. Female MYSE were fitted with Advanced Telemetry Solutions (ATS) radio-transmitters (Appendix D). Coordination with Installation tenant commands was required to obtain approval for types of transmitters/receivers and ranges of frequencies that could be utilized on the Installation due to potential conflicts with military communication requirements. The transmitters were the smallest commercially available, weighing only 0.29 grams and representing less than 5% of each bat's body mass. Fur was removed from between the scapulae and the transmitter was attached to the bare skin using Skin Bond surgical cement. The radio transmitter was tested for functionality before releasing the bat.

Female MYSE were tracked both by vehicle and on foot to facilitate collection of data necessary to determine home range as outlined in the USFWS *Northern Long-Eared Bat Interim Conference and Planning Guidance* (USFWS 2014a). Following the night of capture, bat locations were identified using the homing technique specified in White and Garrot (1990). ATS R4000 receivers (Advanced Telemetry Systems, Isanti, MN) and Yagi antennas were used during radio-tracking efforts (Appendix D). The ATS transmitters have about a 300-meter range of detection. MYSE home ranges were estimated using a 3-mile buffer around a capture site if no other information was available for that individual (no radio telemetry), per USFWS guidelines. Home range for MYSE with known capture and roost site information were created using a buffer of 1.5 miles surrounding the mapped capture and roost site(s).

MYSE fitted with radio transmitters were tracked for six consecutive day's post-capture according to the USFWS protocols for identifying roosting sites. Once a MYSE roost was found through radio-telemetry, emergence counts were conducted using methods outlined in Section 3.3.

3.3 EMERGENCE COUNTS

Roosting sites identified by radio-telemetry were monitored for emergence counts following methodologies outlined in the USFWS protocol (USFWS 2014b). A minimum of two evening-emergence counts were conducted at all roosts located via radio-tracking. A biologist would position themselves at the site of the roost tree around dusk each night (about ½ hour before sunset) and count the number of bats emerging from the tree until about one hour after sunset or until it was too dark to see emerging bats. The positioning of the biologist(s) conducting the emergence counts was in a location suitable for observing emerging bats silhouetted against the sky. Biologists also positioned themselves close enough to the roost to observe emerging bats, but not so close as to influence emergence. Therefore, biologists did not stand directly beneath the roost. Biologists minimized noise and use of artificial light sources (i.e. flashlight) when in the vicinity of the roost. Emergence counts were not conducted if during the 30 minutes before and during the observation temperatures were below 50 degrees Fahrenheit, precipitation was occurring for at least 30 minutes or intermittently (including rain or fog), or if wind speeds exceeded 4 meters/second due to reduced activity during these conditions.

4.0 RESULTS

4.1 CAPTURE

A total of 89 bats representing seven species were captured during the 18 June 2015 to 23 June 2015, 42-net-night survey conducted within the area of interest at NALF Fentress (Table 4-1 and Figure 1-1). Four MYSE were captured. The majority of bats trapped (*61%*) were evening bats (*Nycticeius humeralis*) followed by big brown bats (*Eptesicus fuscus*) *(15%*) and southeastern bats (*Myotis austroriparius)* (11%). Also captured were Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), eastern red bat (*Lasiurus borealis*), and little brown bats (*Myotis lucifugus*). One bat

escaped before metrics were taken and one was released immediately because it had a broken or dislocated leg.

All bats caught were adults (over 1 year in age) of which 61% were female and 39% were male. Of female bats caught, 98% were lactating and 2% were non-reproductive. Of male bats caught, 83% had descended testes and 11% were non-reproductive. No bats exhibited any noticeable wing damage (bats were 1 or 0 on Reichard Wing Damage Index).

The three adult female MYSE and one adult male were captured at mist-net Site 1 in multiple nets (Table 4-2). The three females were equipped with a radio-transmitter for radio-tracking. Habitat associated with the capture sites included mixed mature forest (red maple [*Acer rubrum*], sweet gum [*Liquidambar styraciflua*], and loblolly pine [*Pinus taeda*]).

Table 4-1. Nightly Summary of Bats Captured at NALF Fentress, Virginia - 2015.

Species	NALFF 1		NALFF 2		NALFF 3		Species Total
	18-Jun	19-Jun	20-Jun	21-Jun	22-Jun	23-Jun	
Big brown bat	2	5		1	5		**13**
Eastern red bat		2	1		1		**4**
Rafinesque's bat			2				**2**
Southeastern bat				2	5	3	**10**
Little brown bat			2				**2**
Evening bat	3	4	16	16	12	3	**54**
Northern long-eared bat	2	2					**4**
Night Total	**7**	**13**	**21**	**19**	**23**	**6**	**89**
Site Total	**20**		**40**		**29**		**89**

Table 4-2. Northern Long-Eared Bat Individuals Captured at NALF Fentress, Virginia - 2015.

Number	Date	Time	Radio-frequency	Sex	Age	Site	Capture Lat/ Long		Habitat
1	18-Jun	23:10	148.642	Female	Adult	1	36.70522	-76.12177	Loblolly Pine, Sweet Gum, Red Maple
2	18-Jun	0:53	148.672	Female	Adult	1	36.70509	-76.11466	
3	19-Jun	1:40	148.813	Female	Adult	1	36.70545	-76.12157	
4	19-Jun	2:19		Male	Adult	1	36.70545	-76.12157	

4.2 RADIO-TELEMETRY, HOME RANGE, AND ROOSTS

During capture, three female MYSE were fitted with an ATS radio transmitter. Following the initial night of capture, the three radio-tagged bats were tracked for six consecutive days and all were subsequently picked up by the radio-telemetry equipment (Table 4-3). The radio-transmitters may have fallen off prematurely due to glue melt from the heat and high humidity.

The first lactating female (Freq. 148.642) was radio-tracked for three non-consecutive days back to its respective roosts on 19, 21, and 24 June 2015. The female used the same roost twice and showed a preference for red maple roosts, both live and dead. A bark roost was used in the dead tree that had 10% canopy cover. The live tree had 80% canopy cover and the largest roost tree diameter at breast height (30 cm) observed in this survey.

Since multiple roosts were documented via radio-telemetry, the home range of MYSE 148.642 was delineated by first drawing a polygon around the three roosts. Secondly, since the capture site was within 1.5 miles of the multi-roost polygon, the known home range was defined as all suitable habitat within a 1.5-mile radius of the multi-roost polygon (Figure 4-2). The farthest distance between two known locations, however, was actually under 1,800 ft. Approximately 4,956 acres fall within the 1.5-mile radius, 1,501 acres of which is inside the Installation boundary. After extracting unsuitable, non-forested habitat, 30% of the habitat in this female's home range is within NALF Fentress.

The second lactating female (Freq. 148.672) was successfully radio-tracked for three consecutive nights from 19 June to 21 June 2015 (Table 3-3). This female chose dead red maples (Figure 3-1) with 80% of bark remaining in close proximity of each other and one unknown tree. These trees had varying canopy cover (10, 30, and 70%). Roost A was found in a downed red maple lying almost horizontal suspended over the water. Home range was similarly calculated as above for MYSE 149.823 (Figure 4-3). Approximately 5,092 acres fall within the 1.5-mile radius; however, 2,509 acres of this is not considered suitable habitat (i.e., non-forested habitat). Again, only 30% of suitable habitat within the female's home range is within the Installation boundary. Although the calculated suitable habitat is large, the farthest distance between two known bat locations was only approximately 1,200 ft.

The third non-reproductive female (Freq. 148.813) was tracked for one night on 25 June 2015 (Figure 3-4). The exact tree was unable to be located due to the difficult terrain, although triangulation on the radio signal revealed that it was roosting in a red maple swamp. Home range was similarly calculated as above for MYSE 149.837 (Figure 4-4). The longest distance between know bat locations was 4,300 ft. Approximately 4,521 acres fall within the 1.5-mile radius; however, only 61% of this is considered suitable habitat (i.e., forested habitat). Much of this suitable habitat (77%) does not fall within the Installation boundary.

All known roosts were in red maple trees, predominantly dead, with more than 50% of bark remaining. These trees were all 18-30-cm diameter at breast height with large variation in heights (7-37m). There was no pattern in percent canopy cover, which ranged from 10 to 70%. (Table 4-3). Roost trees were predominantly found in a red maple and green ash (*Fraxinus pennsylvanica*) forest with a few loblolly pines.

The lone male MYSE was not fitted with a radio-transmitter (figure 4-5). In the absence of roost site locations, home range was calculated as a 3-mile buffer from capture location based on USFWS guidelines. Approximately 18,080 acres fall within the 3-mile radius, but only 55% of this is considered suitable habitat, of which 1,067 is within the Installation boundaries or 11%.

Table 4-3. Day Roosts of Northern Long-Eared Bats at NALF Fentress, Virginia, June 2015.

Band #	Transmitter	NLEB Sex	Capture Site*	Roost #	Date Used	Roost Coordinates (Lat/Long)		Tree Species	DBH (cm)	Height (m)	Tree State	% Bark Remaining	Significant/Dominant Tree Species in 0.1 ha plot	Roost Type	% Roost Canopy Cover	Roost Aspect	Roost DBH (cm)	Roost Height (m)
DEY4742	148.642	Female Lactating	NLFF 1-Net H	A	19-Jun-15	36.70744	-76.11621	Red Maple	18	12	dead	65	Red maple, green ash (pumpkin ash?)	Unk	15	Unk	Unk	Unk
				A	21-Jun-15	36.70744	-76.11621	Red Maple	20	10	dead	50	Red maple and green ash. Few loblolly pines.	Bark	10	Unk	30	10
				B	24-Jun-15	36.70915	-76.11966	Red Maple	30	25	live	100	Unknown	Unk	80	Unk	Unk	Unk
DEY4743	148.672	Female Lactating	NLFF 1-Net F	A	19-Jun-15	36.70754	-76.11200	Red Maple	20	10	dead	80	red maple, greenbrier	Unk	70	Unk	Unk	Unk
				B	20-Jun-15	36.70570	-76.11235	Unk	most trees: 9	most trees: 7	Unk	Unk	Red maple and green ash. Few loblolly pines.	Unk	10, very open	Unk	Unk	Unk
				C	21-Jun-15	36.70747	-76.11599	Red Maple	30	37	dead	80	Red maple and green ash. Few loblolly pines.	Unk	30	Unk	Unk	Unk
DEY4894	148.813	Female Non-reproductive	NLFF 1-Net I	A	25-Jun-15	36.70998	-76.10784	Exact tree unknown, red maple swamp	Unk	Unk	Unk	Unk	Unknown	Unk	Unk	Unk	Unk	Unk

148.642 Roost A Red Maple
Photo Credit: Biological Diversity Research Institute

148.672 Roost A Red Maple
Photo Credit: Biological Diversity Research Institute

Figure 4-1. Examples of Roost Trees Used by Northern Long-Eared Bats (*Myotis septentrionalis*) in NALF Fentress, Virginia in June 2015.

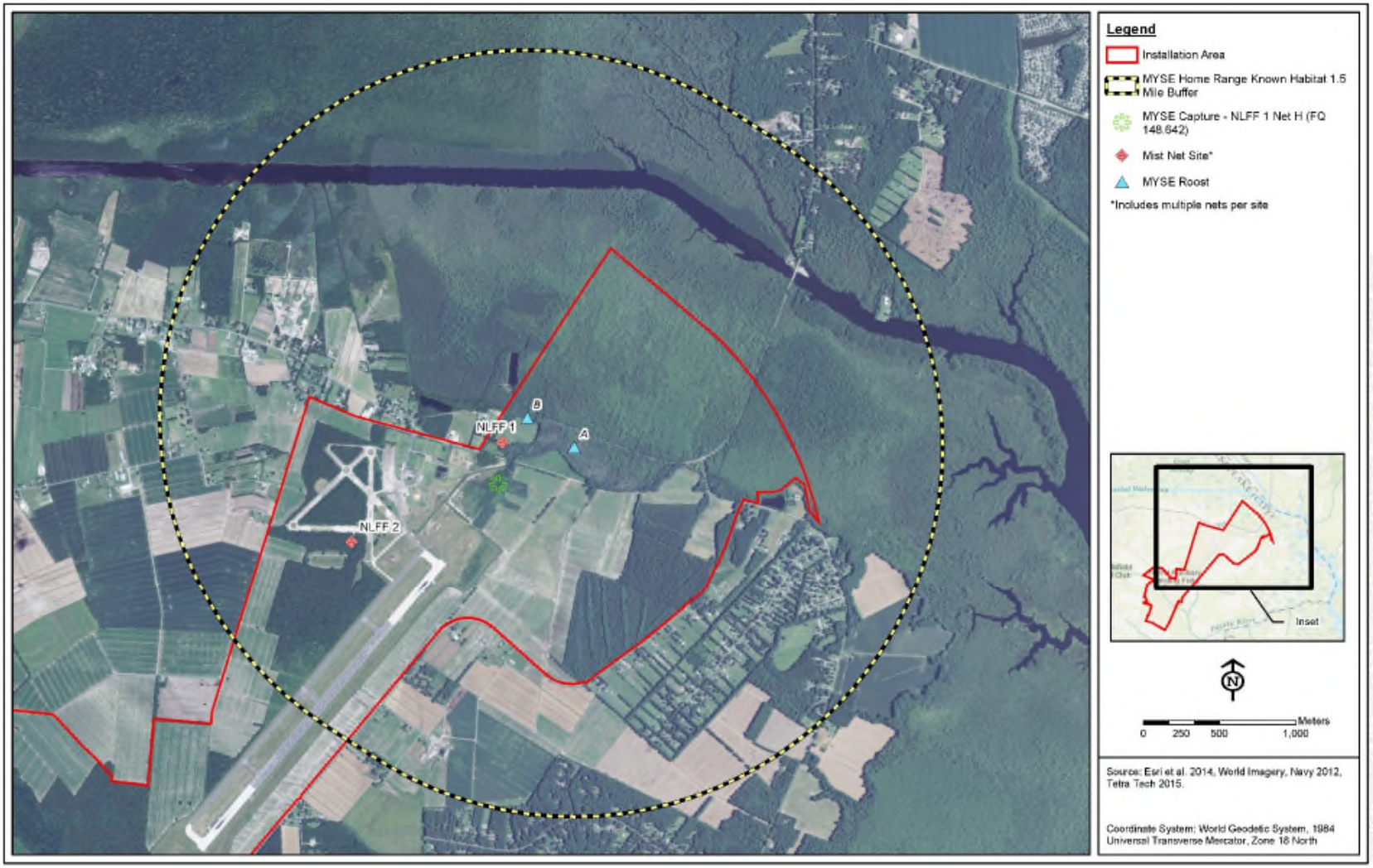


Figure 4-2. Northern Long-Eared Bat Home Range for Frequency 148.642 Including Capture and Roost Sites at NALF Fentress, Virginia - 2015.

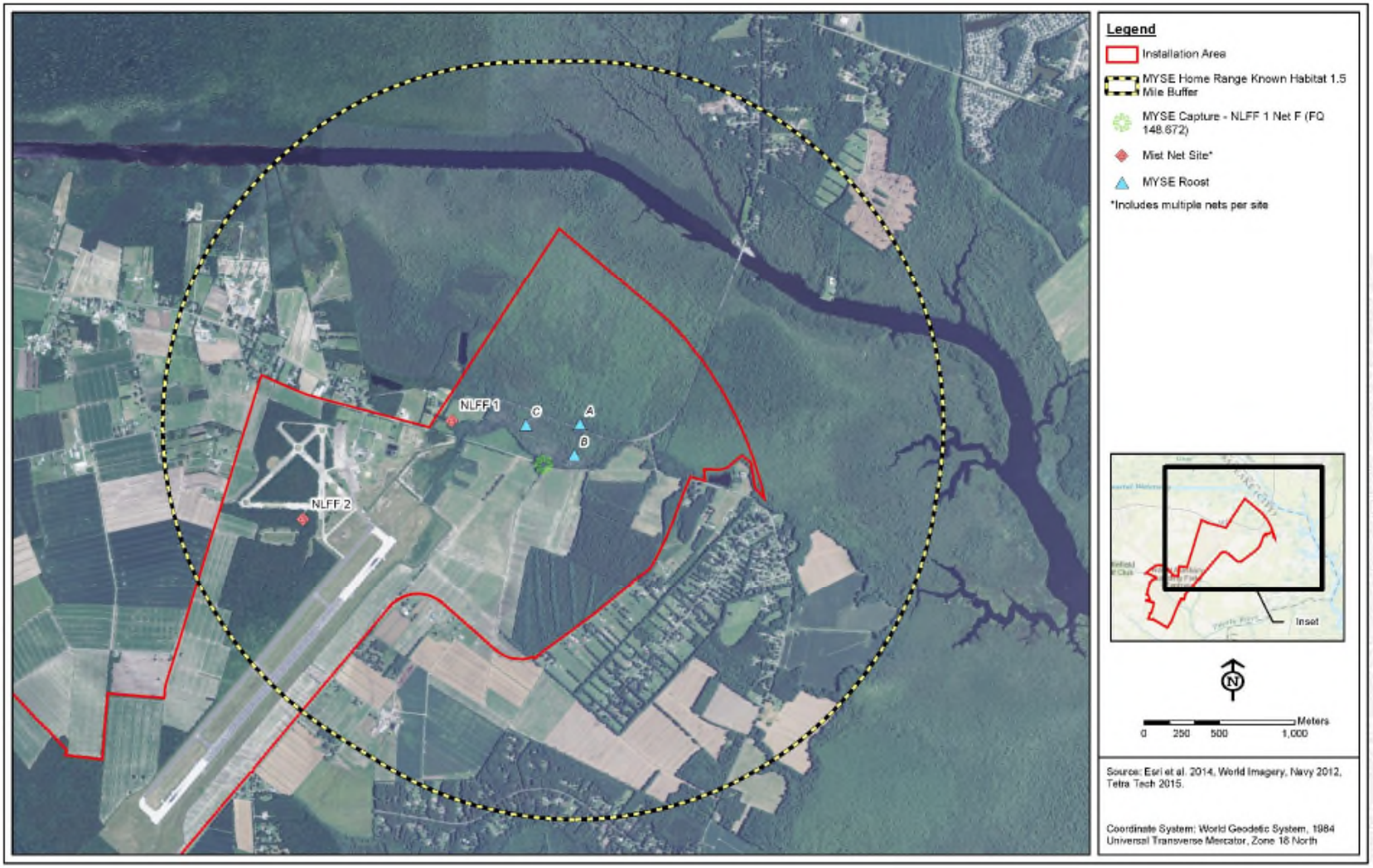


Figure 4-3. Northern Long-Eared Bat Home Range for Frequency 148.672 Including Capture and Roost Sites at NALF Fentress, Virginia – 2015.

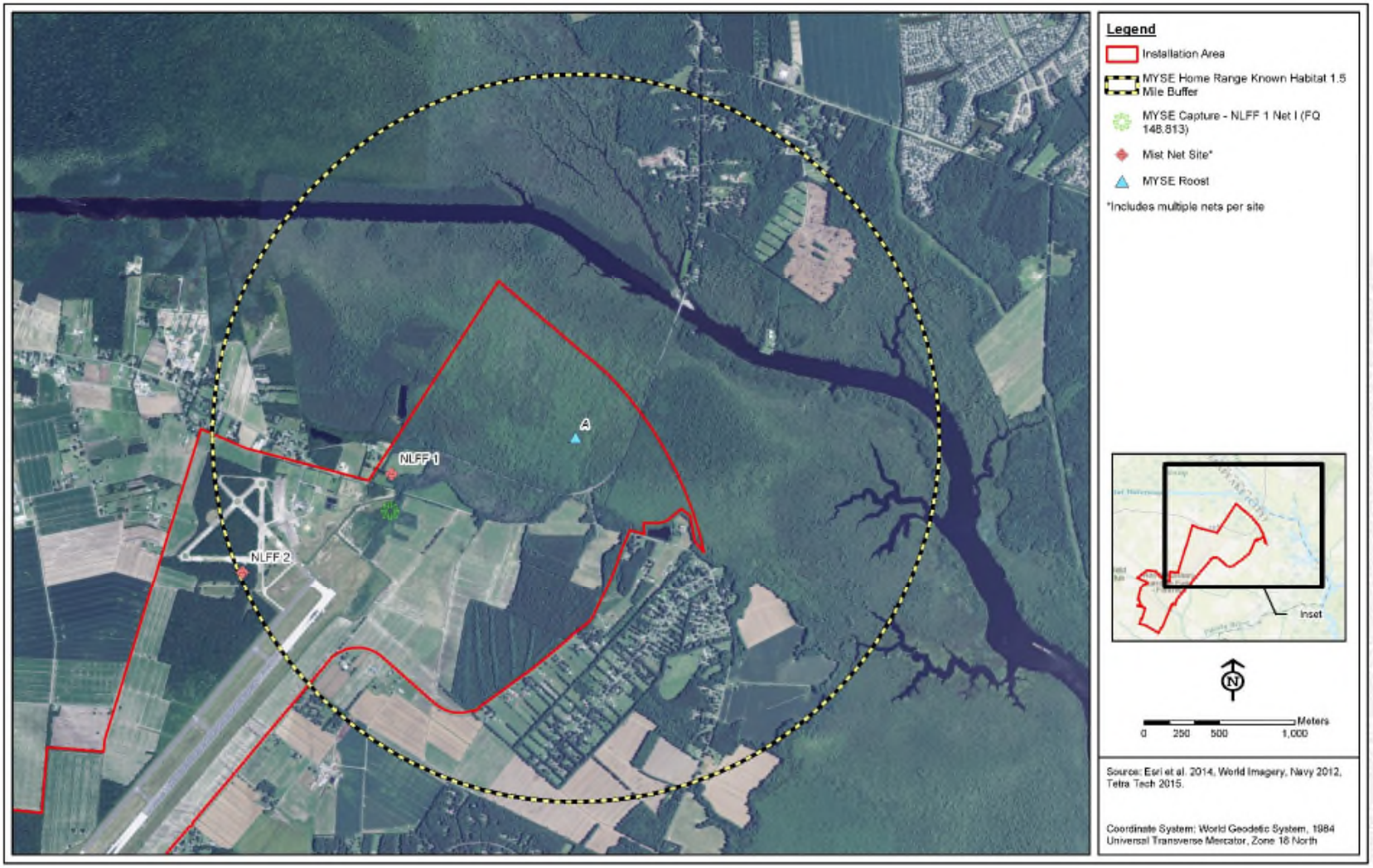


Figure 4-4. Northern Long-Eared Bat Home Range for Frequency 148.813 Including Capture and Roost Sites at NALF Fentress, Virginia - 2015.

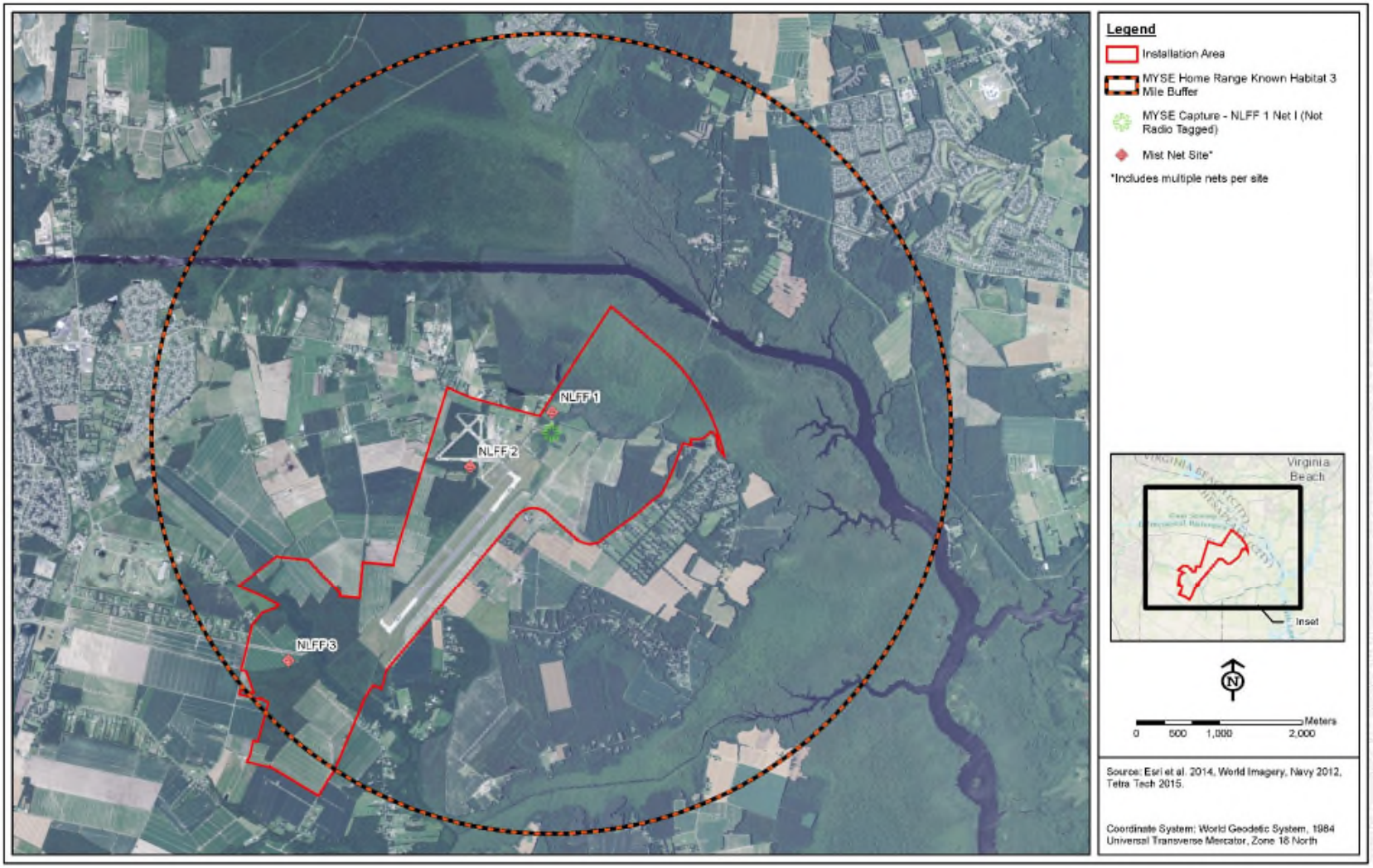


Figure 4-5. Northern Long-Eared Bat Home Range for Untagged Male Including Capture Site at NALF Fentress, Virginia – 2015.

4.3 EMERGENCE COUNTS

Emergence counts were conducted at the known MYSE roosts of two of the three female radio-tagged bats between 19 and 22 June 2015 (Table 4-4). The observed emergence counts were typical of this species with a maximum of 8 bats emerging in one evening. Maternity groups of less than 100 individuals and with a mean colony size of 11 bats, for example, were found at a study in New Hampshire (Sasse and Perkins 1996).

Emergence counts were unable to be performed on the female 148.813 because the roost location was only triangulated and not visually found. The roost tree was deep inside a maple swamp that was deemed a human health and safety hazard for travel during the night without the proper safety gear.

Table 4-4. Summary of Emergence Counts at Northern Long-Eared Bat Roost Tree at NALF Fentress, Virginia – 2015.

Frequency	Date	Time of Emergence	Total # of Bats
148.642	19-Jun-15	20:45	1
	21-Jun-15	20:43	1
	22-Jun-15	20:48	1
148.672	20-Jun-15	20:39	8
	21-Jun-15	20:48	1

5.0 DISCUSSION

This survey documented that MYSE are present at the Installation likely due to the large contiguous area of mature forest available on the Installation and the surrounding areas. All four MYSE were captured at mist net site 1, which is surrounded by hardwood swamps and large acreage of continuous forest that extends off the Installation and connects the North Landing River, a large river system, towards the northeast. The capture and roost locations are consistent with past studies that found preferred habitat of MYSE includes continuous mature forest and specifically wetland habitat with a closed canopy (Yates and Muzika 2006, Henderson and Broder 2008).

The majority of bats captured in the mist-nets were evening bats followed by big brown bats and southeastern bats, which is typical for this white-nose affected area. Evening bat are migratory and generally do not come into contact with *Pseudogymnoascus destructans* because they are not using hibernacula, which harbors the fungus. Big brown bats and southeastern bats are hibernators, which are most affected by WNS. Big brown bats are less affected than Myotis species, however, by WNS possibly because they are larger and thus go into hibernation later and emerge earlier in the season, giving the fungus less time to affect them. Southeastern bats have been found with the fungus, but have not been confirmed with diagnostic symptoms of white-nose syndrome that lead to mortality. Including all species captured, there were more females (61%) than males and all but one female was lactating, suggesting successful breeding of multiple species in the area.

The MYSE sex ratio was skewed toward females and included two lactating females, suggesting that there are successful maternity colonies in the area. During the radio-tracking period, only one of the bats used the same roost. This is typical for the species and during the lactation period females often switch roosts every two to five days (Foster and Kurta 1999). The single roost type identified was under bark on a dead red maple, which is similar to roost site selection reported from the central Appalachians (Menzel *et al.* 2002, Ford *et al*. 2006). Contrary to the black locust specialization found by Ford *et al*. (2006), however, these females specialized in red maples (100% of the known trees used). This does align with the findings of Thompson (2006), who documented variability in roost tree preference across MYSE range. Roosts were often in swampy areas because in roost tree selection, particularly for lactating females, proximity to a water source is an important factor (Sasse and Perkins 1996).

Roost trees were all 18-30-cm diameter at breast height with large variation in heights (7-37 m). There was no pattern in percent canopy cover, which ranged from 10 to70%. This is not consistent with many studies in Kentucky and West Virginia, which found canopy covers of 90% or higher (Owen 2002, Silvis 2015, Johnson 2008). MYSE, however, have been known to use roosts near small canopy gaps where solar radiation can raise the roost temperature, which is particularly good for maternity roosts and can increase insect abundance and activity (Owen *et a*l. 2003).

Many bats are known to share roost trees, or use the same tree over successive days (Owen *et al.* 2002). MYSE emerge at dusk to forage on insects in upland and lowland woodlands and tree-lined corridors to feed on insects that are caught in flight using echolocation, or by gleaning from vegetation and water surfaces (USFWS 2014a). Emergence counts conducted at the roost locations identified, at most, 8 bats emerging from a single roost tree on 20 June, including the lactating female. This suggests that there are maternity colonies in the area because females with young roost together, for safety and increased warmth, and male MYSE tend to roost alone (Broders and Forbes 2004). The next night one bat was seen leaving that same roost tree. This could suggest that there are multiple suitable roosts in the area that the bats are able to relocate to or the bats didn't emerge due to environmental conditions.

The Installation is considering removing a large portion of forested area south of Mt. Pleasant Road due to Airfield Height Obstruction concerns associated with Aviation Safety Requirements. Two thirds of the MYSE roosts found were within this forested area slated for removal and all MYSE captures were from the net site on the edge of that forested area. This demonstrates that the forest patch offers multiple roosting opportunities including likely maternity colonies. Although only the area immediately surrounding the roost tree (46 meters) is protected from tree removal during pup season (01 June -31 July) under the 4(d) rule, MYSE appear to be using this area and it might be important to retain (USFWS 2016).

The home range, or "known habitat" as calculated using the USFWS protocol, of MYSE is larger than was reported for female MYSE in the central Appalachians using the 95% adaptive kernel method, in which the mean home range was 65 acres (Owen *et al*. 2002). This is likely attributable to the coarse assessment of home range following the USFWS protocol (USFWS 2014a). Two sampling components have a strong relationship on measurement of space use and home range size: number of radio marked animals and number of locations for each animal, which is small for this survey (Kernohan *et al*. 2001). Home range varied from 2,554 to 9,915 acres, using only suitable habitat, and overlapped with the areas of interest provided by the Navy. The Installation's resident population of MYSE are using this suitable habitat for both breeding and foraging. The area in consideration for tree removal for aviation safety is within the home range of all MYSE captured.

6.0 RECOMMENDATIONS

Depending on the nature and extent of activities within the areas of interest, there is the potential to directly impact MYSE or its summer habitat by removing forested areas or individual roost trees. Below are several recommendations to protect MYSE and their habitat as well as suggestions of ways to gain more information about MYSE utilization of the Installation.

1) Avoiding activity such as cutting trees during the pup season (01 June -31 July), can prevent NLEB take and curtail adverse effect. However, tree removal is prohibited under

the final 4(d) rule only if it occurs within 46 meters (150 feet) of a known maternity roost tree from 1 June through 31 July (USFWS 2016)

2) Make sure snags are left during cutting or if the area is lacking snags, girdle trees to create snags. Snags can create roosting opportunities like peeling bark and cavities for species such as MYSE. Prescribed fire may also increase the number of snags. Fire also increases the canopy gaps and therefore solar radiation reaching roosts, which can increase maximum roosting temperatures (Johnson et al. 2009). Increased roosting temperatures are associated with rapid development of young (Boyles and Aubrey 2006). However, prescribed fire may reduce roosting opportunities for foliage roosting bats such as hoary bats
3) The tracked female MYSE appeared to prefer roosting in dead red maple trees between 18 and 30cm DBH. Consider maintain stands of trees that contain this type of tree structure
4) Each bat species has a preferred habitat for foraging so maintaining multiple habitats on base is important. Many species prefer to feed over open water, thus protecting wetlands and both the forest around them and corridors that connect with other forest patches is vital. The larger species prefer to forage in open meadow areas and along forest edges that tend to collect insects. Finally, many species, such as MYSE, prefer to forage in forested areas that tend to be wetter and breed more insects. Forested corridors that connect the forest patches or run along streams is important to provide a sheltered environment that bats can use to move around the landscape.
5) Construct or place bat houses around the facility to create roosting habitat
6) Conduct a true home range (95% adaptive kernel method) or core utilization study to determine bats true use of Installation, which requires 30-50 radio-telemetry re-location points
7) For future radio-tracking efforts, success can be improved through the use of aircraft to locate bats that have left the immediate area, or have roosted in areas that are unsafe to be travelled by vehicle or on foot. This method was employed at Naval Support Activity Northwest Annex to find bats that may have left the Installation. Kayaks and proper safety equipment may also aid the search in swamp areas during the night. Surgical glue used for attaching radio-transmitters must be new and consider conducting the survey early in the season when temperatures are cool to inhibit glue melt
8) Conduct acoustic monitoring during an entire season, spanning early spring to late fall, to determine when bats are arriving and when bats are leaving the base. This will pertain both to bats migrating from distant areas and individuals arriving from local hibernacula. If swarms are detected in late fall it may indicate a hibernacula nearby

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APPENDIX A

FIELD SURVEY DATA FORMS – ROOST CHARACTERISTICS

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Northern Long Eared Bat Roost Characteristics

Biologist: M. Ingalls Date: 19 June 2015

Name of Base/Location: Fentress: to the South of Mt. Pleasant Rd.

Town: Chesapeake State: VA County: N/A

Lat/Long (WGS 84): 36.707436, -76.116205

Frequency: 148.642 Sex: F Age: A Date Tagged: 18 June 2015

Roost Tree Data

Tree Species: Red Maple Live OR (Dead)

DBH (cm): 18 Tree height (m): 12 Snag Roost Decay Stage (1-4): 4

% Bark Remaining: 65% % Roost Canopy Cover (average 4 directions): 15%

Roost Aspect (if known): Unknown

Surrounding Habitat

Dist. to Water Source (m): On- in swamp

Significant/Dominant Tree Species in 0.1 ha plot: red maple, green ash (pumpkin ash?)

# of live trees in 0.1 ha plot: 6 # of snags in 0.1 ha plot: 25

Anthropogenic Roost

Roost type: N/A

Roost Aspect: N/A % Roost Canopy Cover: N/A

Decay Stages

	1	2	3	4
Branches	80-100%	few- no branches	Limb stubs to none	none
Bark	80-100%	30-80%	w/ most of ht <30% bark w/ <50% ht: >80% bark	<80%
Height	Full- broken top	Broken top	Broken top to <50% height	<50% height

Northern Long Eared Bat Roost Characteristics

Biologist: CV + KN Date: 8 6/24

Name of Base/Location: Fentress to the north of Mt. Pleasant Rd.

Town: Chesapeake State: VA County: N/A

Lat/Long (WGS 84): 36. 70915 / - 76. 11966

Frequency: 148.642 Sex: F Age: A Date Tagged: 18 June 2015

Roost Tree Data

Tree Species: Red Maple (Live) OR Dead

DBH (cm): 30 Tree height (m): 25 Snag Roost Decay Stage (1-4): 1 n/a

% Bark Remaining: 100% % Roost Canopy Cover (average 4 directions): 80%

Roost Aspect (if known): Unknown

Surrounding Habitat

Dist. to Water Source (m): 5

Significant/Dominant Tree Species in 0.1 ha plot: _____

_____

# of live trees in 0.1 ha plot: 100 # of snags in 0.1 ha plot: 5

N/A

Anthropogenic Roost

Roost type: _____

Roost Aspect: _____ % Roost Canopy Cover: _____

Decay Stages

	1	2	3	4
Branches	80-100%	few- no branches	Limb stubs to none	none
Bark	80-100%	30-80%	w/ most of ht <30% bark w/ <50% ht: >80% bark	<80%
Height	Full- broken top	Broken top	Broken top to <50% height	<50% height

Northern Long Eared Bat Roost Characteristics

Biologist: M. Ingalls Date: 19 June 2015

Name of Base/Location: Fentress. To the north of Mt. Pleasant Rd.

Town: Chesapeake State: VA County: N/A

Lat/Long (WGS 84): 36.707543, -76.111997

Frequency: 148.072 Sex: F Age: A Date Tagged: 18 June 2015

Roost Tree Data

Tree Species: red maple Live OR Dead

DBH (cm): 20 Tree height (m): 10 Snag Roost Decay Stage (1-4): 3

% Bark Remaining: 80% % Roost Canopy Cover (average 4 directions): 70%

Roost Aspect (if known): N/A

Surrounding Habitat

Dist. to Water Source (m): 0- in swamp

Significant/Dominant Tree Species in 0.1 ha plot: red maple, green briar

# of live trees in 0.1 ha plot: 50 # of snags in 0.1 ha plot: 3

N/A

Anthropogenic Roost

Roost type: _____

Roost Aspect: _____ % Roost Canopy Cover: _____

Decay Stages

	1	2	3	4
Branches	80-100%	few- no branches	Limb stubs to none	none
Bark	80-100%	30-80%	w/ most of ht <30% bark w/ <50% ht: >80% bark	<80%
Height	Full- broken top	Broken top	Broken top to <50% height	<50% height

Northern Long Eared Bat Roost Characteristics

Biologist: M. Ingalls & M. Bailey Date: 6/21/18

Name of Base/Location: Fentress - to the south of Mt. Pleasant Rd.

Town: Chesapeake State: VA County: N/A

Lat/Long (WGS 84): 36.70570, -76.11235

Frequency: 148.672 Sex: F Age: A Date Tagged: 6/18

Roost Tree Data

Tree Species: red maple swamp - exact tree unk (most trees) Live OR Dead

DBH (cm): ~9cm Tree height (m): 7m Snag Roost Decay Stage (1-4):

% Bark Remaining: Unknown % Roost Canopy Cover (average 4 directions): 10% → very open

Roost Aspect (if known): Unknown

Surrounding Habitat

Dist. to Water Source (m): 0

Significant/Dominant Tree Species in 0.1 ha plot: maple & green ash

a few loblolly pines

# of live trees in 0.1 ha plot: 29 # of snags in 0.1 ha plot: 12

Anthropogenic Roost

Roost type: NA

Roost Aspect: NA % Roost Canopy Cover: NA

Decay Stages

	1	2	3	4
Branches	80-100%	few- no branches	Limb stubs to none	none
Bark	80-100%	30-80%	w/ most of ht <30% bark w/ <50% ht: >80% bark	<80%
Height	Full- broken top	Broken top	Broken top to <50% height	<50% height

Northern Long Eared Bat Roost Characteristics

Biologist: M. Ingalls & M. Barley Date: 25 June 2015

Name of Base/Location: Fentress - to the North of Mt. Pleasent Rd.

Town: Chesapeake State: VA County: N/A

Lat/Long (WGS 84): Approx: 36.709982°, -76.107840°

Frequency: 148.813 Sex: F Age: A Date Tagged: 19 June 2015

Roost Tree Data

Tree Species: Exact tree unknown - red maple swamp Live OR Dead (?)

DBH (cm): ? Tree height (m): ? Snag Roost Decay Stage (1-4): ?

% Bark Remaining: ? % Roost Canopy Cover (average 4 directions): ?

Roost Aspect (if known): ?

Surrounding Habitat

Dist. to Water Source (m): In swamp

Significant/Dominant Tree Species in 0.1 ha plot: See notes on back

# of live trees in 0.1 ha plot: see notes # of snags in 0.1 ha plot: see notes

N/A

Anthropogenic Roost

Roost type: _____

Roost Aspect: _____ % Roost Canopy Cover: _____

Decay Stages

	1	2	3	4
Branches	80-100%	few- no branches	Limb stubs to none	none
Bark	80-100%	30-80%	w/ most of ht <30% bark w/ <50% ht: >80% bark	<80%
Height	Full- broken top	Broken top	Broken top to <50% height	<50% height

We were unable to locate the exact roost for this bat, however we triangulated with the following points:

Location 1:
36.706802
-76.109809
Aspect: 23°

Location 2:
36.706573
-76.109258
Aspect: 19°

Location 3:
36.70960
-76.10387
Aspect: 304°

Location 4:
36.710335
-76.103555
Aspect: 345°

Location 5
36.711358
-76.103259
Aspect: 238°

These led us to (very approximitly) the lat./long. on the front.

APPENDIX B

FIELD SURVEY DATA FORMS – EMERGENCE COUNTS

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Emergence Count

Biologist: Baxter Seguin Date: 6/19/2015 Frequency: 148:642

Start time: 20:15 End time: 20:55

Location

Name of Base: Fentress

Description: Swamp to the South of Mt. Pleasent Rd.

Lat/Long: 36.707436, -76.116205

Roost Details

Roost Type: (Bark) OR Crevice/cavity % Roost Canopy Cover: 5%

Roost Aspect (deg): NNW 315° Roost DBH (cm): ~~1~~ 18cm Roost Height (m): 10

Bats

Time of first bat: 20:50 Time of last bat: 20:50

Time of transmittered bat: 20:45 Total # of bats: 1

Weather

Temperature: ~~attttccccc~~ 89° % Clouds: 100% Wind: 0

Force	What it looks like	What it's called	Wind Speed (mph)
0	Smoke rises straight up	Calm	0
1	Smoke drifts, indicating wind direction	Light air	1-3
2	Leaves rustle	Light breeze	4-7
3	Leave and twigs move	Gentle breeze	8-12
4	Branches move; flags flap	Moderate breeze	13-18
5	Small trees sway; whitecaps on water	Fresh breeze	19-24
6	Large branches move; flags beat	Strong breeze	25-31
7	Whole trees move; flags extend	Near gale	32-38
8	Twigs break; walking is hard	Fresh gale	39-46
9	Signs blow down; slate blows off roofs	Strong gale	47-54
10	Trees uproot	Whole gale	55-63
11	Much general damage	Storm	64-72
12	Widespread destruction	Hurricane	72+

Emergence Count

Biologist: Baxter Seguin Date: 20 June 15 Frequency: 148.672

Start time: 20:10 End time: 20:55

Location

Name of Base: Fentress

Description: Swamp 100 m south of Mount Pleasent Rd.

Lat/Long: 36.70745, -76.11627

Roost Details

Roost Type: (Bark) OR Crevice/cavity % Roost Canopy Cover: 40%

Roost Aspect (deg): 120 Roost DBH (cm): 17 Roost Height (m): 4

Bats

Time of first bat: 20:35 Time of last bat: 20:50

Time of transmittered bat: 20:39 Total # of bats: 8

Weather

Temperature: 91 % Clouds: 20% Wind: 3

Force	What it looks like	What it's called	Wind Speed (mph)
0	Smoke rises straight up	Calm	0
1	Smoke drifts, indicating wind direction	Light air	1-3
2	Leaves rustle	Light breeze	4-7
3	Leave and twigs move	Gentle breeze	8-12
4	Branches move; flags flap	Moderate breeze	13-18
5	Small trees sway; whitecaps on water	Fresh breeze	19-24
6	Large branches move; flags beat	Strong breeze	25-31
7	Whole trees move; flags extend	Near gale	32-38
8	Twigs break; walking is hard	Fresh gale	39-46
9	Signs blow down; slate blows off roofs	Strong gale	47-54
10	Trees uproot	Whole gale	55-63
11	Much general damage	Storm	64-72
12	Widespread destruction	Hurricane	72+

Emergence Count

Biologist: KN Date: 6-21-15 Frequency: 148.642

Start time: 20:19 End time: 21:02

Location

Name of Base: Fentress

Description: Swamp off of Mt. Pleasant

Lat/Long: 36.70745, -76.11627

Roost Details

Roost Type: (Bark) OR Crevice/cavity % Roost Canopy Cover: 10

Roost Aspect (deg): UKN Roost DBH (cm): UKN Roost Height (m): UKN

Bats

Time of first bat: 20:43 Time of last bat: 20:43

Time of transmittered bat: 20:43 Total # of bats: 1

Weather

Temperature: 90 % Clouds: 30 Wind: 1

Force	What it looks like	What it's called	Wind Speed (mph)
0	Smoke rises straight up	Calm	0
1	Smoke drifts, indicating wind direction	Light air	1-3
2	Leaves rustle	Light breeze	4-7
3	Leave and twigs move	Gentle breeze	8-12
4	Branches move; flags flap	Moderate breeze	13-18
5	Small trees sway; whitecaps on water	Fresh breeze	19-24
6	Large branches move; flags beat	Strong breeze	25-31
7	Whole trees move; flags extend	Near gale	32-38
8	Twigs break; walking is hard	Fresh gale	39-46
9	Signs blow down; slate blows off roofs	Strong gale	47-54
10	Trees uproot	Whole gale	55-63
11	Much general damage	Storm	64-72
12	Widespread destruction	Hurricane	72+

Emergence Count

Biologist: CV Date: 6/8/21 Frequency: 8.672

Start time: 8:20 End time: 9:00

Location

Name of Base: Fentress

Description: To the South of Mt. Pleasant Rd.

Lat/Long: around 36.70572 / -76.11243

Unknown

Roost Details

Roost Type: Bark OR Crevice/cavity % Roost Canopy Cover: _____

Roost Aspect (deg): _____ Roost DBH (cm): _____ Roost Height (m): _____

Bats

Time of first bat: 8:48 Time of last bat: 8:48

Time of transmittered bat: 8:48 Total # of bats: 1

Weather

Temperature: 90° % Clouds: 30% Wind: 1

Force	What it looks like	What it's called	Wind Speed (mph)
0	Smoke rises straight up	Calm	0
1	Smoke drifts, indicating wind direction	Light air	1-3
2	Leaves rustle	Light breeze	4-7
3	Leave and twigs move	Gentle breeze	8-12
4	Branches move; flags flap	Moderate breeze	13-18
5	Small trees sway; whitecaps on water	Fresh breeze	19-24
6	Large branches move; flags beat	Strong breeze	25-31
7	Whole trees move; flags extend	Near gale	32-38
8	Twigs break; walking is hard	Fresh gale	39-46
9	Signs blow down; slate blows off roofs	Strong gale	47-54
10	Trees uproot	Whole gale	55-63
11	Much general damage	Storm	64-72
12	Widespread destruction	Hurricane	72+

Emergence Count

Biologist: Baxter Seguin Date: 22 June 15 Frequency: 148.642

Start time: 20:10 End time: 20:53

Location

Name of Base: Fentress

Description: Swamp 100 m South of Mount Pleasent Rd.

Lat/Long: 36.70745, -76.11627

Roost Details

Roost Type: (Bark) OR Crevice/cavity % Roost Canopy Cover: 5%

Roost Aspect (deg): 330° Roost DBH (cm): 12 Roost Height (m): 9

Bats

Time of first bat: ~~20:10~~ 20:48 Time of last bat: ~~20:53~~ 20:48

Time of transmitted bat: 20:48 Total # of bats: 1

Weather

Temperature: 89 % Clouds: 90% Wind: 0

Force	What it looks like	What it's called	Wind Speed (mph)
0	Smoke rises straight up	Calm	0
1	Smoke drifts, indicating wind direction	Light air	1-3
2	Leaves rustle	Light breeze	4-7
3	Leave and twigs move	Gentle breeze	8-12
4	Branches move; flags flap	Moderate breeze	13-18
5	Small trees sway; whitecaps on water	Fresh breeze	19-24
6	Large branches move; flags beat	Strong breeze	25-31
7	Whole trees move; flags extend	Near gale	32-38
8	Twigs break; walking is hard	Fresh gale	39-46
9	Signs blow down; slate blows off roofs	Strong gale	47-54
10	Trees uproot	Whole gale	55-63
11	Much general damage	Storm	64-72
12	Widespread destruction	Hurricane	72+

APPENDIX C

RESUMES AND PERMITS FOR FIELD CREWS

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DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
Endangered Species Permit Office
1875 Century Boulevard, Suite 200
Atlanta, GA 30345
permitsR4ES@fws.gov

FEDERAL FISH AND WILDLIFE PERMIT

1. PERMITTEE

BIODIVERSITY RESEARCH INSTITUTE
652 MAIN STREET
GORHAM, ME 04038
U.S.A.

2. AUTHORITY-STATUTES
16 USC 1539(a)

REGULATIONS
50 CFR 17.22

50 CFR 13

3. NUMBER
TE63633A-3 AMENDMENT

4. RENEWABLE ☒ YES ☐ NO

5. MAY COPY ☒ YES ☐ NO

6. EFFECTIVE
04/09/2015

7. EXPIRES
04/09/2018

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*
DAVID C EVERS
EXECUTIVE DIRECTOR

9. TYPE OF PERMIT
NATIVE ENDANGERED SP. RECOVERY - E WILDLIFE

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
Alabama, Georgia, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Minnesota, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia, and West Virginia

11. CONDITIONS AND AUTHORIZATIONS

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

C. 1. Continued: the following individuals are authorized to conduct activities as authorized by this permit: Carl Anderson, Timothy Divoll, Shaylyn Hatch, Dustin Meattey, David Yates, and for Indiana bats only: Jonathan Fiely.

Trained assistants not named on this permit may work on permitted bat activities under the direct and on-site supervision of the individuals named above. However, trained assistants may not work independently at a site. Trained assistants are individuals who are considered qualified by the permitted biologist(s) to select sampling sites, deploy sampling equipment and nets, and handle bats in the field.

D. ACCEPTANCE OF THIS PERMIT SERVES AS EVIDENCE THAT THE PERMITTEE UNDERSTANDS AND AGREES TO ABIDE BY THE TERMS OF THIS PERMIT AND ALL SECTIONS OF TITLE 50 CODE OF FEDERAL REGULATIONS, PARTS 13 AND 17, PERTINENT TO ISSUED PERMITS. SECTION 11 OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED, PROVIDES FOR CIVIL AND CRIMINAL PENALTIES FOR FAILURE TO COMPLY WITH PERMIT CONDITIONS.

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS
Annual reports are due by Januaty 31 following each year this permit is in effect

ISSUED BY	TITLE	DATE
Roxanna Hinzman Chief, Division of Environmental Review	CHIEF, DIVISION OF ENVIRONMENTAL REVIEW	04/09/2015

E. PERMITTEE IS AUTHORIZED TO TAKE (ENTER HIBERNACULA OR MATERNITY ROOST CAVES, SALVAGE DEAD BATS, CAPTURE WITH MIST NETS OR HARP TRAPS, HANDLE, IDENTIFY, COLLECT HAIR SAMPLES, BAND, RADIO TAG, LIGHT-TAG, AND WING-PUNCH) INDIANA BATS (Myotis sodalis), GRAY BATS (Myotis grisescens), AND NORTHERN LONG-EARED BATS (Myotis septentrionalis), FOR SCIENTIFIC RESEARCH AIMED AT RECOVERY OF THE SPECIES, SUCH AS: PRESENCE/ABSENCE SURVEYS, STUDIES TO DOCUMENT HABITAT USE, POPULATION MONITORING, AND TO EVALUATE POTENTIAL IMPACTS OF WHITE-NOSE SYNDROME OR OTHER THREATS AS CONDITIONED BELOW.

F. Activities at the following locations require written site-specific approval from the USFWS Field Supervisor in the State(s) where the project will occur (as outlined in Condition G):

F.1. Locations within Region 3 of the USFWS: Illinois, Indiana, Missouri, Minnesota, and Ohio

F.2. Locations within Region 4 of the USFWS: Alabama, Georgia, Kentucky, Mississippi, North Carolina, Louisiana, South Carolina, and Tennessee

F.3. Locations within Region 5 of the USFWS: Massachusetts, New Jersey, New York, Pennsylvania, Virginia and West Virginia

G. Permittee shall notify the USFWS Field Supervisor for the State in which activities are proposed to occur at least 15 days prior to conducting any activities. Contact information is in Condition P., below. Your request for this site-specific approval must be in writing and must indicate:

G.1. The purpose and a description of the activities proposed (e.g., surveys, radio telemetry studies, etc.).

G.2. Location of proposed activities, including project site (legal description and lat/long), county, and state.

G.3. Dates when the project is proposed to take place.

G.4. You may proceed with activities only upon receipt of written concurrence from the applicable USFWS Field Supervisor. *Your concurrence letter must be carried with this permit to authorize site-specific activities.*

H. Permittee shall adhere to the following conditions involving capture and handling of bats:

H.1. Federally listed bats may be captured (e.g., mist-nets and harp traps) following the protocol(s) provided by the USFWS, when available. Permittees must contact the USFWS FO in the State(s) in which activities are proposed to ensure correct protocol(s) are used. For example, the current Range-wide Indiana Bat Summer Survey Guidelines are available at: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html. The monitoring interval for mist nets is once every 10 minutes. Harp traps must be continually monitored.

H.2. Captured bats may be held for a maximum of 30 minutes, unless injured. If an exception is required to this prohibition, permittee must receive prior written approval from the USFWS Field Supervisor for the State in which the activities are proposed to occur.

H.3. Permittees shall carry out non-intrusive measurements on all captured bats. Data shall be recorded for all bats captured and include, but not be limited to, the data requested in any automated or species specific data form provided by the USFWS (e.g., INDIANA BAT SURVEY AND BANDING DATA form). Handling should be limited to the maximum extent practicable and should cease immediately at signs of undue stress (e.g., bat becoming unresponsive, etc.). Bats that appear stressed from handling should be placed in a dark, quiet location away from activity where it can safely fly away after recovery, and should be checked to ensure successful

recovery before leaving the study site. Photographs of the identifying characteristics for each individual federally listed species captured are encouraged. The permittee may be requested to provide individual photographs after submittal of annual reporting data.

H.4. If bands are applied, these must be lipped metal bands having a unique identifier. Bands should be applied to the forearm of captured bats prior to release. No more than one band per bat may be used. Position the band on the wing so that when the bat is hanging upside down, the band numbers are right-side up. A single band should be placed on the right forearm of each male and the left forearm of each female bat.

H.5. Radio transmitters may be applied during spring, summer, and fall roosting and migration periods via nontoxic skin bond adhesive. The total weight of the transmitter may not exceed 5% of the bat's body weight and the total weight of the package (transmitter and adhesive) may not exceed 6% of the bat's body weight. The lightest package (both transmitter and adhesive) capable of accomplishing the required task should be used, especially with pregnant females and newly volant juveniles. Bats carrying transmitters must be monitored daily for at least five days, or until the transmitter falls off, whichever occurs first.

H.6. No capture activities shall occur within 20 meters of a known or potential summer or winter roost site, either natural or artificial, of a federally listed bat. If an exception is required to this prohibition, permittee must receive prior written approval from the USFWS Field Supervisor for the State in which the activities are proposed to occur.

H.7. Permittee may collect dorsal hair samples, wing biopsy tissue samples, fungal lift tape and swab samples from captured bats for scientific study. Hair samples shall be obtained via clipping fur from between scapula from females and juvenile males. The clipped area is the same area frequently clipped for radio transmitter attachment. Wing tissue samples may be taken using a new, sterile biopsy punch (2mm) for each endangered bat sampled. No more than two samples, one from each wing, may be obtained per individual. All boards and equipment used to obtain samples must be disinfected according to the protocol cited in Condition H.9.

H.8. Cyalume light tags may be affixed to the back of unmarked bats during summer roosting period via non-toxic skin bond adhesive to aid in identification of individuals for echolocation recordings. Light tags shall not be affixed to bats carrying radio transmitters. Light tag cannot exceed 2 cm in length or 0.15 g in weight. The light tag must be resistant to tooth puncture and sealed to prevent bats from ingesting cyalume compound. Any light tag that has the potential to expose bats to the cyalume compound is prohibited; the compound is known to be toxic to bats.

H.9. Equipment used to capture and handle bats shall be cleaned and decontaminated, including personal gear such as boots and gloves, using products cited in decontamination guidelines and in compliance with label directions. The most recent decontamination guidance is found on the web at: http://whitenosesyndrome.org/

H.10. Caves, mines, or other suitable hibernation sites may be quietly searched in a manner that minimizes disturbance by utilizing the minimum number of people and time required to complete the survey. Surveys of known hibernacula conducted during the winter hibernation season shall follow the guidelines established in the recovery plans for each federally listed bat species with regards to how often a site may be visited and other species-specific requirements related to entering hibernaculum (for example, for Indiana bats, winter surveys should not be repeated more often than once every other year in any given hibernaculum; for gray bats, winter surveys should not be repeated more often than once every three years in any given hibernaculum), unless authorized by the appropriate Service Recovery Lead identified in Condition O (below).

Under no circumstances should multiple trips to the hibernation area occur within the same year without written approval of the USFWS Field Supervisor for the state in which activities are proposed.

Bats may be handled during winter surveys in order to collect band information and confirm the identification of

listed species. When possible, bands should be read without touching the bat. Banded bats should only be handled if easily accessible and removal of the bat does not disturb a large number of additional bats and is unlikely to result in injury to the bat. Detailed photographs should be taken to document the presence of listed species in previously undocumented hibernaculum. Where hibernacula area and safety conditions allow, individuals entering hibernacula are recommended to utilize night vision goggles or red-filtered light and to remain in the site no more than 90 minutes to complete the work.

H.11. Surveys of gray bat maternity roosts and their other known summer roost sites shall be conducted by observing the bats with night vision equipment and/or infrared light sources (e.g., thermal infrared) as they emerge from their roosts to avoid any possible disturbance to these bats. At previously undocumented sites for these species, the accepted method to determine if they are present is to carefully and slowly enter the potential roost site to check for evidence of presence/use, such as visual observation of bats, significant quantities or a strong smell of guano, or the audible sounds produced by bats roosting at the site. As soon as any evidence is obtained that the roost site is being used by a federally-listed bat species, survey team members shall immediately exit the roost site and make further observations from outside the entrance to the roost. All further observations shall be made from the entrance during the evening emergence.

I. Upon determination that endangered bats are present, permittee shall notify the following offices immediately (not to exceed 1 business day): the appropriate USFWS Regional Office (Condition N.), and the USFWS Field Office within the geographic location of study areas (Condition P.).

J. Permittee must carry a copy of this permit at all times when conducting the authorized activities. Shipments of collected biological materials should also be accompanied by a copy of this permit. NOTE: This permit is limited to the above activities and identified species.

K. Issuance of this permit does not constitute permission to conduct these activities on National Wildlife Refuges or any other public or private lands; such permission must be obtained separately from the appropriate landowner or land manager before beginning these authorized activities. This permit, neither directly nor by implication, grants the right of trespass.

L. Accidental mortality may not exceed one specimen. In the event that an accidental mortality occurs, cease all activities until consulting with the USFWS. Any bat mortality or serious injury must be reported immediately (not to exceed 1 business day) to the applicable office listed in condition N. and to the appropriate Field Office identified in Condition P. The USFWS will work with you to determine the cause of injury or mortality and whether such could be avoided should activities be allowed to proceed. Dead or moribund bats may be retained for further study only with the written permission of the USFWS. Any bats that are not authorized for retention are to be chilled and promptly transferred to the USFWS for potential necropsy and/or for scientific or educational purposes.

Upon locating a dead, injured, or sick bat, or any other threatened or endangered species, under circumstances not addressed in this authorization, initial notification must be made immediately (not to exceed 1 business day) to the appropriate USFWS Office identified in condition N., below, including a description of the circumstances, location information, and photo documentation. Notification should also be made at the same time to the appropriate USFWS Field Office identified in condition P., below. Care should be taken in handling sick, injured, or dead specimens to ensure effective treatment or to preserve biological materials for later analysis. In conjunction with the care of sick or injured threatened or endangered species, and the preservation of biological materials from a dead animal, the permittee should take responsible steps to ensure that the site is not unnecessarily disturbed. Prior to collecting the specimen(s), you must photograph the specimen(s) to document the conditions in which they were found. You may preserve the specimen(s) by freezing them or other suitable method to allow scientific study. Disposition of collected specimen(s) shall be determined by the USFWS Field Office.

M. Reports are due on January 31 following each year this permit is in effect. At a minimum, your report shall include:

M.1. The date, time, geographic locations (including datum and projection information).

M.2. All locations surveyed (regardless of whether federally listed bats were captured/observed).

M.3. Band numbers of all bats banded and all bats recovered/observed.

M.4. Information on any injuries and/or mortalities and disposition of specimens.

M.5. Location and characteristics of roost trees and bat colonies.

M.6. Copies of any separate reports and/or publications resulting from work conducted under the authority of this permit.

M.7. Data shall be submitted for all bats captured and include, but not be limited to, the data requested in any automated or species-specific data form provided by the USFWS (e.g., INDIANA BAT SURVEY AND BANDING DATA forms, the data collection forms found in the current Rangewide Indiana Bat Summer Survey Guidelines cited in Condition H.1., or other species specific forms). Photographs of the identifying characteristics for each individual federally-listed species captured are encouraged. The Permittee may be requested to provide individual photographs after submittal of annual reporting data.

M.8. Copies of all site specific authorization letters required under Condition G.

If no activities occurred over the course of the year, indication of such shall be submitted as an annual report.

N. Copies of your reports shall be sent to the offices listed below. When possible, electronic copies shall be submitted in lieu of hard copies in MS Word, Portable Document Format, Rich Text Format, or other file format that is compatible with the receiving office.

N.1
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Midwest Region (Region 3)
Ecological Services - Endangered Species
5600 American Blvd. W., Suite 990
Bloomington, Minnesota 55437-1458
(612/713-5343; fax 612/713-5292)
permitsR3ES@fws.gov

N.2.
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Southeast Region (Region 4)
1875 Century Boulevard, Suite 200
Atlanta, Georgia 30345-3301
(404/679-7101; fax 404/679-7081)
permitsR4ES@fws.gov

N.3.
Regional Recovery Permits Coordinator
U.S. Fish and Wildlife Service - Northeast Region (Region 5)
Endangered Species Division

300 Westgate Center Drive
Hadley, Massachusetts 01035-9589
(703/358-2402; fax 413/253-8482)
permitsR5ES@fws.gov

O. Additionally, based on species, reports and publications shall be submitted to the following:

O.1. For Studies involving Indiana Bats:

Lori Pruitt
U.S. Fish and Wildlife Service
Indiana Ecological Services Field Office
620 S. Walker Street
Bloomington, Indiana 47403-2121
(812/334-4261 x1213; fax 812/334-4273)

O.2. For Studies involving Gray Bats:

Shauna Marquardt
U.S. Fish and Wildlife Service
Missouri Ecological Services Field Office
101 Park De Ville Drive, Suite A
Columbia, Missouri 65203
(573/234-2132 x174; fax 573/234-2181)

O.3. For Studies involving Northern Long-eared Bats:

Jill Utrup
U.S. Fish and Wildlife Service
Twin Cities Ecological Services Field Office
4104 American Blvd. E
Bloomington, Minnesota 55425
(612/725-3548 x207; fax 612/725-3609)

P. Additionally, based on geographic area, reports and publications shall be submitted to the following:

P.1. For studies conducted in Alabama:

Field Supervisor
Alabama Ecological Services Field Office
1208-B Main Street
Daphne, Alabama 36526-4419
(251) 441-5181

P.2. For studies conducted in Georgia:

Field Supervisor
Georgia Ecological Services Field Office
105 Westpark Drive, Suite D
Athens, GA 30606-3175
(706) 613-9493; fax 706/613-6059

P.3. For studies conducted in Illinois:

P.3.a.
Kristen Lundh
Endangered Species Coordinator for Illinois/Iowa
U.S. Fish and Wildlife Service
Ecological Services Field Office
1511 47th Ave.
Moline, Illinois 61265
(309/757-5800, x215; fax 309/757-5807)

P.3.b.
Joe Kath
Endangered Species Coordinator
Illinois Department of Natural Resources
Division of Natural Heritage
One Natural Resource Way
Springfield, Illinois 62702-1271
(217/785-8764; fax 217/785-2438)

P.4. For studies conducted in Indiana:

P.4.a.
Lori Pruitt
Endangered Species Coordinator for Indiana
Indiana Ecological Services Field Office
620 S. Walker Street
Bloomington, Indiana 47403-2121
(812/334-4261 x1213; fax 812/334-4273)

P.4.b.
Scott Johnson
Indiana Department of Natural Resources
5596 East State Road 46
Bloomington, IN 47401
(812/334-1137, ext. 3400)

P.5. For studies conducted in Kentucky:

Field Supervisor
Frankfort Ecological Services Field Office
J C Watts Federal Bldg., Rm 265
330 West Broadway
Frankfort, KY 40601-8670
(502) 695-0468

P.6. For studies conducted in Louisiana

Field Supervisor

Louisiana Ecological Service Field Office

646 Cajundome Boulevard, Suite 400

Lafayette, LA 70506

(337) 291-3100

P.7. For studies conducted in Massachusetts:

Field Supervisor
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301
(603) 223-2541

P.8. For studies conducted in Minnesota and Wisconsin:

P.8.a.
Phil Delphey
Endangered Species Coordinator for Minnesota and Wisconsin
U.S. Fish and Wildlife Service
Ecological Services Field Office
4101 American Blvd E.
Bloomington, Minnesota 55425
(612/725-3548 x2206; fax 612/725-3609)

P.8.b.
Richard Baker
Minnesota Endangered Species Coordinator
Division of Ecological and Water Resources
Minnesota Department of Natural Resources
500 Lafayette Rd., Box 25
St. Paul, MN 55155
Phone: 651/259-5073
richard.baker@state.mn.us <mailto:richard.baker@dnr.state.mn.us>

P.9. For studies conducted in Mississippi:

Field Supervisor
Mississippi Ecological Services Field Office
6578 Dogwood View Pkwy, Ste A
Jackson, MS 39213-7856
(601) 321-1122

P.10. For studies conducted in Missouri:

P.10.a.
Field Supervisor
U.S. Fish and Wildlife Service
Missouri Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-2132

(573/234-2132; fax 573/234-2181)

P.10.b.
Tara Jennings
Scientific Collecting Permit Coordinator
Missouri Department of Conservation
Endangered Species and Natural History Division
2901 W. Truman Blvd., P.O. Box 180
Jefferson City, Missouri 65102-0180
(573/522-4115 ext. 3322; fax 573/751-4864)

P.11. For studies conducted in New Jersey:

Field Supervisor
New Jersey Ecological Services Field Office
927 N. Main Street, Building D
Pleasantville, NJ 08232-1454
(609) 646-9310

P.12. For studies conducted in New York:

Field Supervisor
New York Ecological Services Field Office
3817 Luker Road
Cortland, NY 13045
(607) 753-9334

P.13. For studies conducted in North Carolina:

Field Supervisor
Asheville Ecological Services Field Office
160 Zillicoa Street
Asheville, NC 28801-1082
(828) 258-3939

P.14. For studies conducted in Ohio:

P.14.a.
Angela Boyer
Endangered Species Coordinator for Ohio
U.S. Fish and Wildlife Service
Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, Ohio 43230
(614/416-8993, x22; fax 614/416-8994)

P.14.b.
Endangered Species Coordinator
Ohio Department of Natural Resources
Division of Wildlife
2045 Morse Road, Building G
Columbus, Ohio 43229-6693

(614-265-6329; fax 614/262-1143)

P.15. For studies conducted in Pennsylvania:

Field Supervisor
Pennsylvania Ecological Services Field Office
315 So. Allen Street, Suite 322
State College, PA 16801-4850
(814) 234-4090

P.16. For studies conducted in South Carolina:

P. 16.a.
Field Supervisor
South Carolina Ecological Services Field Office
176 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558
(843) 727-4707 x227

P. 16.b.
Mary Bunch
Biologist/Preserve Manager
South Carolina Department of Natural Resources
311 Natural Resources Drive
Clemson, SC 29631
(864) 654-6738 x15
Fax: (864) 654-9168
bunchm@dnr.sc.gov

P.17. For studies conducted in Tennessee:

P. 17. a.
Field Supervisor
Cookeville Ecological Services Field Office
U.S. Fish and Wildlife Service
446 Neal Street
Cookeville, TN 38501-4027
(931) 528-6481

P. 17.b.
Brian Flock
Bat Coordinator
Tennessee Wildlife Resources Agency
P.O. Box 40747
Nashville, TN 37204
(615) 781-6569

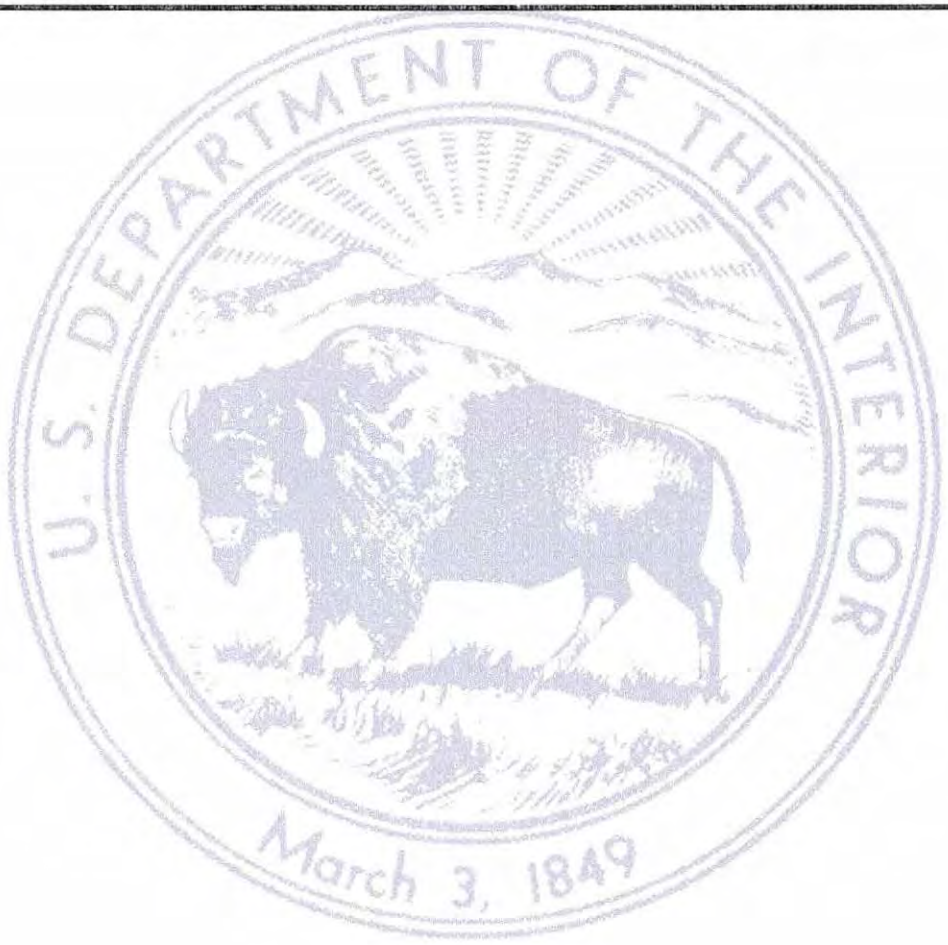
P.18. For studies conducted in Virginia:

Field Supervisor
Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061

(804) 693-6694

P.19. For studies conducted in West Virginia:

Field Supervisor
West Virginia Ecological Services Field Office
694 Beverly Pike
Elkins, WV 26241
(304) 636-6586



Virginia Department of Game and Inland Fisheries

4010 West Broad Street, P.O. Box 11104, Richmond, VA 23230-1104
(804) 367-1000 (V/TDD)
Under Authority of § 29.1-412, § 29.1-417, & § 29.1-418 of the Code of Virginia

Scientific Collection Permit

Permit Type: **New** Fee Paid: **$40.00** VADGIF Permit No. **051933**

Permittee: **Dave Yates**
Address: **Biodiversity Research Institute**
19 Flaggy Meadow Road
Gorham, ME 04038

Office: **(207) 839-7600**
City/County: **Out of State**

Contract Species Surveys

Authorized Collection Methods: Harp Traps for Bats/Terrestrial Mist Nets (Bats/Birds)
Authorized Waterbodies: N/A
Authorized Marking Techniques: N/A

PERMIT AMENDMENT 5/18/2015: This amendment adds the following:
Authorized Subpermittees: Amanda Bailey/Morgan Ingalls/Caroliine Byrnes/Chelsea Vosburgh
Authorized Locations: Naval Properties: Yorktown/Northwest/Norfolk/Oceana/Fentress/Fort Story/Dam Neck/Fort Eustis/Langley

Permittee MUST notify VDGIF a minimum of 7 days prior to each sampling event. Notification must be made via email to: collectionpermits@dgif.virginia.gov

Report Due: 31 January 2015, 31 January 2016

ALL PERMIT REPORTS MUST CONTAIN COORDINATES; PERMITTEE CAN USE THE VIRGINIA FISH AND WILDLIFE INFORMATION SERVICE (VAFWIS) TO OBTAIN COORDINATES BY VISITING: HTTPS://FWISWEB1.DGIF.VIRGINIA.GOV/FWIS/INDEX.HTML

STANDARD CONDITIONS ATTACHED APPLY TO THIS PERMIT.

Authorized Counties / Cities:
York
Norfolk

Authorized Species:

Description	ID Number	Scientific Name
Bats		

Annual Report Due End of Each Year

Authorized Sub-Permittees:
See Attached Sheet

Approved by: *James E. Husband*

Applicants may appeal permit decisions within 60 days of issuance. The appeal must be in writing to the Director, Department of Game and Inland Fisheries.

Title: **James E. Husband - Permits Manager** **Date:** **5/18/2015**

20 Permit Effective **7/28/2014** through **12/31/2015** **15**

Virginia Department of Game and Inland Fisheries

4010 West Broad Street, P.O. Box 11104, Richmond, VA 23230-1104
(804) 367-1000 (V/TDD)

Under Authority of § 29.1-412, § 29.1-417, & § 29.1-418 of the Code of Virginia

Scientific Collection Permit

Permit Type: **New**	FeePaid:	**$40.00**	VADGIF Permit No.	**051933**

Authorized Sub-Permittees:

Tim Divoll, Biodiversity Research Institute
Dustin Meattey, Biodiversity Research Institute
Carl Anderson, Biodiversity Research Institute
Lauren Gilpatrick, Biodiversity Research Institute
Amanda Bailey, Biodiversity Research Institute
Morgan Ingalls, Biodiversity Research Institute
Caroline Byrne, Biodiversity Research Institute
Chelsea Vosburgh, Biodiversity Research Institute

DAVID YATES

719 Moosehead Lake Rd
Greenville, ME 04441
(207) 491-4707

EDUCATION:

Bachelor of Science, Wildlife Biology and Management
Unity College, Unity, ME
Graduated May 1999

M.Sc., Conservation Biology
Antioch University New England
Graduated May 2006

SKILLS:

- Proficient in animal tagging and release methods
- Ability to identify bats of N. and C. America in and QIBS by USFWS and PA State
- HERO training
- Collected and prepared blood samples for contaminant analyses.
- Current DEA drug license
- Analyzed water quality of ponds, rivers and streams
- Experience using tranquilizers/sedatives
- B3 and HUET certificates for low level flights
- HAZWOPR training
- Trained in CPR and First Aid

EXPERIENCE:

Biodiversity Research Institute – *Research Biologist/Mammal Director*, Gorham, ME January 1998 -present

- Certified Indiana Bat Identifier for the state of PA and USFWS
- Project Manager for Acadia National Park bat survey and tracking study
- Project manager and conducted bat surveys for US Navy in VA and NJ
- Lead Biologist Indiana bat surveys for Gas fracking and pipelines in PA
- Project Manager/Lead Biologist for Maine IF&W Eco-region Surveys for bats for 5 years
- Project Manager/Lead Biologists for bat mercury studies at superfund sites from VA to Maine involving U.S.F.&W.S.
- Project Manager/Lead Biologist at 4 U.S. Fish and Wildlife NRDAR sites for bats and furbearers
- Project Manager bat surveys at multiple National Wildlife Refuges in the northeast
- Telemetry Coordinator Gulf Oil Spill Project for USFWS NRDAR bird injury assessment
- Developed Scope of Work for USFWS NRDAR Gulf Oil Spill bird injury assessment
- Coordinated aerial and ground tracking of more than 400 birds using multiple airplanes and satellite technology
- Project Manager/Lead Biologist for FPL Maine Hydro. Beaver, muskrat, otter, and mink telemetry study
- Project Manager/Lead Biologist for live trapping mink and otter study in Maine for state DEP (Master's thesis)
- Project Manager/Lead Biologist for live trapping mink and otter study in Massachusetts for EPA and other superfund studies
- Project Manager for Maine IF&W Ecoregion for three areas in Maine, birds and small mammals
- Project Manager for common loon monitoring in northern and western Maine
- Project Manager/Lead Biologist for National Park Service survey of small and large mammals of Appalachian Trail in Maine
- Winter large carnivore tracking surveys for NPS and private landowner
- Administered schedule III drugs for mink and otter study (Ketemine & Metetomidine)
- DEA Schedule II-III license
- Researched recent trends of mercury and lead contaminants in the North American piscivorous bird's mammals.
- Captured, banded and gathered mercury and lead level data in piscivorous birds.
- Entered banding data into database for Biodiversity Research Institute data analysis.
- Compiled banding data into official banding schedules for U.S. Fish & Wildlife Services.
- Supervised banding of Common Loons, Eagles, Kingfishers and various other species.
- Surveyed reservoirs and lakes for Common Loons, Kingfishers and other piscivorous birds.
- Presented Mammal, Bat and Common Loon slide show to various organizations for educational purposes
- Wrote reports for Loon productivity on Reservoirs for state and private agencies.
- Proposed, designed and organized a mink and otter study for Maine Department of Environmental Protection.

Publications and Reports:

Yates, David E., Evan M. Adams, Sofia E. Angelo, David C. Evers, John Schmerfeld, Marianne S. Moore, Thomas H. Kunz et al. Mercury in bats from the northeastern United States. Ecotoxicology 23, no. 1 (2014): 45-55.

Nam, D.-H., Yates, D., Ardapple, P., Evers, D. C., Schmerfeld, J., & Basu, N. 2012. Elevated mercury exposure and neurochemical alterations in little brown bats (Myotis lucifugus) from a site with historical mercury contamination. Ecotoxicology, 12(4), 1094–1101

Yates, D., K. Taylor, and C. Niven. 2008. Effects of Water Levels on Muskrat (Ondatra zibethicus) Populations within the West Grand Lake Project, Maine. Report BRI 2008-25 submitted to BIA and OA System Corporation, Amarillo, Texas. BioDiversity Research Institute, Gorham, Maine.

Wada, H., D. Yates, D. Evers, R. Taylor, W. Hopkins. 2010. Tissue mercury concentrations and adrenocortical responses of female big brown bats (Eptesicus fuscus) near a contaminated river. Ecotox. 19:7 1277-84.

Yates, D., S. Angelo, T. Divoll and D.C. Evers, 2009. Assessment of mercury exposure to bats at Onondaga Lake, New York. Report BRI 2010-11 submitted to U.S. Fish and Wildlife Service, Cortland, NY. BioDiversity Research Institute, Gorham, Maine, 44 pp.

T. Divoll, D. Yates, D.C. Evers, 2008. Pilot assessment of mercury exposure to bats at Onondaga Lake, New York. Report BRI 2009-10 submitted to U.S. Fish and Wildlife Service, Cortland, NY. BioDiversity Research Institute, Gorham, Maine, 44 pp.

Yates, D., S.E. Angelo, M.W. Goodale and D.C. Evers. 2011. Bat Mercury Study Examining Footprint Area and Downstream: South River, Virginia - 2009. Report BRI 2009-10 submitted to DuPont Corporate Remediation Group, Newark, Delaware and the U.S. Fish Wildl. Serv., Gloucester, Virginia. BioDiversity Research Institute, Gorham, ME. 57pp.

Yates, D., M. Moore, T. Kunz, and D.C. Evers 2008. Pilot assessment of methlymercury availability to bats on the South River, Virginia - 2008. Report BRI 2009-16 submitted to DuPont Corporate Remediation Group, Newark, Delaware and the U.S. Fish Wildl. Serv., Gloucester, Virginia.BioDiversity Research Institute, Gorham, ME. 47pp.

Yates, D., D.C. Evers, and D. Meattey. 2008. Pilot assessment of methlymercury availability to muskrat and shrews on the South Fork River, Virginia - 2008. Report BRI 2009-21 submitted to the U.S. Fish Wildl. Serv., Gloucester,Virginia.BioDiversity Research Institute, Gorham, ME.

Yates, D., W. Goodale, M. Holden, and D. Evers. 2008. Home ranges size in relation to water level fluctuations in river otter, muskrat, mink and beaver on Brassua Lake and surrounding waterbodies. Report BRI 2008-18 submitted to FPL Energy Maine Hydro. BioDiversity Research Institute, Gorham, Maine.

Yates, D. and D.C. Evers. 2007-6. Small Mammals and Bat Inventory of the Appalachian Trail in Maine-2006. Report BRI 2007-6 submitted to the Maine Natural Areas Program and NPS. BioDiversity Research Institute, Gorham, ME.

Yates, D., H. Wada , M. Moore, B. Hopkins, T. Kunz, and D.C. Evers 2007. Pilot assessment of methlymercury availability to bats on the South River, Virginia - 2007. Report BRI 2008-08 submitted to DuPont Corporate Remediation Group, Newark, Delaware and the U.S. Fish Wildl. Serv., Gloucester, Virginia. BioDiversity Research Institute, Gorham, ME. 42pp.

Yates, D., D.C. Evers, and L. Savoy. 2004. Developing a mercury exposure profile for mink and river otter in Maine. Report BRI 2004-09 submitted to Maine Department of Environmental Protection and Maine Inland Fisheries and Wildlife. BioDiversity Research Institute, Gorham, Maine.

Yates, D. E., D.T. Mayack, K. Munney, D.C. Evers, A. Major, T. Kaur, and R.J. Taylor. 2005. Mercury levels in mink (*Mustela vison*) and river otter *(Lontra canadensis*) from northeastern North America. Ecotoxicology 14:263-274.

Yates and D.C. Evers. 2007. Pilot assessment of methlymercury availability to furbearers on the North Fork of the Holston River, Virginia - 2005. Report BRI 2007-10 submitted to the U.S. Fish Wildl. Serv., Gloucester, Virginia. BioDiversity Research Institute, Gorham, ME.

Yates, D., and D.C. Evers. 2006. Assessment of bats for mercury contamination on the North Fork of the Holston River, VA- 2005. Report BRI 2006-9. BioDiversity Research Institute, Gorham, ME.

Yates, D.E. and D. Evers. 2005. An overall assessment of the loon population at Lake Umbagog National Wildlife Refuge: Investigations into individual-specific demographics and assessment of individual and population health. Report BRI 2004-13 BioDiversity Research Institute, Gorham, Maine. 17pp.

Yates, D., D.C. Evers, and W. Goodale. 2006. Monitoring of breeding Common Loons: West Branch of the Penobscot River area - 2005. Report BRI 2006-05. BioDiversity Research Institute, Gorham, ME. pp.30

Yates, D., D.C. Evers, W. Goodale, and W. MacCabe. 2005. Monitoring of breeding Common Loons: West Branch of the Penobscot River area - 2004. Report BRI 2005-10. BioDiversity Research Institute, Gorham, ME. 27 pp.

Yates, D., L. Savoy, D. Evers, C. DeSorbo, W. Goodale, L. Attix, A. Paul, C. Niven, E. Saxson, and M. Nelson. 2005. Documentation of the reproductive success of the Common Loon on selected lakes in the Rangeley Lakes and Eagle Lake Regions in 2004. Report BRI 2005-06 submitted to the New England Forestry Foundation. BioDiversity Research Institute, Gorham, ME. 60p.

Morgan K. Ingalls

367 Rice Farm Road
Dummerston, VT. 05301
(802) 254-2988
morgan.ingalls@briloon.org

Education:

Antioch University New England
Keene, NH
Master of Science in Environmental Studies/Conservation Biology, 2014
Thesis Title: *Estimating Little Brown Bat Winter Mortality Rates from White-Nose Syndrome at Aeolus Cave in Dorset, Vermont using PIT Tag Technology*

Marlboro College
Marlboro, VT
Bachelor of Science in Biochemistry, 2010
Thesis Title: *Mysterious Mortalities: A study of White-Nose Syndrome and G. destructans from a molecular biology perspective*

Skill Sets:

- *Supervisory Skills:* Teaching and overseeing others in both laboratory and field settings
- *Animal Handling Skills:* Removal of bats from net; Species identification and biometrics; Attachment of bands; Collection of blood samples, wing punches, hair samples, etc.
- *Radio Telemetry Skills:* Attachment of radio transmitters to animals; Programming of receivers; Interpretation of radio telemetry signals in difficult terrain
- *Data Management and Analysis Skills:* Appropriate use of statistical tests; Large data set management; Geographical Information Systems; Laboratory analysis of molecular products
- *Project Design Skills:* Co-designed study investigating RNA regulation in cells exposed to *Pseudogymnoascus destructans*; Co-designed study to assess over-winter survivorship of Little Brown bats at Vermont's largest hibernaculum
- *Leadership Skills:* Group management and logistics; Collaborative planning; Communication
- *Caving and Outdoor Skills:* National Cave Rescue Commission Level 1 Certification; Six years of caving experience; Familiarity with single rope technique
- *Computer Skills:* Familiarity with Microsoft Office, ArcGIS, JMP, and Sonobat

Relevant Work Experience:

Wildlife Biologist — May 2015 - Present
Biodiversity Research Institute
Portland, ME

- Oversee field staff
- Supervise and participate in live capture of bats
- Supervise and participate in radio tracking of bats
- Analyze data and write/contribute to reports

Bat Technician — July 2014 – October 2014
Biodiversity Research Institute
Portland, ME

- Set up and broke down mist-nets, removed bats from nets
- Species ID and biometrics, attachment of radio transmitters to animals
- Used radio telemetry to determine day roosts and foraging areas for target species
- Managed the data that was gathered from the project

Intern — Summer 2012 – Summer 2013
Biodiversity Research Institute
Portland, ME

- Participated in several bat banding projects at Great Bay NWR, Parker River NWR, and Acadia National Park
- Identified bats by species, determined sex, age, and reproductive status, and measured hind foot, ear, tragus, and forearm
- Used radio telemetry to determine day roosts of *Myotis leibii* and *Myotis septentrionalis*
- Analysis and writing of report

Volunteer — Winter 2010, 2011, & 2014
New York Department of Environmental Conservation
Albany, NY

- Helped conduct bat counts in Merlin's Cave, Dragon Bones Cave, Surprise Cave, and Haile's Cave

Volunteer — Winter 2009, 2010, 2011, & 2014
Massachusetts Division of Fisheries and Wildlife
Dalton, MA

- Helped conduct bat counts in Bat's Den, Crystal Pool, and Red Bat Caves

Freshman Orientation Program Trip Leader — Fall 2008, 2009, & 2010
Marlboro College
Marlboro, VT

- Designed and co-led six to nine day wilderness trips for six to eight incoming students
- Took part in extensive leadership and logistics training prior to running trips
- Led or co-led day long caving trips for students during the school year

Laboratory Assistant — Fall 2008 – Summer 2010
Marlboro College
Marlboro, VT

- Helped with chemical inventory and organization of MSDS
- Assisted with general laboratory organization and upkeep
- Assisted with preparation and running of General Biology Laboratory and General Chemistry Laboratory
- Helped to implement changes to laboratory safety procedures

Research Assistant to Prof. Todd Smith, PhD. — Summer 2008 & Summer 2010
Marlboro College
Marlboro, VT

- Research on anti-freeze glycoprotiens in Atlantic Cod
- Analyzed cod serum samples using SDS-PAGE
- Quantified samples using a BSA protein assay

Office Manager and Production Coordinator — 2007 – 2008
Yellow Barn Music School & Festival
Putney, VT

- Processed and organized student applications
- Organized and implemented mailings
- Organized audio archives

APPENDIX D

RECEIVER AND TRANSMITTER SPECIFICATIONS

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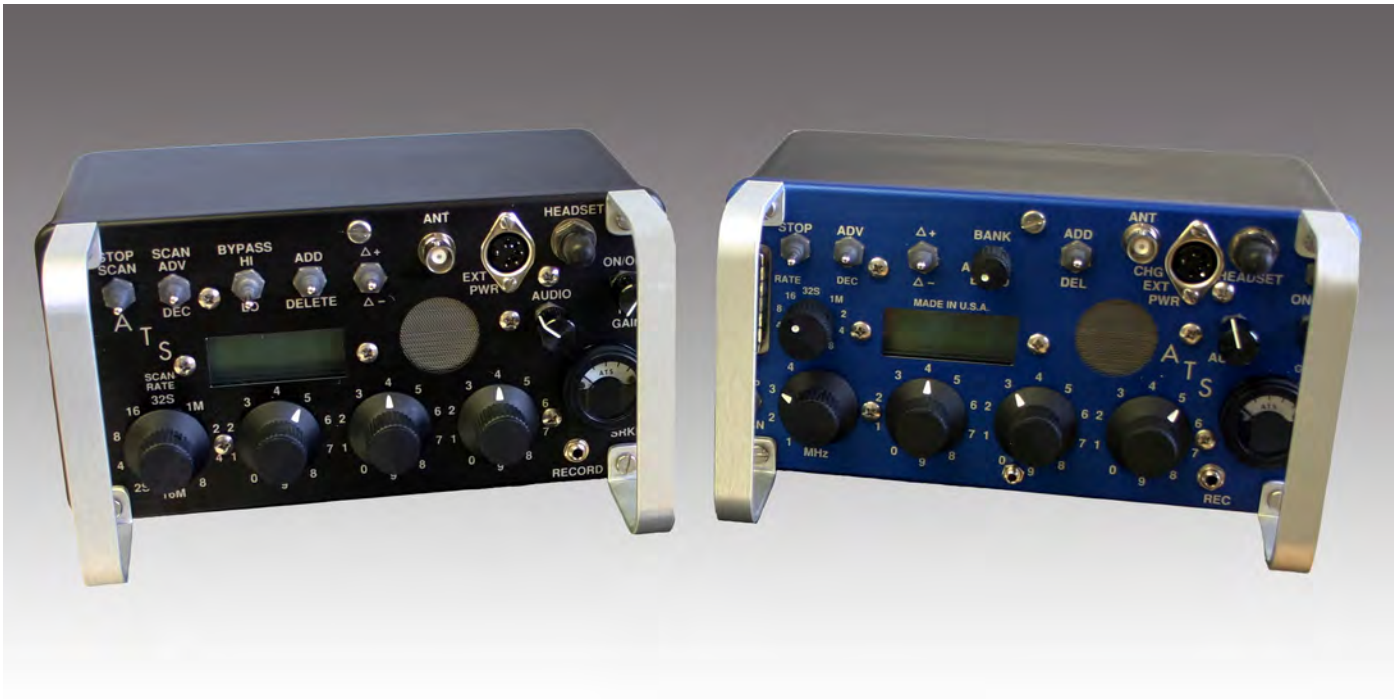
ATS R2000 / R4000 Scientific Receivers

Finding Solutions. Delivering Results.



With performance features and proven reliability, these receivers are an exceptional value.

ATS models R2000 and R4000 are excellent receivers for most aerial, terrestrial and aquatic studies. They offer leading edge technology and outstanding performance.

Both models feature programmable, automatic or manual scanning over a 2 MHz or 4 MHz frequency range. Their 1 kHz channel spacing tracks up to 200 or 400 targets. The user-friendly front panel gives the operator full control over all functions including scan rate, add/delete frequencies, RF gain, audio level, tone decoder threshold, and more. Both units feature state-of-the-art circuitry for exceptional sensitivity, frequency stability, and low noise.

Both receivers are designed for easy field operation. Their large 1/2" LCD display is backlit for night use. A padded Nylon case, battery charger, power cord and detailed operation manual are included with each receiver.

The R2000 and R4000 are lightweight, compact and ruggedly built to withstand heavy field use and extreme environmental conditions. Each can be powered by an external 12 volt DC battery or its own built-in NiCad battery pack for up to 8 hours of use.

ATS R2000 and R4000 receivers offer high performance with high value.

- 2 or 4 MHz Frequency Range
- 1 kHz Channel Spacing
- Improved RF Gain Control For More Precise Direction Finding
- Excellent Frequency Stability
- High Sensitivity/Low Noise
- Sensitive Signal Meter
- Ruggedly Built For Field Use
- Easy Operation
- 4 Distinct Memory Banks (R4000)
- Built-in Computer Interface (R4000)
- Delta Tune Drift Compensation
- Rechargeable NiCad Batteries
- Separate RF Gain And Audio Level Controls
- Battery-Backed Memory
- Auto-Shut Off On Low Battery For Longer Battery Life

WWW.ATSTRACK.COM
MINNESOTA. 763-444-9267
SALES@ATSTRACK.COM

Finding Solutions.
Delivering Results.





TRANSMITTERS
RECEIVERS
GPS SYSTEMS
ANTENNA SYSTEMS
CODED ID SYSTEMS
CONSULTING

ATS
ADVANCED TELEMETRY SYSTEMS
470 FIRST AVE N • BOX 398 • ISANTI, MN 55040
763-444-9267 • 763-444-9384 fax
email:sales@atstrack.com • www.atstrack.com

ATS R2000 / R4000 Scientific Receivers

GENERAL

• **Frequency range:**	R2000 Any Specified 2 MHz range from 30 to 220 MHz R4000 Any Specified 4 MHz range from 140 to 220 MHz
• **Channel spacing:**	1 kHz
• **Input impedance:**	50 ohms
• **Minimum discernible signal (MDS):**	-150 dBm (0.007 uv into 50 ohms)
• **Noise figure:**	3 dB maximum
• **Speaker:**	8 ohms
• **Tone decoder detection range:**	± 2 kHz (Model R4000)
• **Tone decoder detection level:**	-120 dBm minimum (Model R4000)
• **Frequency stability:**	± 1 kHz -20°C to +50°C
• **Delta tune:**	+4 kHz; -4 kHz
• **IF frequency:**	10.7 MHz
• **IF bandwidth:**	6 dB ± 2 kHz; 80 dB ± 7 kHz
• **Image rejection:**	>150 dB
• **RF gain control range:**	>130 dB
• **Operating voltage range:**	9 to 18 volts DC
• **Dwell time (scan rate):**	Selectable, 2 sec. to 16 min. (10 positions)

CONTROLS

- Frequency selectors (4)
- Audio level
- Delta tune
- RF gain
- Increment frequency up/down
- Tone decoder threshold (R4000)
- Memory bank select (R4000)
- Auto scan/memory bypass
- Receiver on/off
- Dwell time (scan rate)
- Add-delete to memory
- Stop scan

MEMORY

- All frequencies programmable in each bank
- Four distinct banks (R4000)
- Sequentially scanned
- Battery backed
- Delete all frequencies in each bank
- Delete frequencies individually with single switch while scanning or on standby

DISPLAYS

• **Selected frequency:**	LCD (0.5" digits) with backlight for night use
• **Memory status:**	Colon in display indicates frequency stored in memory
• **Battery status:**	"Lo Bat" indicator flashes when battery voltage is low
• **Signal detection:**	"+" present in display indicates detection by tone decoder (R4000)
• **Signal level:**	0-1 mA meter

CONNECTIONS

• **Antenna:**	BNC - female
• **Headset:**	Receptacle for 0.25" phone plug
• **Signal level:**	0.125" phone receptacle for external 0.1 mA current meter
• **External power/recharge receptacle:**	5-pin DIN
• **Computer interface (R4000):**	25-pin D-sub filtered connection (socket)

POWER

• **12 volts DC nominal:**	130 mA drain nominal
• **Internal:**	1.2 amp-hour NiCad battery pack; 8-hour nominal operating time
• **External:**	9 to 18 volts, negative ground; switches automatically to external power

COMPUTER INTERFACE (R4000)

- 4 digits BCD (active high)
- Computer control select
- 5 volt DC regulated (5 mA max.)
- 12 volt DC unregulated
- Tone decoder output (active low)
- Signal strength

PHYSICAL

• Size:	11 cm wide x 21 cm long x 18 cm high (4.3" x 8.3" x 7")
• Weight:	2.3 kg (5 lbs)
• Accessories (included):	External power cord, battery charger, padded nylon case, instruction manual
• Accessories (optional):	David Clark aviation-grade headset, DC-DC charger, external battery pack

ENVIRONMENTAL

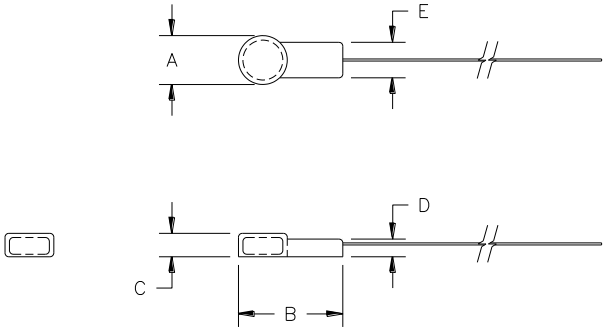
• Operating temperature:	-20°C to +50°C
• Storage temperature:	-70°C to +60°C
• Humidity:	95% non-condensing

WARRANTY

- One year parts and labor on materials and workmanship

AVIAN GLUE ON

Series A2405



Technical Specifications

Transmitter type:	Crystal controlled 2-stage
Calibration tolerance:	±2.5kHz
Frequency stability:	±2.5kHz, -20ºC to 40ºC
Pulse rate and width:	Typical on time 15ms, off time 1.5-4.0sec (controlled by astable circuit)
Pulse rate variation:	5%/volt, ± 20% for temperatures -20ºC to +40ºC
Battery:	Silver Oxide
Activation:	By removing magnet
Encapsulation:	Electrical resin, water-proof, specific gravity: 1.12

MODEL	BATTERY	BATTERY CAPACITY (days)				DIMENSIONS (mm)					WEIGHT (grams)	PRICE GROUP
	1.5V	15 ppm	24 ppm	30 ppm	40 ppm	A	B	C	D	E		
A2412	410	22	15	12	9	5	12	1.5	2.5	4	0.20	F
A2414	337	45	30	24	18	5	12	3	2.5	4	0.30	C
A2415	337	45	30	24	18	5	13	3	4	5	0.50	A
A2426	317	68	45	36	28	6	14	3	4	5	0.65	A
A2435	319	90	60	48	37	6	14	4	4	5	0.75	A
A2445	377	135	89	72	55	7	15	4	4	5	0.90	A
A2455	392	216	143	116	88	8	16	5	4	5	1.20	A

Above models available only in 48.00-50.66MHz, 144.06-151.98MHz, and 164.00-167.99MHz ranges.

Warranty life is 50% of battery capacity.

470 First Ave. No., Box 398 • Isanti, MN 55040
763.444.9267 • fax:763.444.9384 • sales@atstrack.com • www.atstrack.com

04/05/12

Model A2405 Compliance to FCC Part 15 Regulations

This note certifies that Advanced Telemetry Systems, Inc. series A2405 transmitters in frequency range 048.00 – 167.999 comply with regulations under FCC Part15.231 for periodic operation. Periodic operation describes the pulsing mode these units use. The attached antenna may not be altered or the unit may no longer be in compliance.

Regulations under Part 15.5 also apply making them exempt from FCC licensing requirements. These in general state that these devices are secondary users and as such must accept possible interference from other authorized users of the frequency.

Regarding the power output for these transmitters: the power output is less than one milliwatt. (-0.5dBm) when operational with the magnet removed.

Larry B. Kuechle

Engineer
Advanced Telemetry Systems, Inc.
470 1st Avenue North
Isanti, MN 55040

APPENDIX E

MIST-NET COORDINATES AND CAPTURE DATA

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State	VA	VA	VA
County	Chesapeake	Chesapeake	Chesapeake
Town	Chesapeake	Chesapeake	Chesapeake
Site Name	NALFF 1	NALFF 2	NALFF 3
Net A Lat	36.70766117	36.701671	36.680345
Net A Long	-76.1215115	-76.132503	-76.15672817
Net B lat	36.70753433	36.701454	36.67942167
Net B Long	-76.12165767	-76.132584	-76.15551367
Net C Lat	36.70697683	36.700836	36.67878
Net C Long	-76.1227105	-76.132607	-76.15485733
Net D Lat	36.706494	36.700234	36.67867
Net D Long	-76.12045917	-76.132790	-76.15472000
Net E Lat	36.706500	36.700060	-
Net E Long	-76.12046000	-76.132776	-
Net F Lat	36.70509433	36.699921	-
Net F Long	-76.11466	-76.132527	-
Net G Lat	36.70399517	36.699721	-
Net G Long	-76.12274	-76.132991	-
Net H Lat	36.70522517	36.700528	-
Net H Long	-76.12177	-76.132866	-
Net I Lat	36.70545083	-	-
Net I Long	-76.121574	-	-
Datum	WGS84	WGS85	WGS86
Net nights	9	8	4
Habitat	Loblolly Pine, Sweet Gum, Red Maple	Loblolly Pine, Sweet Gum, Red Maple	Loblolly Pine, Sweet Gum, Red Maple, Switch Grass, Poison Ivy

Site Name	Net name	Date	Start Time	Start Temp	End Time	End Temp	% Clouds	Wind	Precip	% Moon	Time	Species	Age	Sex	Reproductive Status	RFA (mm)	Mass (g)	Ear (mm)	RS	Band	Notes
NALFF 1	D	06/18/2015	20:30	84	1:30	82	100	0 mph	None	6.8	22:35	EPFU	A	F	Lactating	46.8	17.8	13	0	DEY1 095	
NALFF 1	E	06/18/2015	20:30	84	1:30	82	100	0 mph	None	6.8	11:30	EPFU	A	F	Lactating	42.6	19.8	14	0	DEY1 096	
NALFF 1	A	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	23:15	EPFU	A	F	Lactating	44.4	18.6	13	0	DEY1 436	
NALFF 1	F	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	23:11	EPFU	A	F	Lactating	47.4	20.7	14	0	DEY1 437	
NALFF 1	E	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	23:11	EPFU	A	F	Lactating	42.8	19.7	13	0	DEY1 438	
NALFF 1	E	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	23:20	EPFU	A	M	non-reproductive	44.1	15.2	14	0	DEY1 439	
NALFF 1	F	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	0:41	EPFU	A	M	Testes descended	46.9	14.9	12	0	DEY1 440	
NALFF 1	E	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	23:05	LABO	A	M	Testes descended	36.2	10.9	11	1	DEY1 435	
NALFF 1	D	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	1:25	LABO	A	F	Lactating	42.1	12.6	10	0	DEY1 441	
NALFF 1	H	06/18/2015	20:30	84	1:30	82	100	0 mph	None	6.8	23:10	MYSE	A	F	Lactating	35.8	7.1	16	0	DEY4 742	48.642, band 4741 lost
NALFF 1	F	06/18/2015	20:30	84	1:30	82	100	0 mph	None	6.8	0:53	MYSE	A	F	Lactating	34	7.4	17	0	DEY4 743	148.672
NALFF 1	I	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	1:40	MYSE	A	F	non-reproductive	35.6	7	18	0	DEY4 894	148.813
NALFF 1	I	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	2:19	MYSE	A	M	non-reproductive	34.5	5.2	17	0	DEY4 895	
NALFF 1	D	06/18/2015	20:30	84	1:30	82	100	0 mph	None	6.8	21:39	NYHU	A	M	Testes descended	33.2	8.8	10	0	DEY4 739	
NALFF 1	E	06/18/2015	20:30	84	1:30	82	100	0 mph	None	6.8	22:25	NYHU	A	M	Testes descended	35.1	9.1	8	0	DEY4 740	
NALFF 1	D	06/18/2015	20:30	84	1:30	82	100	0 mph	None	6.8	22:30	NYHU	A	M	Unknown	Unk	Unk	Unk	Unk		Broken or dislocated leg; released
NALFF 1	D	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	21:45	NYHU	A	F	Lactating	35.2	10.5	11	0	DEY4 891	Sore on tail membrane -- see pics

NALFF 1	D	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	21:30	NYHU	A	M	Unknown	Unk	Unk	Unk	Unk		Escaped
NALFF 1	D	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	22:31	NYHU	A	M	Testes descended	34.1	10.4	9	0	DEY4 893	
NALFF 1	F	06/19/2015	20:30	82	1:30	79	25	1-3 mph	None	12.6	2:30	NYHU	A	F	Lactating	36	11.3	8	0	DEY4 896	
NALFF 2	A	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	23:00	CORA	A	M	Testes Descended	41.4	8.7	31	0	DEY1 098	
NALFF 2	E	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	22:38	CORA	A	M	Non-reproductive	40.6	8.9	Unk	0	DEY4 811	
NALFF 2	H	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	22:40	EPFU	A	F	Lactating	47.4	19.2	12	1	DEY1 099	
NALFF 2	H	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	22:05	LABO	A	F	Lactating	37.5	13.9	11	0	DEY1 097	
NALFF 2	C	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:40	MYAU	A	F	Lactating	39	7.4	11	0	DEY4 826	
NALFF 2	D	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:50	MYAU	A	F	Lactating	38	7.3	9	0	DEY4 827	
NALFF 2	H	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	23:50	MYLU	A	F	Lactating	38.3	7.3	8.5	0	DEY4 813	
NALFF 2	B	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	23:50	MYLU	A	F	Lactating	36.4	7.9	10.2	0	DEY4 812	
NALFF 2	E	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:55	NYHU	A	M	Testes Descended	31.8	9.4	10	0	DEY4 808	
NALFF 2	A	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:21	NYHU	A	F	Lactating	35.5	16	11	0	DEY4 807	
NALFF 2	A	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:26	NYHU	A	F	Lactating	34.8	11.5	8	0	DEY4 806	
NALFF 2	A	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:15	NYHU	A	M	Testes Descended	34.9	8.9	7	0	DEY4 804	
NALFF 2	B	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:19	NYHU	A	M	Testes Descended	34.6	8.7	10	1	DEY4 802	
NALFF 2	H	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:15	NYHU	A	F	Lactating	33.6	10.8	10	0	DEY4 748	
NALFF 2	H	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:15	NYHU	A	M	Testes Descended	33	8.1	8	0	DEY4 746	
NALFF 2	H	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:15	NYHU	A	M	Testes Descended	33.2	9.6	8	0	DEY4 744	
NALFF 2	F	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:20	NYHU	A	F	Lactating	36.8	12.3	8	0	DEY4 745	

NALFF 2	A	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:00	NYHU	A	F	Lactating	34.9	10.7	10	0	DEY4 747	
NALFF 2	A	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:20	NYHU	A	F	Lactating	38.8	12.1	10	0	DEY4 801	
NALFF 2	E	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:15	NYHU	A	M	Testes Descended	33.5	9.1	8	0	DEY4 803	
NALFF 2		06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:19	NYHU	A	F	Lactating	34.8	9.1	11	0	DEY4 891	recapture
NALFF 2	A	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:47	NYHU	A	F	Lactating	35	12	10	0	DEY4 809	
NALFF 2	F	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	21:50	NYHU	A	F	Lactating	35.4	11.1	11	0	DEY4 810	
NALFF 2	H	06/20/2015	20:30	84	2:00	80	50	1-3 mph	Thunder storm at 00:30	23	01:15	NYHU	A	F	Lactating	34.7	11.1	8	0	DEY4 814	Boils on wing
NALFF 2	A	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:00	NYHU	A	F	Lactating	33.3	10.9	10	0	DEY4 816	
NALFF 2	B	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:00	NYHU	A	F	Lactating	36.5	11.2	11	0	DEY4 815	
NALFF 2	H	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:15	NYHU	A	F	Lactating	36.3	11.8	9	0	DEY4 817	
NALFF 2	B	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:30	NYHU	A	F	Lactating	35.2	11	10	0	DEY4 818	
NALFF 2	B	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:30	NYHU	A	M	Testes Descended	34.5	8.7	10	0	DEY4 819	
NALFF 2	A	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:25	NYHU	A	M	Testes Descended	36	9	8	1	DEY4 820	
NALFF 2	B	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:30	NYHU	A	F	Lactating	34.7	10.6	10	0	DEY4 821	
NALFF 2	B	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:35	NYHU	A	M	Testes Descended	34.5	9.5	10	0	DEY4 822	
NALFF 2	B	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:35	NYHU	A	F	Lactating	34.3	10.2	9	0	DEY4 823	
NALFF 2	B	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:35	NYHU	A	M	Testes Descended	34.7	9.7	9	0	DEY4 824	
NALFF 2	E	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	22:00	NYHU	A	M	Testes Descended	33.3	8.1	9	0	DEY4 825	
NALFF 2	H	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:53	NYHU	A	F	Lactating	34.5	11	10	0	DEY4 829	
NALFF 2	F	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:55	NYHU	A	M	Testes Descended	32.2	8.2	9	0	DEY4 828	

NALFF 2	F	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	21:55	NYHU	A	M	Testes Descended	35	9.2	11	0	DEY4 830	
NALFF 2	A	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	22:05	NYHU	A	M	Testes Descended	34.1	8.5	10	0	DEY4 831	
NALFF 2	F	06/21/2015	20:30	88	1:30	82	0	0 mph	None	23	22:00	NYHU	A	M	Testes Descended	35.9	10.1	12	0	DEY4 832	
NALFF 3	A	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:55	EPFU	A	F	Lactating	45.6	17.3	13	0	DEY1 455	
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	22:42	EPFU	A	F	Lactating	41.9	19.2	12	0	DEY1 456	
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	23:05	EPFU	A	M	Testes descended	41.9	15.1	13	0	DEY1 457	
NALFF 3	A	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	23:35	EPFU	A	F	Lactating	46.5	21.6	13	0	DEY1 250	Band out of order****
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	23:40	EPFU	A	F	Lactating	46.1	20.1	12	0	DEY1 458	
NALFF 3	B	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:40	LABO	A	F	Lactating	39.7	16.2	8	0	DEY1 100	
NALFF 3	D	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	22:25	MYAU	A	F	Lactating	37.3	8	8	0	DEY4 845	
NALFF 3	B	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	22:25	MYAU	A	F	Lactating	37.2	9	7	0	DEY4 844	
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	22:32	MYAU	A	F	Lactating	36.1	8.4	8	0	DEY4 846	
NALFF 3	D	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	22:25	MYAU	A	F	Lactating	37.5	7.6	10	0	DEY4 847	
NALFF 3	A	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	23:40	MYAU	A	F	Lactating	36.1	8.3	8	0	DEY4 850	
NALFF 3	C	06/23/2015	20:30	90	1:30	75	10	0 mph	None	46.2	22:20	MYAU	A	M	non-reproductive	35.6	6.8	11	0	DEY3 517	
NALFF 3	A	06/23/2015	20:30	90	1:30	75	10	0 mph	None	46.2	23:16	MYAU	A	F	Lactating	37.5	8.5	9	0	DEY3 518	
NALFF 3	C	06/23/2015	20:30	90	1:30	75	10	0 mph	None	46.2	1:10	MYAU	A	F	Lactating	36.4	7.9	9	0	DEY3 519	
NALFF 3	B	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:15	NYHU	A	F	Lactating	37.2	10.7	9	0	DEY4 834	
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:15	NYHU	A	F	Lactating	36.4	11.6	7	0	DEY4 835	
NALFF 3	B	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:41	NYHU	A	M	Testes descended	34.1	9.4	8	0	Dey48 36	

NALFF 3	B	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:15	NYHU	A	M	Testes descended	34	9.4	9	0	DEY4 837	Funky joint. See photo 100-1454
NALFF 3	A	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:35	NYHU	A	M	Testes descended	34.5	11.5	10	0	DEY4 838	
NALFF 3	B	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:20	NYHU	A	M	Testes descended	33.4	8.1	10	0	DEY4 839	
NALFF 3	B	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:15	NYHU	A	M	Testes descended	34.6	9.5	9	0	DEY4 840	
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:45	NYHU	A	F	Lactating	35.1	13.3	8	0	DEY4 842	
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:45	NYHU	A	F	Lactating	35.1	12.3	10	0	DEY4 841	
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	21:45	NYHU	A	F	Lactating	35.9	14.2	9	0	DEY4 843	
NALFF 3	C	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	22:42	NYHU	A	F	Lactating	35	12.6	9	0	DEY4 848	
NALFF 3	B	06/22/2015	20:30	81	1:30	73	25	0 mph	None	36.8	22:45	NYHU	A	F	Lactating	35.9	12	9	0	DEY4 849	
NALFF 3	C	06/23/2015	20:30	90	1:30	75	10	0 mph	None	46.2	21:30	NYHU	A	M	Testes descended	43	12.8	12	0	DEY3 514	
NALFF 3	A	06/23/2015	20:30	90	1:30	75	10	0 mph	None	46.2	21:40	NYHU	A	M	Testes descended	35.2	10.1	9	0	DEY3 515	
NALFF 3	C	06/23/2015	20:30	90	1:30	75	10	0 mph	None	46.2	21:55	NYHU	A	F	Lactating	33.7	11.9	8	0	DEY3 516	

APPENDIX F

PHOTO LOG OF MIST-NET SITES

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Base: Fentress	**Site #** 1	**Net #** A	**Lat:** 36.707661	**Long:** -76.121511

Base: Fentress	**Site #** 1	**Net #** B	**Lat:** 36.707534	**Long:** -76.121657

Base: Fentress	**Site #** 1	**Net #** C	**Lat:** 36.706976	**Long:** -76.122710

Base: Fentress	**Site #** 1	**Net #** D	**Lat:** 36.706494	**Long:** -76.120459

Base: Fentress	**Site #** 1	**Net #** E	**Lat:** 36.7065	**Long:** -76.12046

Base: Fentress	**Site #** 1	**Net #** F	**Lat:** 36.705094	**Long:** -76.11466

Base: Fentress	**Site #** 1	**Net #** G	**Lat:** 36.703995	**Long:** -76.12274

Base: Fentress	**Site #** 1	**Net #** H	**Lat:** 36.705225	**Long:** -76.121774

Base: Fentress	**Site #** 1	**Net #** I	**Lat:** 36.70545	**Long:** -76.121574

Base: Fentress	**Site #** 2	**Net #** A	**Lat:** 36.701671	**Long:** -76.132503

Base: Fentress	**Site #** 2	**Net #** B	**Lat:** 36.701454	**Long:** -76.132584

Base: Fentress	**Site #** 2	**Net #** C	**Lat:** 36.700836	**Long:** -76.132607

Base: Fentress	**Site #** 2	**Net #** D	**Lat:** 36.700234	**Long:** -76.13279

Base: Fentress	**Site #** 2	**Net #** E	**Lat:** 36.70006	**Long:** -76.132776

Base: Fentress	**Site #** 2	**Net #** F	**Lat:** 36.699921	**Long:** -76.132527

Base: Fentress	**Site #** 2	**Net #** G	**Lat:** 36.699721	**Long:** -76.132991

Base: Fentress	**Site #** 2	**Net #** H	**Lat:** 36.700528	**Long:** -76.132866

APPENDIX G

PHOTO LOG OF BATS CAPTURED AND ROOST TREES

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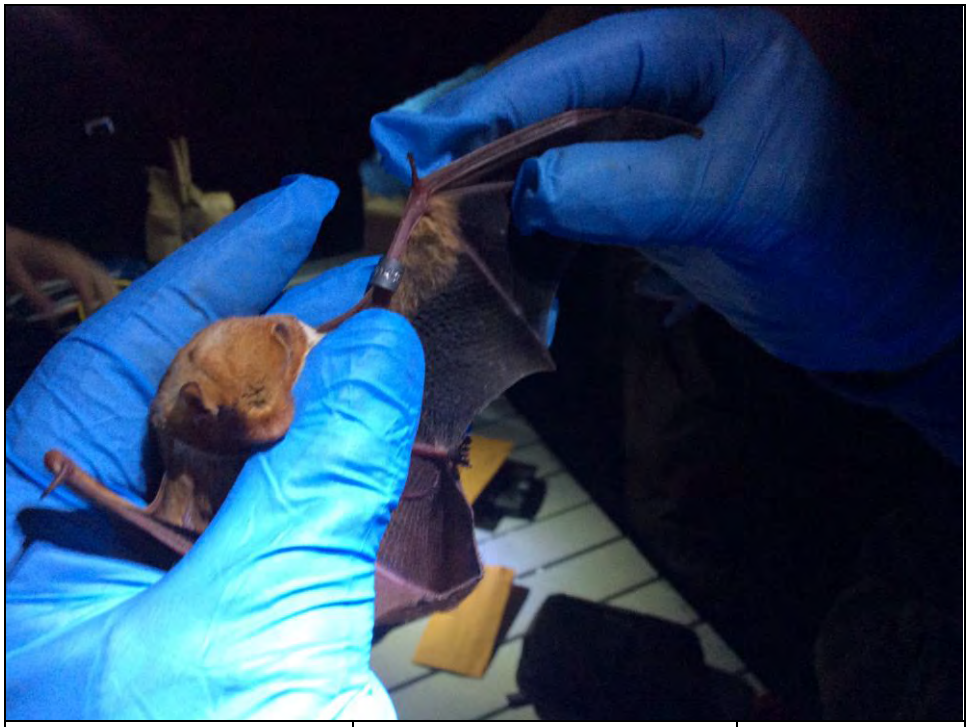
Evening bat (*Nycticeius humeralis*)	**Date Photo Taken:** 6/19/2015	**Base:** Fentress



Eastern red bat (*Lasiurus borealis*)	**Date Photo Taken:** 6/19/2015	**Base:** Fentress

Northern long-eared bat (*Myotis septentrionalis*) **roost tree**			
Base: Fentress	**Transmitter #** 148.642	**Band #** DEY4742	**Date Photo Taken:** 6/19/2015

Northern long-eared bat (*Myotis septentrionalis*) **roost tree**			
Base: Fentress	**Transmitter #** 148.642	**Band #** DEY4742	**Date Photo Taken:** 6/19/2015

Northern long-eared bat (*Myotis septentrionalis*) **roost tree**			
Base: Fentress	**Transmitter #** 148.642	**Band #** DEY4742	**Date Photo Taken:** 6/19/2015

Northern long-eared bat (*Myotis septentrionalis*) **with transmitter**			
Base: Fentress	**Transmitter #** 148.672	**Band #** DEY4743	**Date Photo Taken:** 6/18/2015

Northern long-eared bat (*Myotis septentrionalis*) **with transmitter**			
Base: Fentress	**Transmitter #** 148.672	**Band #** DEY4743	**Date Photo Taken:** 6/18/2015

Northern long-eared bat (*Myotis septentrionalis*) **roost tree**			
Base: Fentress	**Transmitter #** 148.672	**Band #** DEY4743	**Date Photo Taken:** 6/19/2015

Northern long-eared bat (*Myotis septentrionalis*) **roost tree**			
Base: Fentress	**Transmitter #** 148.672	**Band #** DEY4743	**Date Photo Taken:** 6/19/2015

Northern long-eared bat (*Myotis septentrionalis*) **roost tree**			
Base: Fentress	**Transmitter #** 148.672	**Band #** DEY4743	**Date Photo Taken:** 6/19/2015

APPENDIX H

SAFETY PLANS

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INCIDENT PREVENTION PLAN

1. GENERAL INFORMATION

Client Name:	U.S. Department of the Navy		
Project Location:	Various Navy installations located in New Jersey, Virginia, and North Carolina	Project Number:	194-8480
Project Manager:	Derek Hengstenberg	Estimate Dates for Field Work	Spring and fall of 2015, 2016, and 2017

All incidents including near misses involving Tt personnel or Tt subcontractors under Tt's immediate direction ***must be reported*** *to the Project Manager within 24 hours. Incidents may include any injury, illness, potential exposure to hazardous chemicals or biological agents, property damage, theft or motor vehicle damage/accident.*

2. Work Scope

Tetra Tech CES biologists will conduct field work at several U.S. Department of the Navy (Navy) NAVFAC Mid-Atlantic installations located in New Jersey, Virginia, and North Carolina, including Naval Weapons Station (NWS) Earle (Colts Neck, New Jersey); NWS Yorktown (including Cheatham Annex), Naval Station Norfolk, Naval Air Station Oceana Dam Neck Annex, Joint Expeditionary Base Fort Story, Naval Air Station Oceana, and Naval Auxiliary Landing Field Fentress located in Virginia; and Naval Support Activity Hampton Roads, Northwest Annex located in Virginia and North Carolina. Field surveys include bat acoustic surveys to be conducted between 15 March and 15 November 2015, and mist netting surveys to be conducted during the summer of 2015. These presence/absence surveys will be conducted in accordance with federal protocols established for northern long-eared bat (NLEB) (*Myotis septentrionalis*). Tetra Tech has teamed with Biodiversity Research Institute to complete the field work and data analysis for this work. Deployment, retrieval and period downloading of acoustic monitoring equipment will occur during normal, daylight hours. Mist-netting surveys will be conducted during nighttime hours. This IPP will be revised prior to Mist-netting activities in order to more fully outline the control measures to be implemented to mitigate the risks of this activity.

All field survey personnel will be provided with project-specific training, maps and GPS data, indicating the locations and survey limits of their respective survey areas, and restricted access locations prior to mobilization. Due to the presence of explosive ordnance at NWS Earle and NWS Yorktown, lead staff conducting field work at these locations are required to take the Navy's Hazards of Electromagnetic Radiation to Ordnance (HERO) training. The project manager for this project, Derek Hengstenberg, received this required training from the Navy in 2014. Coordination to obtain security access approval to all the installations for all field staff involved will be required in advance of conducting the field efforts, and the project manager will notify each installation Natural Resources Manager (NRM) of the proposed field survey schedule ahead of the field effort. Daily check in/out with the project manager Derek Hengstenberg (cell: 908.616.0436 or office: 207.358.2401) will be conducted by field staff via phone call or text message, to let him known times and locations of where the field work at the start and end of each field effort.

3. PROJECT TASKS, POTENTIAL HAZARDS, AND CONTROL MEASURES (Or Attach Relevant AHA)

3a. TASK(S)	3b. POTENTIAL SAFETY AND HEALTH HAZARD(S)	3c. CONTROL MEASURE(S) (Medical or Training Qualifications, Work Practices, PPE*, etc.)
All field tasks (acoustic monitoring and mist-net surveys)	Slip/Trip/Fall Hazards	▪ Be careful and alert when walking and driving around the installation for overhead wires and objects protruding from the ground (i.e., stumps, anchors, wires)
	Poisonous Plants	▪ The most common poisonous plants that will be encountered are poison ivy (*Toxicodendron radicans*), poison sumac (*T. vernix*), and poison oak (*T. diversilobum*). The best way to avoid the effects caused by urushiol oil produced by these plants is to avoid coming into contact with any part of the

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		plant. These plants are easily identifiable, and all field staff should become familiar with their identification and any known locations on the installations being surveyed. If contact is made, immediately wash contact area with water and soap or use soaps or washes designed for these plants available in drug stores (e.g., Technu). Avoid touching the face and eyes areas and be careful when handling materials and/or equipment that may have come into contact with the plants. Calamine or Caladryl lotion may be effective in relieving the irritation.
	Ticks/Biting Insects	▪ Applying good bug spray and sealing the bottom of your pants (by tucking into boots or socks) will reduce exposure. It is also extremely important to *thoroughly* check yourself for ticks at the end of each field day. The deer tick is (*Ixodes scapularis)* prevalent on East Coast and transmits Lyme disease. Chiggers or mites from the family Trombiculidae live in forests and grasslands and are also found in the vegetation of low, damp areas such as woodlands, berry bushes, orchards, along lakes and streams, and even in drier places where vegetation is low, such as lawns, golf courses, and parks. They are most numerous in early summer when grass, weeds and other vegetation are heaviest. In their larval stage, they attach to various animals, including humans, and feed on skin, often causing itching. These relatives of ticks are nearly microscopic, measuring 0.4 mm and have a chrome-orange hue. Field workers should be able to identify the deer tick and chiggers.
	Inclement Weather	▪ Prepare clothing and field gear by checking weather forecasts often. Develop work plans that account for the weather (drastic storms forecasted = work in non-remote areas). Anticipate and prepare for drastic weather noted for the season and region. Seek shelter as necessary. ▪ Do not work during lightning storms.
	Heat and Cold Stress	▪ It is important to be aware of climate conditions and related health effects, such as heat stress and heat stroke, or cold-related conditions such as hypothermia and frostbite. Heat stress can result in serious injury or death. Become familiar with the following heat-related warning signs and symptoms: ▪ Heat Fatigue—Impaired performance on skilled sensory-motor, mental, or vigilance work. ▪ Heat Cramps—Cramping of the muscles because of loss of salt through sweat

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		▪ Heat Exhaustion—Skin is pale, cool, and moist; heavy sweating; dizziness; fainting; headache; nausea; weakness. It is important to cool a person down quickly should they experience these symptoms ▪ Heat Stroke—Red, hot, dry skin with a lack of perspiration. (Note: Use of PPE can prevent the evaporation of sweat and cause high body temperature, rapid pulse, dizziness, confusion, delirium, coma, or death). Heat stroke is characterized by a cessation of sweating and is considered a medical emergency. 911 should be contacted if someone exhibits the symptoms of heat stroke ▪ Pre-Existing Conditions may impair your ability to tolerate heat. Acclimate yourself to working in hot environments over an approximate 6-day period. (Fit workers may acclimate more quickly.) ▪ Heat stress preventive measures include the following: o Drinking plenty of replacement fluids. You can lose 2-3 gallons (8-12 liters) of water per shift when the weather is hot. Water works just as well as non-carbonated flavored drinks. o Follow the appropriate work/rest regimen whenever working in a high temperature and humidity environment. o Take breaks out of direct sunlight and in areas cooler than where you've been working. o If you feel ill, notify the field team lead or the project manager. o Do not work alone in extreme heat stress conditions; always use the Buddy System. o Field personnel will be trained about signs and symptoms of heat stress and hypothermia. o Proper clothing shall be worn.
	Hunting Seasons	▪ Check with Navy Technical Representative, installation NRM, project manager, and/or field escorts regarding hunting seasons, area restrictions, and safety requirements. Wear hunter orange vests and hats during applicable hunting seasons.
	Interaction with Public/Strangers	▪ Encounters with the public or strange and/or threatening individuals may occur at any time; however, since work will occur on military installations, the chance of these encounters are

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		low. If they do occur, the majority of the time it is friendly and curious individuals. Questions and comments from the public should be directed to the project manager Derek Hengstenberg (cell: 908.616.0436 or office: 207.358.2401) and the installation NRM.
	Water Quality/Water Safety Hazards	▪ Personnel shall refrain from drinking directly from rivers, streams, lakes, and ponds. A minimum of one quart of potable fresh water shall be carried by each person for a field day. Water purification tablets shall be carried for emergency use. If absolutely necessary for drinking, water from rivers, streams, lakes, and ponds should be boiled for at least 5 minutes and then cooled prior to use. In-water surveys should be conducted when water levels are low to prevent injuries or accidents. If current is too swift to safely survey, personnel should not conduct the survey. ▪ Standard Safety Equipment: (1) Waders – All crew members must wear chest or hip waders when conducting in-water survey work. Suitable waders are generally constructed of neoprene, PVC, silicon, and should be breathable for work conducted during high temperatures. (2) Footwear - All footwear must have non-slip soles. ▪ Terrain - Common hazards encountered during sampling activities in streams, rivers, and other waterbodies include slippery surfaces, unstable footing, and strong currents. Use caution to avoid falls, cuts, and injuries.
	Vehicle travel, including parking along public/private roadways and getting stuck.	▪ Wear seat belts at all times. ▪ Park only where there is enough room to pull completely off roadway, pull completely off roadway to park. ▪ Wear High Visibility Clothing. ▪ Do not leave vehicle unattended with the engine running. ▪ Check parking area for soft or unstable surfaces. ▪ Plan ahead to leave the installation before dark (not applicable to mist-netting surveys, which will occur during nighttime hours) as required by security requirements.
	Scratches/cuts/other injuries from vegetation.	▪ Always wear long pants and long-sleeved shirts; carry a first aid kit.

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3a. TASK(S)	3b. POTENTIAL SAFETY AND HEALTH HAZARD(S)	3c. CONTROL MEASURE(S) (Medical or Training Qualifications, Work Practices, PPE*, etc.)
	General site requirements	▪ Wear hard hats and safety vest when working in active construction areas, or on/near roadways. ▪ Where applicable, do not enter restricted areas, ordnance storage areas, or active range areas (typically a flag is raised and flown when the range is active).
Mist-netting surveys	Contact with live or dead animals that have the potential to carry rabies.	▪ The rabies virus is present in the saliva and neural tissue of infected mammals and the most widely known route of exposure occurs from the bite of a rabid animal. However, exposure to rabies may also occur when the virus, from the saliva or other potentially infectious material (neural tissue) is introduced into the handler. Direct exposure routes consist of: o Bites – even those that do not cause bleeding o Existing open cuts in the handler's skin o Mucus membranes of the handler (i.e., rubbing one's eyes, mouth or nose after handling) ▪ Bats (and other small mammals) should never be handled by untrained and unvaccinated field staff. Field staff who handle bats will have received pre-exposure vaccinations and a current antibody check (titer level). ▪ Use appropriately sized PPE, including face shields/masks, eye protection, gloves, gowns, and laboratory coats when handling small mammals (bats) to prevent blood or other potentially infectious materials to pass through to or reach clothes, skin, eyes, mouth, or mucous membranes under normal conditions for the full duration of use. If necessary, provide training to field staff on proper use of PPE. ▪ All reusable equipment must be kept clean and repaired/replaced, and/or disposed of when necessary to maintain its intended protective use. ▪ Properly dispose of used PPE. ▪ When handling live bats, field staff will wear Kevlar lined deer skin gloves, or similar deer skin gloves for protection. ▪ Hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives should be made available for field staff that are allergic to standard gloves. ▪ Wash hands or use sanitizer gel or wipes after handling bats. ▪ Properly dispose of any dead animal carcasses.

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		▪ If suspected exposure to rabies or other infectious diseases occur, the mammal should be retained for testing, the bitten/scratched area should be thoroughly cleansed, and the individual should seek medical counsel and possible vaccination regardless of their previous vaccination history. If the animal is a listed species, the local USFWS Game Warden office will be contacted to take control of the animal[RL1]. Refer to the CDC website http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5902a1.htm
Safety meetings	General site risks and hazards, and emergency protocols	▪ Conduct tail-gate safety meetings at the beginning of each field effort for a new site/location to discuss safety related topics, including site-specific health and safety risks, hazards, and procedures and medical emergency locations in the event of an accident or emergency. If new staff join the field effort after the site-specific, tail-gate safety meeting was conducted, they will be provided the information prior to conducting the field effort (by the field team lead). Any near misses or injuries that have occurred specific to the nature of work or location, and to prevent future incidents should also be discussed at these safety meetings. Documentation of the name and date personnel receive the training, and a summary of topics discussed should be retained by the field team lead and project manager. Any near misses or injuries/emergencies need to be reported to the Tetra Tech Health and Safety Officer as soon as possible after the incident, but no more than 24 hours after the incident.

* PPE identified in this Plan was selected in accordance with 29 CFR 1910.132 and additional TtCES requirements.

4. EMERGENCY INFORMATION (Or attach Client—or other—plans that meet requirements)
4a. Procedure to account for field staff: Field team lead will call or text project manager (or designee) before the beginning of the day's/night's field work. Once field work is completed for the day/night, field team lead will call or text project manager (or designee) to let them know that all field staff are safe and off the project site.
4b. First aid/CPR trained individual's name and first aid kit location: Derek Hengstenberg will ensure all field teams contain at least one person that is CPR/First Aid certified, and that a stocked first aid kit is available for use during all field survey work.

4c. Location of urgent care facilities: Locations and contact information for medical facilities located both on and off the installations covered by this plan are provided below. Most of the installations where the work will take place will have a medical clinic; however, these may not be equipped to handle life-threatening emergencies. For life-threatening emergencies, proceed to the nearest emergency facility noted in this section.

NWS Earle, Colts Neck New Jersey
On-Installation
Branch Health Clinic NWS Earle
201 Highway 34 South, Bldg. C-3,
Colts Neck, NJ 07722
732-866-2300 or 732-866-7493

The NWS Earle Branch Medical Clinic provides outpatient ambulatory care by appointment only, between the hours of 0730 – 1600 Monday – Thursday, and 0730 – 1100 on Friday, excluding holidays.

Off-Installation
Monmouth Medical Center
300 2nd Avenue
Long Branch, New Jersey 07740
(732) 222-5200

NWS Yorktown (including Cheatham Annex)
On-Installation
Branch Health Clinic NWS Yorktown
160 Main Road, Bldg. 1806
Yorktown, VA 23691
(757) 953-8454

The NWS Yorktown Branch Health Clinic is open Monday – Friday, 0730 – 1530; close weekends and federal holidays
Clinic is located at the intersection of Longfellow Rd and Jefferson Ave, in Newport News, VA. From Base Gate #1, take the first Right at Fullinwinder Lane. At the end of this road, make another Right. Thereafter, the road will come to a "Y"-section. Take the Left fork of the "Y". The clinic is the second building on the Right.

Off-Installation
Riverside Doctors' Hospital
1500 Commonwealth Avenue
Williamsburg, VA 23185
(757) 585-2200

Naval Station Norfolk
On-Installation
Branch Health Clinic NAVSTA Norfolk
1721 Admiral Taussig Blvd.
Norfolk, VA 23511-2899
(757) 953-9000

The NAVSTA Norfolk Branch Health Clinic is open Monday – Friday 0700-1600

Off-Installation
Bon Secours DePaul Medical Center
150 Kingsley Lane
Norfolk, VA 23505
(757) 889-5000

Naval Air Station Oceana Dam Neck Annex
Off-Installation
Sentara Virginia Beach General Hospital
1060 First Colonial Rd
Virginia Beach, VA 23454
(757) 395-8000 or (757) 395-8890 (emergency department)

Joint Expeditionary Base Fort Story
On-Installation
Medical Clinic
Bldg. 649 New Guinea Road, Fort Story, VA 23451
(757) 422-7851

Hours: 0630-1500 Mon-Fri

Off-Installation
Sentara Virginia Beach General Hospital
1060 First Colonial Rd
Virginia Beach, VA 23454
(757) 395-8000 or (757) 395-8890 (emergency department)

Naval Air Station Oceana
On-Installation
Oceana Branch Medical Clinic
1550 Tomcat Blvd. Suite 150
Virginia Beach, VA 23460
(757) 953-3933

Off-Installation
Sentara Virginia Beach General Hospital
1060 First Colonial Rd
Virginia Beach, VA 23454
(757) 395-8000 or (757) 395-8890 (emergency department)

Naval Auxiliary Landing Field Fentress
Off-Installation
Chesapeake Regional Medical Center
736 North Battlefield Boulevard
Chesapeake, Virginia 23320

(757) 312-8121

Naval Support Activity Hampton Roads, Northwest Annex
Off-Installation
Chesapeake Regional Medical Center
736 North Battlefield Boulevard
Chesapeake, Virginia 23320

(757) 312-8121

4d. Evacuation routes and rally point(s):

Return to parked vehicle at start of field work. Consult attached medical facility information. Drive to nearest hospital identified for the installation, if necessary.

4e. Emergency contact information

WorkCare Phone: 800-455-6155 (24 hour)
Project Manager: **Derek Hengstenberg**
(908) 616-0436 (cell)
(207) 358-2401 (office)
Safety Manager: **Tami Froelich**
(509) 372-5827 (office)
(509) 392-9080 (cell)
Local Tt Personnel: **Emily Cowperthwaite**
(207) 358-2397 (office)
(207) 329-7381 (cell)
Local Client Reps: **Michael Wright** – Natural Resources Manager for NSAHR NWA, NASO DNA, NAS Oceana, and NALF Fentress; (757) 433-3461 (work) or (757) 373-8531 (cell)
JOHN PULVER **~~Melanie Frisch~~** – Natural Resources Manager for NWS Yorktown; (757) ~~462~~-5351 ~~(Work) or~~ (757) ~~544-4796~~ 887-4952 Jennifer Podlesek 322-4782
Patricia Chizmadia – Natural Resources Manager for NWS Earle; (732) 866-2254 (work)
Emmett Caraway **~~Melanie Frisch~~** –for Naval Station Norfolk; ~~(757) 462-5351 (Work) or (757) 544-4796~~ (757) 341-0495
Roger White **~~Michael Wright~~** – Natural Resources Manager for JEB Fort Story; (757) ~~433-3461~~ ~~(work)~~ or (757) ~~373-8531~~ ~~(cell)~~. 462-5361 462-5350 Sharon Waligora

On-site emergencies should call 911

What do I do in an emergency situation?

1. Call 911 or your local emergency responder for initial employee evaluation and transport to the hospital.
2. Administer first aid to minimize the injury effects.
3. Call WorkCare at 800-455-6155 for a triage call/discussion with an occupational health nurse or physician. Please mention as soon as possible that the call is regarding an emergency injury. At this point, the nurse or physician will assist the field staff to determine the best treatment plan.
4. Call your Project Manager: (See 4e).
5. Call your Safety Manager, Tami Froelich (See 4e).

What do I do in a non-emergency situation?

1. Administer first aid as soon as possible to minimize the injury effects
2. Follow steps 3 thru 5 above.
3. Call the local clinic identified above to notify them that you are bringing an injured worker in for evaluation.
   - You may transport the injured employee to the local clinic in a privately owned vehicle. A designated Tetra Tech employee must accompany the injured worker to the local clinic. Encourage the clinic, with WorkCare support, to consider first aid measures first.

5. INCIDENT PREVENTION PLAN SIGNOFFS

Prepared By:	Linda Rivard Linda Rivard	Phone No.:	207.358.2393	Date:	~~26~~ 09 May 2015
Project Manager Approval:	Derek Hengstenberg Del	Phone No.:	207.358.2401	Date:	26 May 2015
PESM Approval:	Tami Froelich Tami Froelich	Phone No.:	509.392.9080	Date:	5/20/15
		Incident Prevention Plan expiration		Date:	5/20/2016

INCIDENT PREVENTION PLAN AWARENESS TRAINING RECORD*

"I have read and understand the requirements and my responsibilities under this Incident Prevention Plan"

PRINTED NAME	SIGNATURE	EMPLOYEE ID/NUMBER	DATE	CELL PHONE #
Derek Hengstenberg				(908) 616-0436
Clinton Parrish				(410) 596-5103

*This Training Record should be retained as part of the original project files.

ATTACHMENT A – PERSONAL PROTECTIVE EQUIPMENT

The Personal Protective Equipment (PPE) specified for this project is based on the hazard analysis. Because no chemical hazards are anticipated, the initial PPE will be Level D. Level D PPE includes the following:

- Hard hats – Required in active construction areas (if applicable)
- Safety boots –Sturdy boots are required but steel toe or composite toed boots are not necessary, but are recommended if working in active construction zones
- Footwear - All footwear must have non-slip soles
- Puncture-resistant gloves and face masks- Wear face masks and Kevlar lined deer skin gloves, or similar deer skin gloves are required for protection when handling live bats
- High visibility vest – Required when working around traffic and in/near construction zones
- Safety glasses – Not required but recommended for work in dense vegetation
- Long pants – Required
- Leather gloves –Recommended if working in dense and thorny vegetation
- Sunscreen – Not required, but is recommended
- Insect repellant – Not required, but is recommended for ticks and biting insects. DEET is an effective repellent that typically must be applied every 5 hours. Perform tick self-inspections after exiting wooded areas and tall grasses. Inspect areas for insects and spiders before entering or before placing hands near the ground
- Water or other hydrating fluids – Not required, but should be consumed throughout the day to stay hydrated
- Hip or chest waders – waders should be worn when conducting in-water survey work. Suitable waders are generally constructed of neoprene, PVC, silicon, and should be breathable for working high temperatures
- A first aid kit containing medical supplies (bandages, dressing, antibiotic ointment, first aid manual, etc.), Technu, Caladryl or similar lotion, sunscreen, insect repellent, and emergency water purification tablets shall be available during all aspects of field survey work

ATTACHMENT B – EMERGENCY INFORMATION

NWS Earle, Colts Neck New Jersey
On-Installation
Branch Health Clinic NWS Earle
201 Highway 34 South, Bldg. C-3,
Colts Neck, NJ 07722
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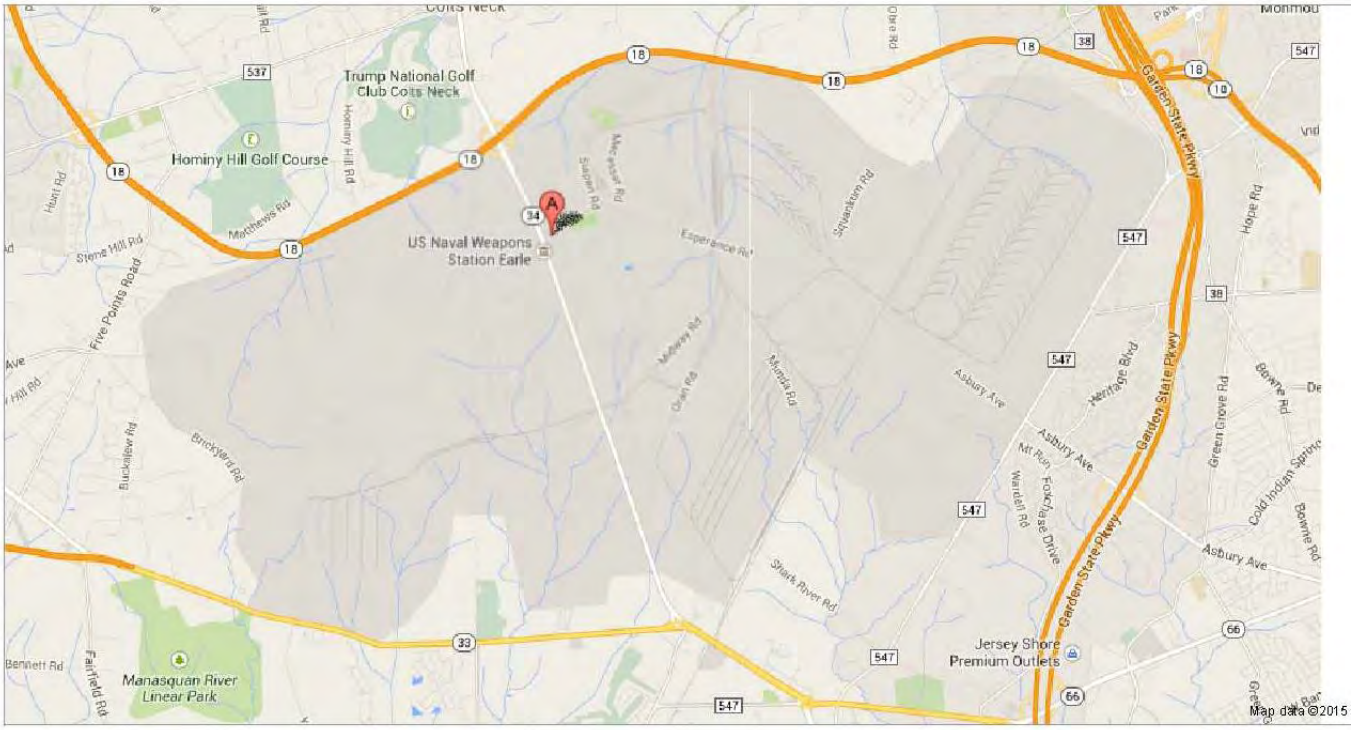
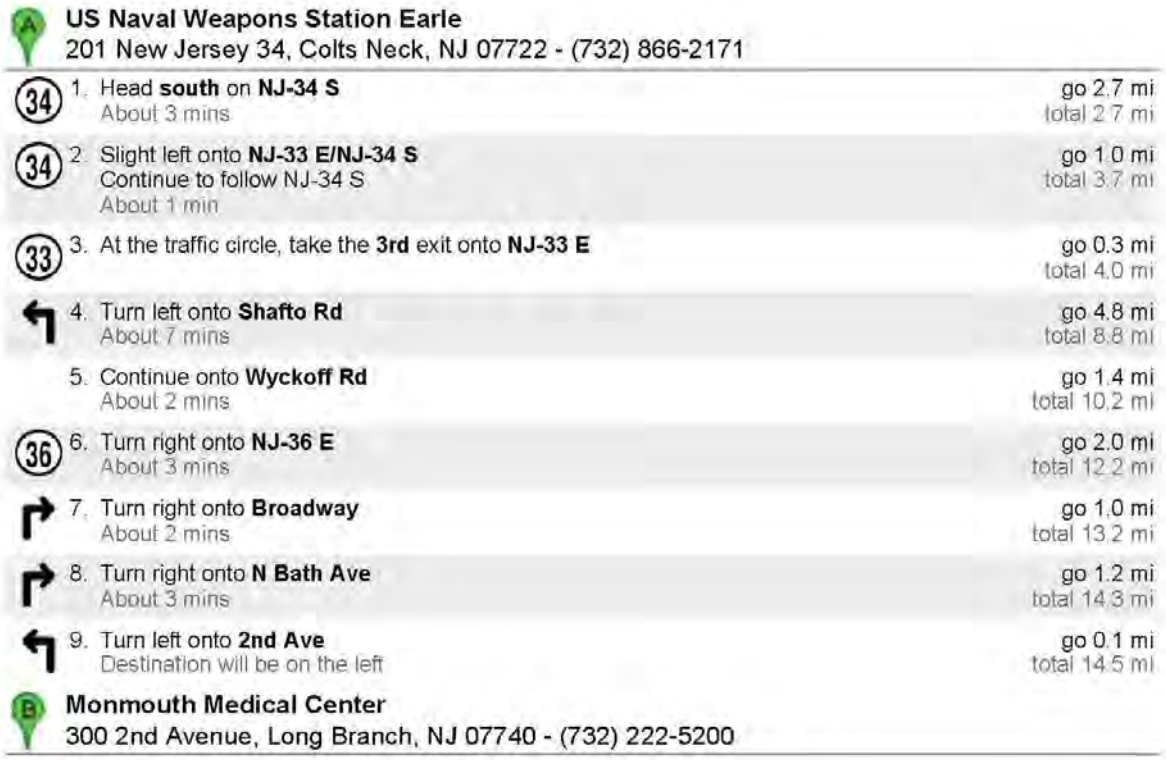


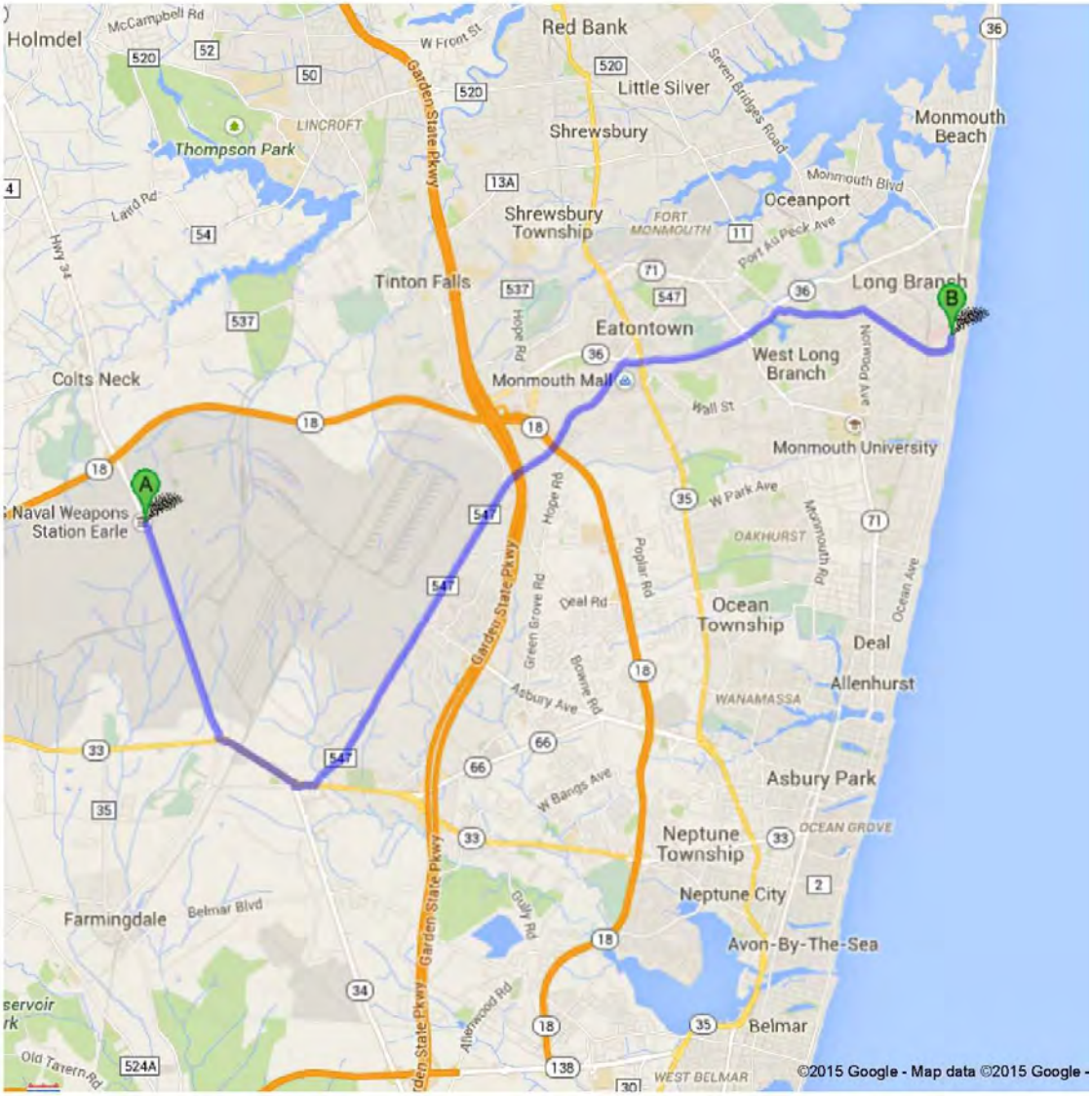
NWS Earle, Colts Neck New Jersey
Off-Installation
Monmouth Medical Center
300 2nd Avenue
Long Branch, New Jersey 07740
(732) 222-5200



US Naval Weapons Station Earle
201 New Jersey 34, Colts Neck, NJ 07722 - (732) 866-2171

34	1. Head **south** on **NJ-34 S** About 3 mins	go 2.7 mi total 2.7 mi
34	2. Slight left onto **NJ-33 E/NJ-34 S** Continue to follow NJ-34 S About 1 min	go 1.0 mi total 3.7 mi
33	3. At the traffic circle, take the **3rd** exit onto **NJ-33 E**	go 0.3 mi total 4.0 mi
	4. Turn left onto **Shafto Rd** About 7 mins	go 4.8 mi total 8.8 mi
	5. Continue onto **Wyckoff Rd** About 2 mins	go 1.4 mi total 10.2 mi
36	6. Turn right onto **NJ-36 E** About 3 mins	go 2.0 mi total 12.2 mi
	7. Turn right onto **Broadway** About 2 mins	go 1.0 mi total 13.2 mi
	8. Turn right onto **N Bath Ave** About 3 mins	go 1.2 mi total 14.3 mi
	9. Turn left onto **2nd Ave** Destination will be on the left	go 0.1 mi total 14.5 mi

Monmouth Medical Center
300 2nd Avenue, Long Branch, NJ 07740 - (732) 222-5200



NWS Yorktown (including Cheatham Annex)
On-Installation
Branch Health Clinic NWS Yorktown
160 Main Road, Bldg. 1806
Yorktown, VA 23691
(757) 953-8454

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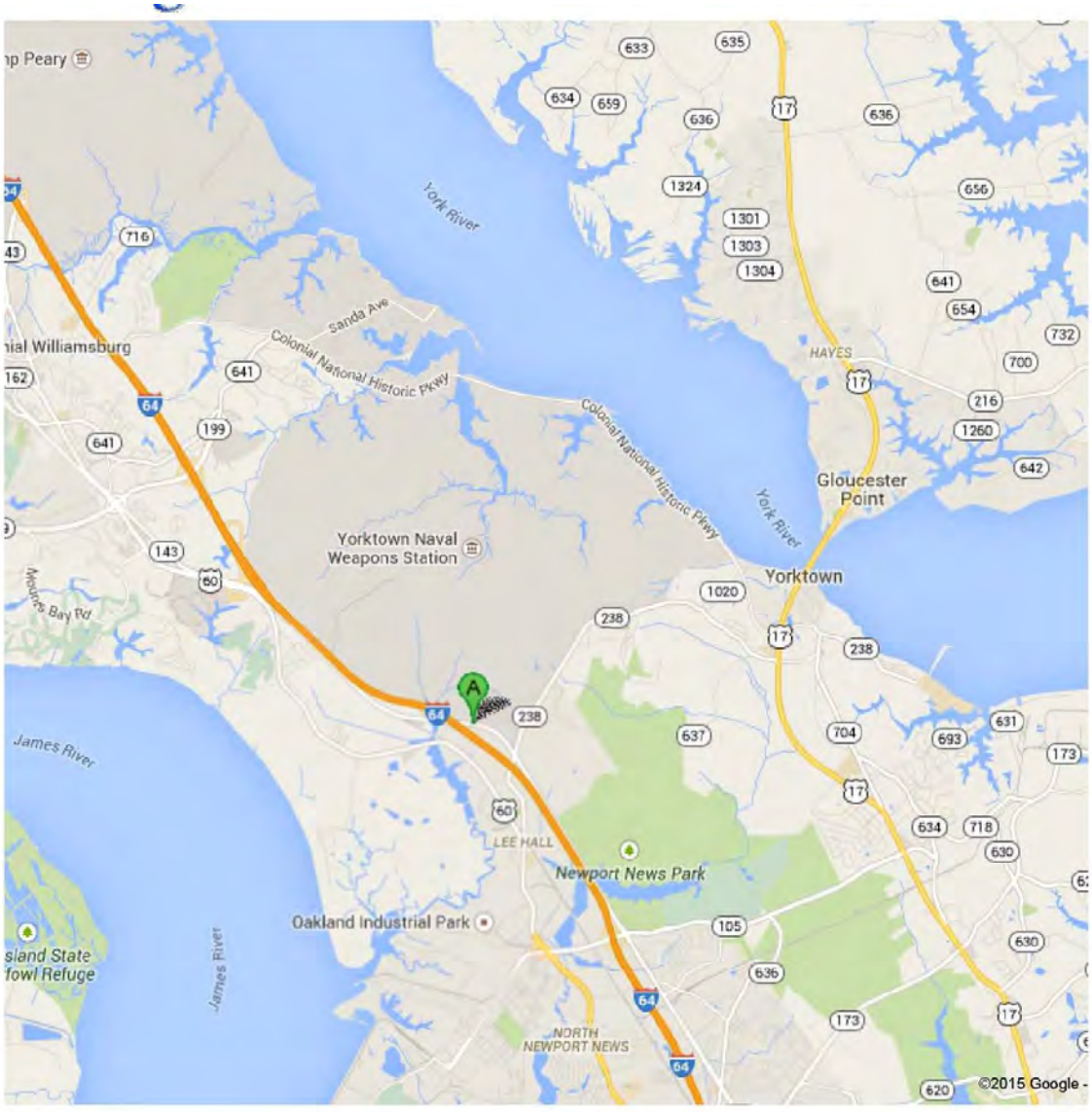
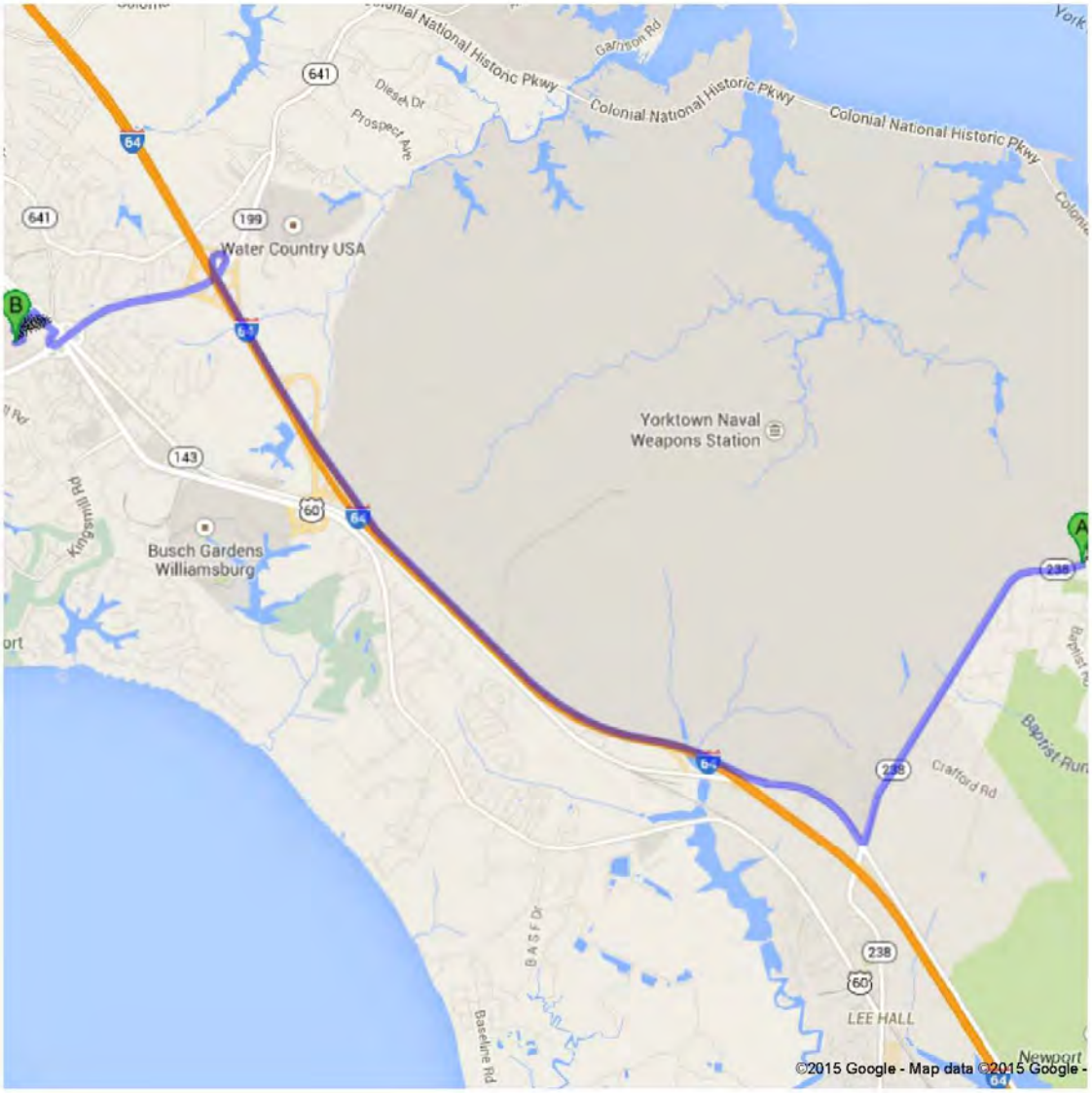


NWS Yorktown (including Cheatham Annex)
Off-Installation
Riverside Doctors' Hospital
1500 Commonwealth Avenue
Williamsburg, VA 23185
(757) 585-2200

A	Naval Weapons Station Yorktown, Yorktown, VA	
238	1. Head **west** on **VA-238 W** toward **Red Oak Ln** About 3 mins	go 2.3 mi total 2.3 mi
↱	2. Turn right onto **Jefferson Ave** About 1 min	go 0.8 mi total 3.1 mi
64	3. Take the ramp onto **I-64 W** About 4 mins	go 4.7 mi total 7.8 mi
199	4. Take exit **242A** to merge onto **VA-199 W** toward **Williamsburg/Jamestown** About 2 mins	go 1.4 mi total 9.2 mi
↱	5. Take the **US 60** ramp to **Williamsburg/Busch Gardens**	go 0.1 mi total 9.3 mi
60	6. Turn left onto **US-60 W**	go 0.2 mi total 9.5 mi
↰	7. Turn left onto **Battery Blvd**	go 0.1 mi total 9.6 mi
↱	8. At the traffic circle, take the **3rd** exit onto **Commonwealth Ave**	go 0.1 mi total 9.7 mi
↱	9. Turn right	go 285 ft total 9.8 mi
↰	10. Turn left Destination will be on the right	go 16 ft total 9.8 mi
B	**Riverside Doctors' Hospital Williamsburg** 1500 Commonwealth Avenue, Williamsburg, VA 23185 - (757) 585-2200	

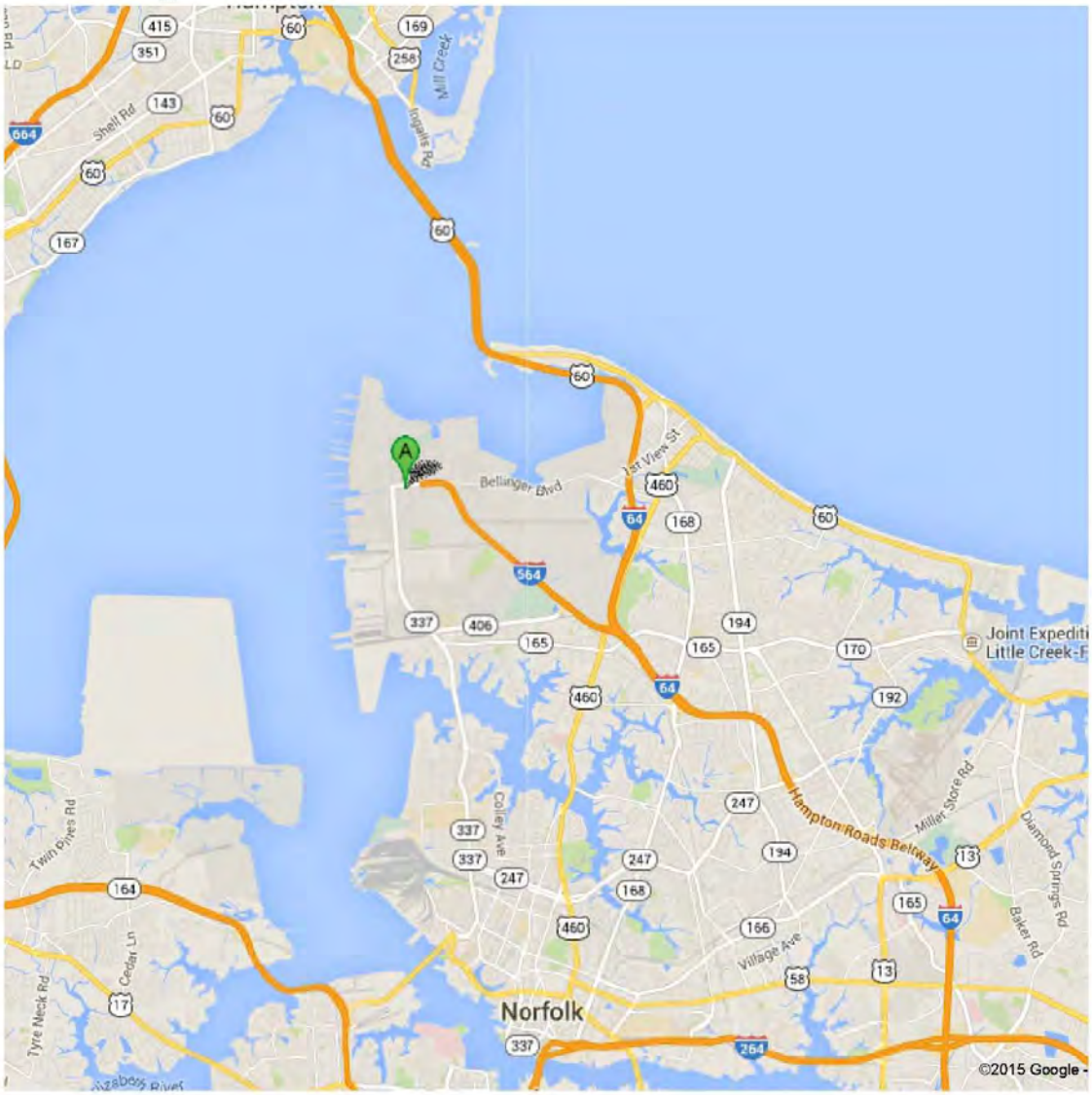
Google

Directions to Riverside Doctors' Hospital Williamsburg
1500 Commonwealth Avenue, Williamsburg, VA 23185 - (757) 585-2200
9.8 mi – about **13 mins**



Naval Station Norfolk
On-Installation
Branch Health Clinic NAVSTA Norfolk
1721 Admiral Taussig Blvd.
Norfolk, VA 23511-2899
(757) 953-9000

The NAVSTA Norfolk Branch Health Clinic is open Monday – Friday 0700-1600



Naval Station Norfolk
Off-Installation
Bon Secours DePaul Medical Center
150 Kingsley Lane
Norfolk, VA 23505
(757) 889-5000

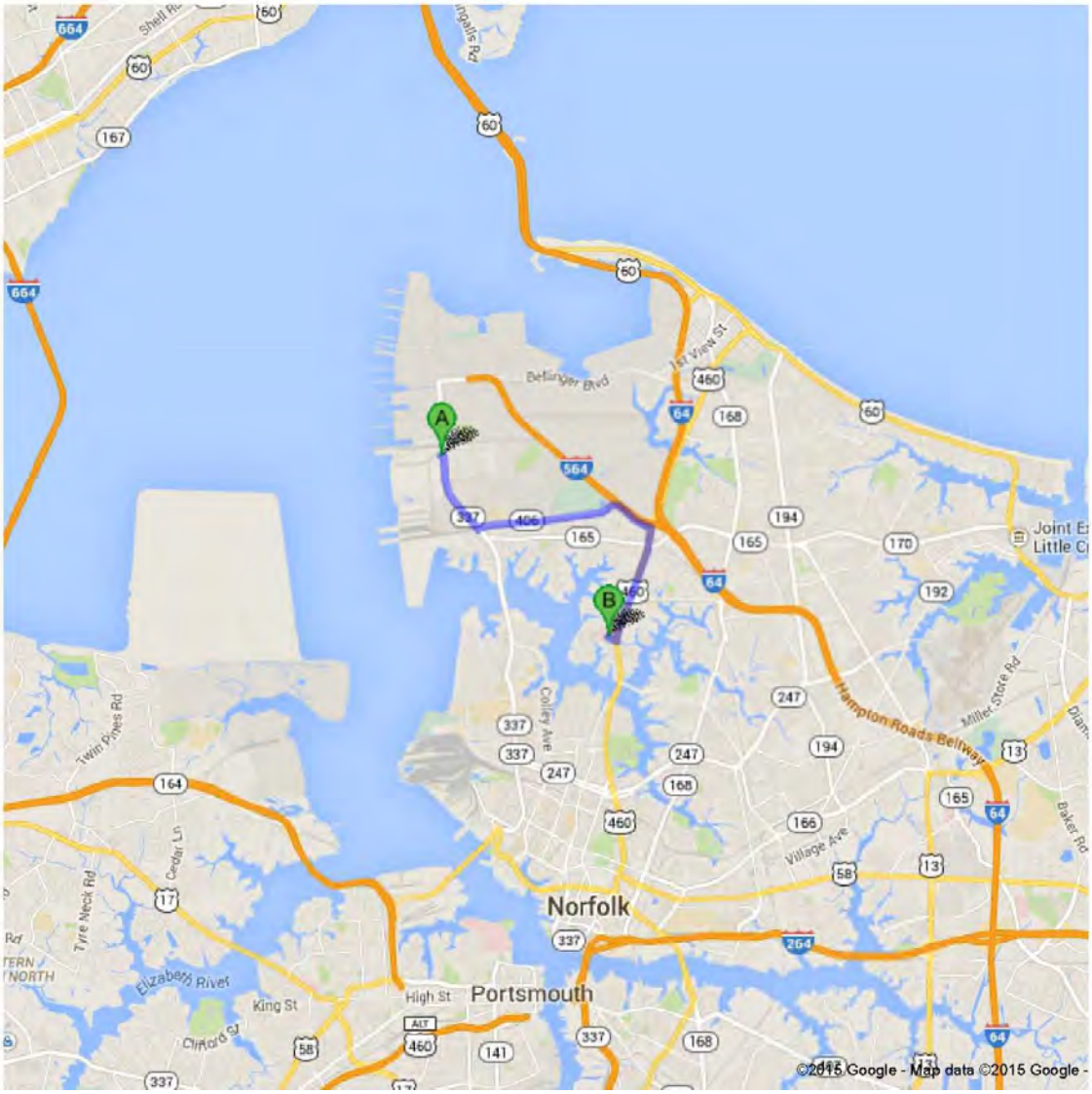
Naval Station Norfolk

	1. Head **east** toward **Hampton Blvd**	go 217 ft total 217 ft
↱	2. Turn right onto **Hampton Blvd** About 3 mins	go 1.0 mi total 1.1 mi
↰	3. Turn left onto **Terminal Blvd** About 3 mins	go 1.6 mi total 2.7 mi
	4. Take the **US-460/Granby St** ramp About 59 secs	go 0.7 mi total 3.3 mi
460	5. Turn right onto **US-460 W/Granby St** About 3 mins	go 1.5 mi total 4.8 mi
↱	6. Turn right onto **Kingsley Ln** Destination will be on the right About 48 secs	go 0.1 mi total 4.9 mi

Bon Secours DePaul Medical Center
100 Kingsley Lane, Norfolk, VA 23505 - (757) 889-5000

Google

Directions to Bon Secours DePaul Medical Center
100 Kingsley Lane, Norfolk, VA 23505 - (757) 889-5000
4.9 mi – about **10 mins**



Naval Air Station Oceana, Dam Neck Annex
Off-Installation
Sentara Virginia Beach General Hospital
1060 First Colonial Rd
Virginia Beach, VA 23454
(757) 395-8000 or (757) 395-8890 (emergency department)

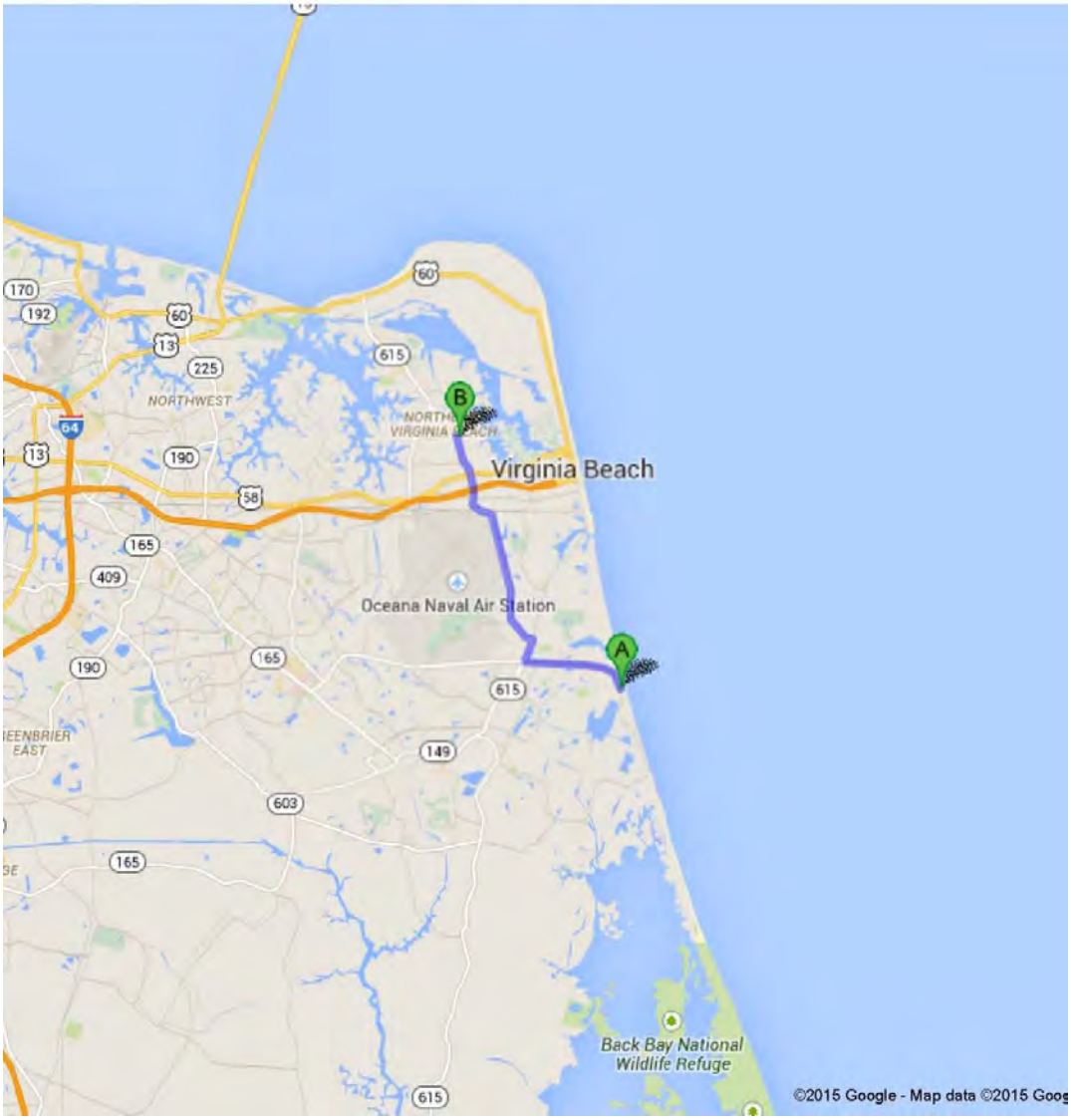
naval air station oceana dam neck annex

	1. Head **north** on **Regulus Ave** toward **Talos St** Restricted usage road	go 0.4 mi total 0.4 mi
	2. Turn left onto **Vanguard St** Restricted usage road About 1 min	go 0.3 mi total 0.7 mi
	3. Continue onto **Dam Neck Rd** About 3 mins	go 1.9 mi total 2.6 mi
	4. Slight right toward **General Booth Blvd**	go 200 ft total 2.6 mi
	5. Turn right onto **General Booth Blvd** About 51 secs	go 0.5 mi total 3.2 mi
	6. Turn left onto **Oceana Blvd** About 5 mins	go 3.8 mi total 7.0 mi
	7. Continue onto **First Colonial Road** About 4 mins	go 1.7 mi total 8.7 mi
	8. Turn right at **1st General Pkwy**	go 308 ft total 8.8 mi

Sentara Virginia Beach General Hospital, 1060 First Colonial Rd, Virginia Beach, VA 23454

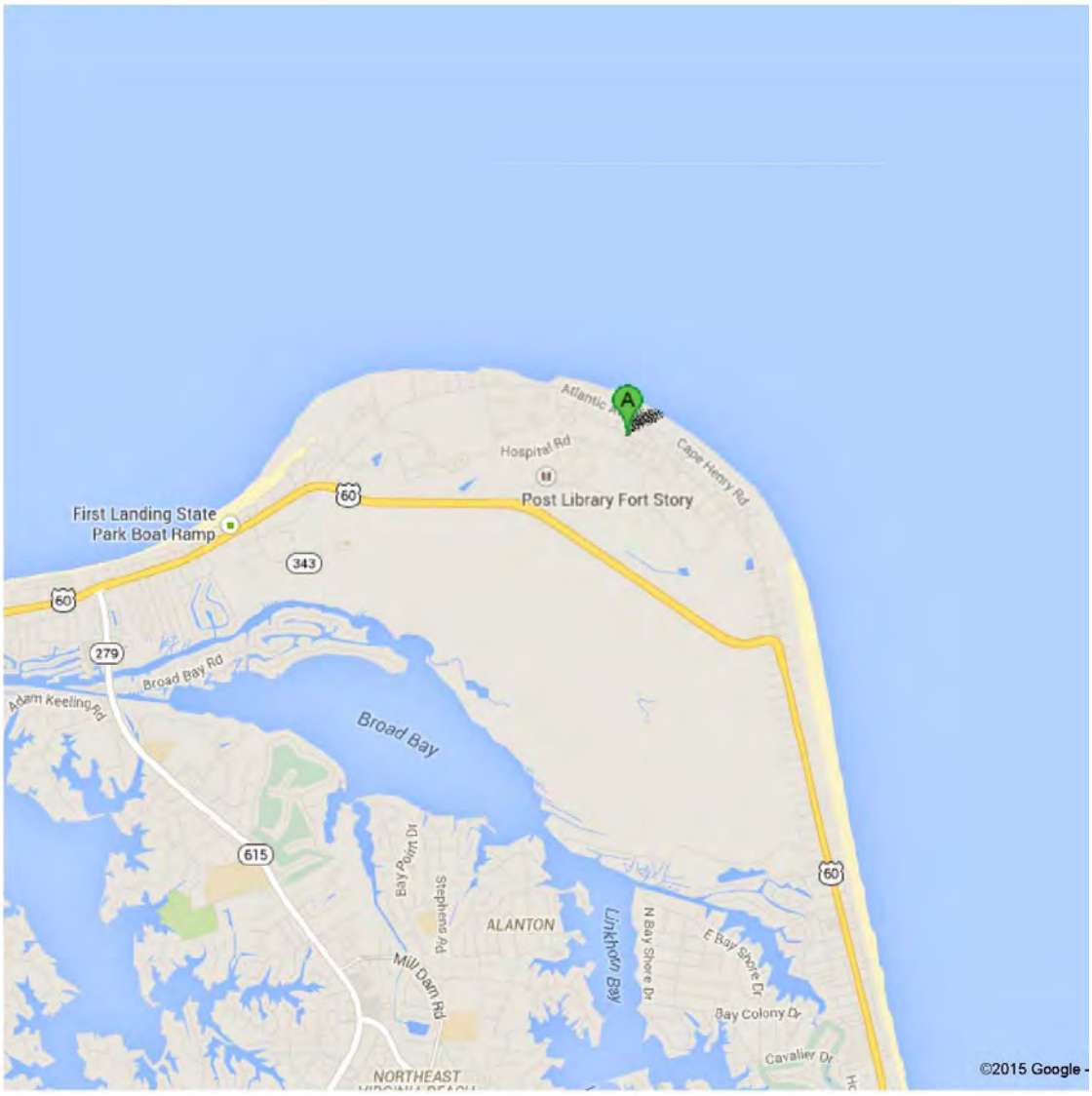
Google

Directions to Sentara Virginia Beach General Hospital, 1060 First Colonial Rd, Virginia Beach, VA 23454
8.8 mi – about **15 mins**



Joint Expeditionary Base Fort Story
On-Installation
Medical Clinic
Bldg. 649 New Guinea Road, Fort Story, VA 23451
(757) 422-7851

Hours: 0630-1500 Mon-Fri

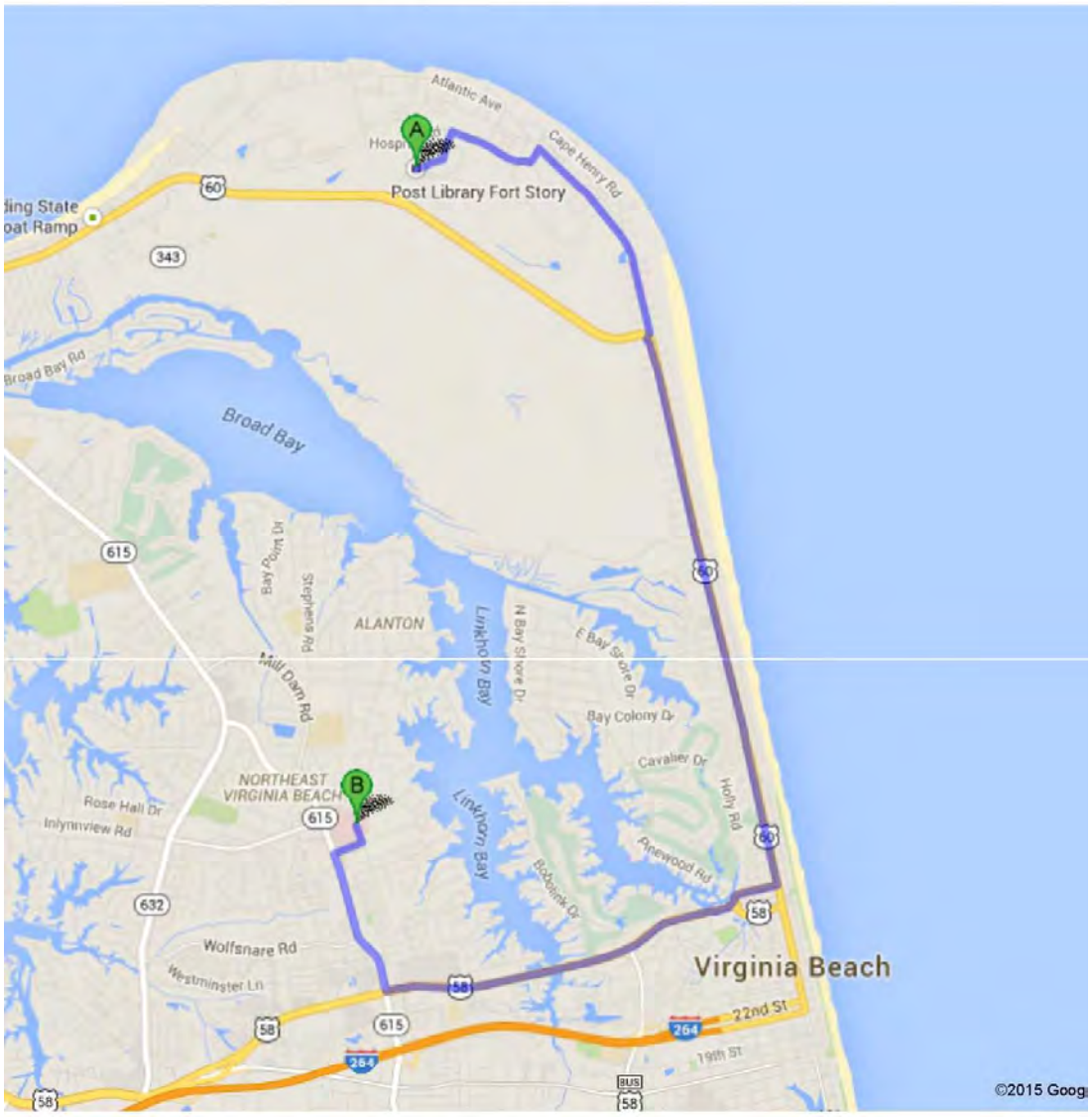


Joint Expeditionary Base Fort Story
Off-Installation
Sentara Virginia Beach General Hospital
1060 First Colonial Rd
Virginia Beach, VA 23454
(757) 395-8000 or (757) 395-8890 (emergency department)

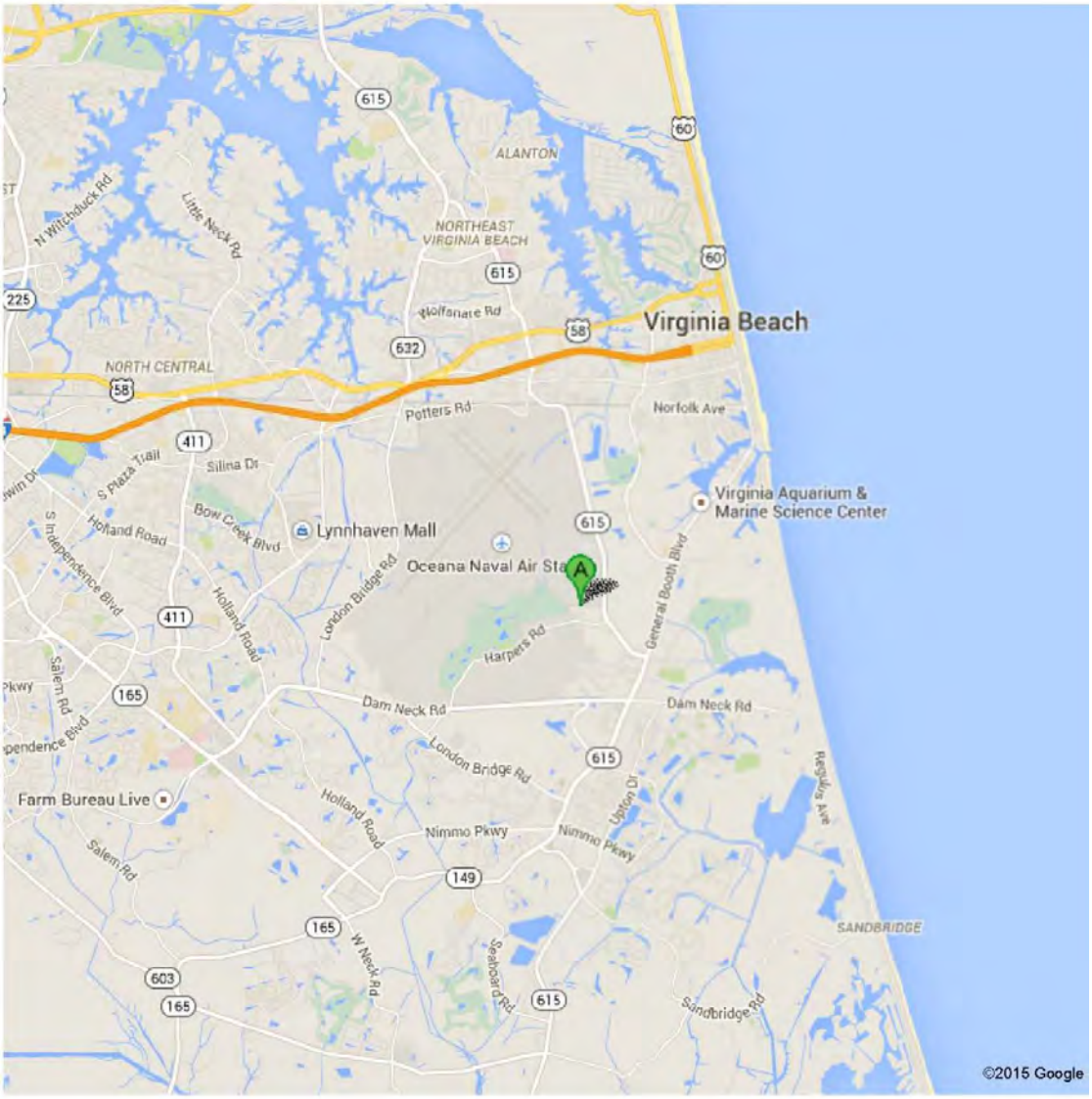
A	Fort Story, Virginia Beach, VA	
	1. Head **east** on **Desert Rd**	go 0.2 mi total 0.2 mi
↰	2. Turn left to stay on **Desert Rd**	go 0.2 mi total 0.4 mi
↱	3. Turn right onto **Hospital Rd** About 1 min	go 0.5 mi total 0.9 mi
↰	4. Turn left onto **1st Landing Rd**	go 0.1 mi total 1.0 mi
↱	5. Turn right onto **Atlantic Ave** About 3 mins	go 1.4 mi total 2.3 mi
↰	6. Turn left to stay on **Atlantic Ave** About 5 mins	go 2.7 mi total 5.1 mi
	7. Continue onto **Pacific Ave** About 1 min	go 0.7 mi total 5.7 mi
↱	8. Turn right onto **32nd St**	go 0.2 mi total 5.9 mi
	9. Continue onto **Pinewood Rd**	go 292 ft total 6.0 mi
	10. Continue onto **32nd St**	go 79 ft total 6.0 mi
↱	11. Keep right to continue toward **Laskin Rd**	go 344 ft total 6.1 mi
↗	12. Slight right onto **Laskin Rd** About 3 mins	go 2.0 mi total 8.1 mi
↗	13. Slight right toward **First Colonial Road**	go 0.1 mi total 8.2 mi
↱	14. Turn right onto **First Colonial Road** About 2 mins	go 0.9 mi total 9.1 mi
↱	15. Turn right onto **Will O Wisp Dr**	go 0.2 mi total 9.3 mi
↰	16. Turn left onto **Facilities Ln** Destination will be on the left	go 0.1 mi total 9.4 mi
B	1060 First Colonial Rd, Virginia Beach, VA 23454	

Google

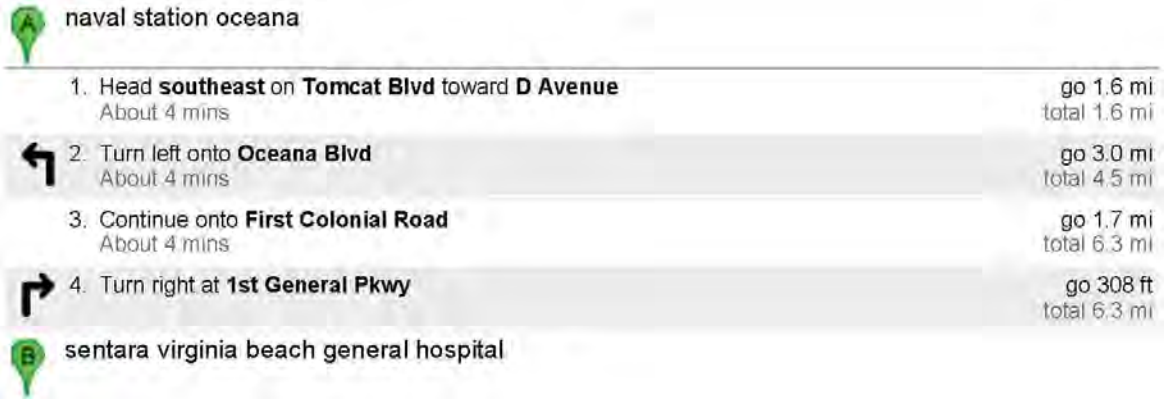
Directions to 1060 First Colonial Rd, Virginia Beach, VA 23454
9.4 mi – about **20 mins**



Naval Air Station Oceana
On-Installation
Oceana Branch Medical Clinic
1550 Tomcat Blvd. Suite 150
Virginia Beach, VA 23460
(757) 953-3933

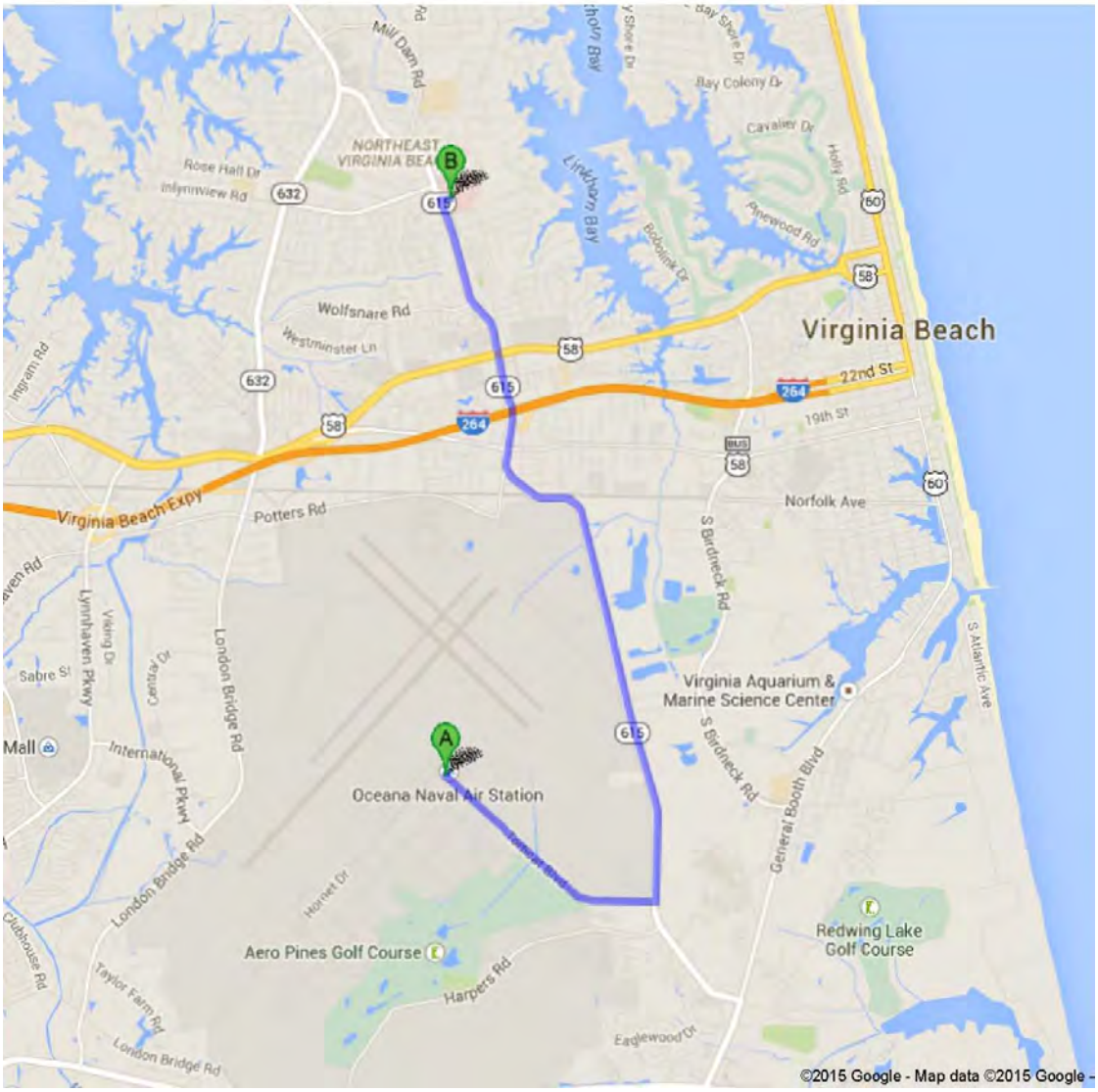


Naval Air Station Oceana
Off-Installation
Sentara Virginia Beach General Hospital
1060 First Colonial Rd
Virginia Beach, VA 23454
(757) 395-8000 or (757) 395-8890 (emergency department)



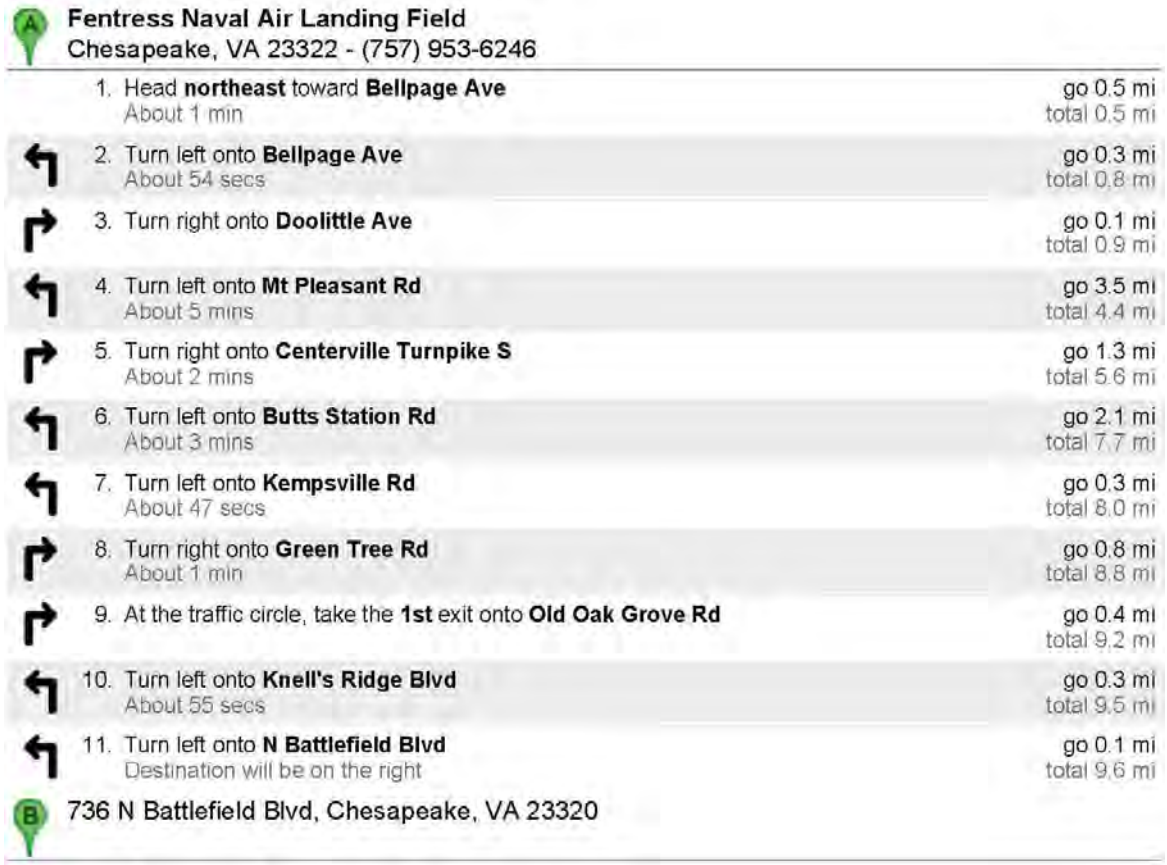
Google

Directions to sentara virginia beach general hospital
6.3 mi – about **12 mins**



Naval Auxiliary Landing Field Fentress
Off-Installation
Chesapeake Regional Medical Center
736 North Battlefield Boulevard
Chesapeake, Virginia 23320

(757) 312-8121



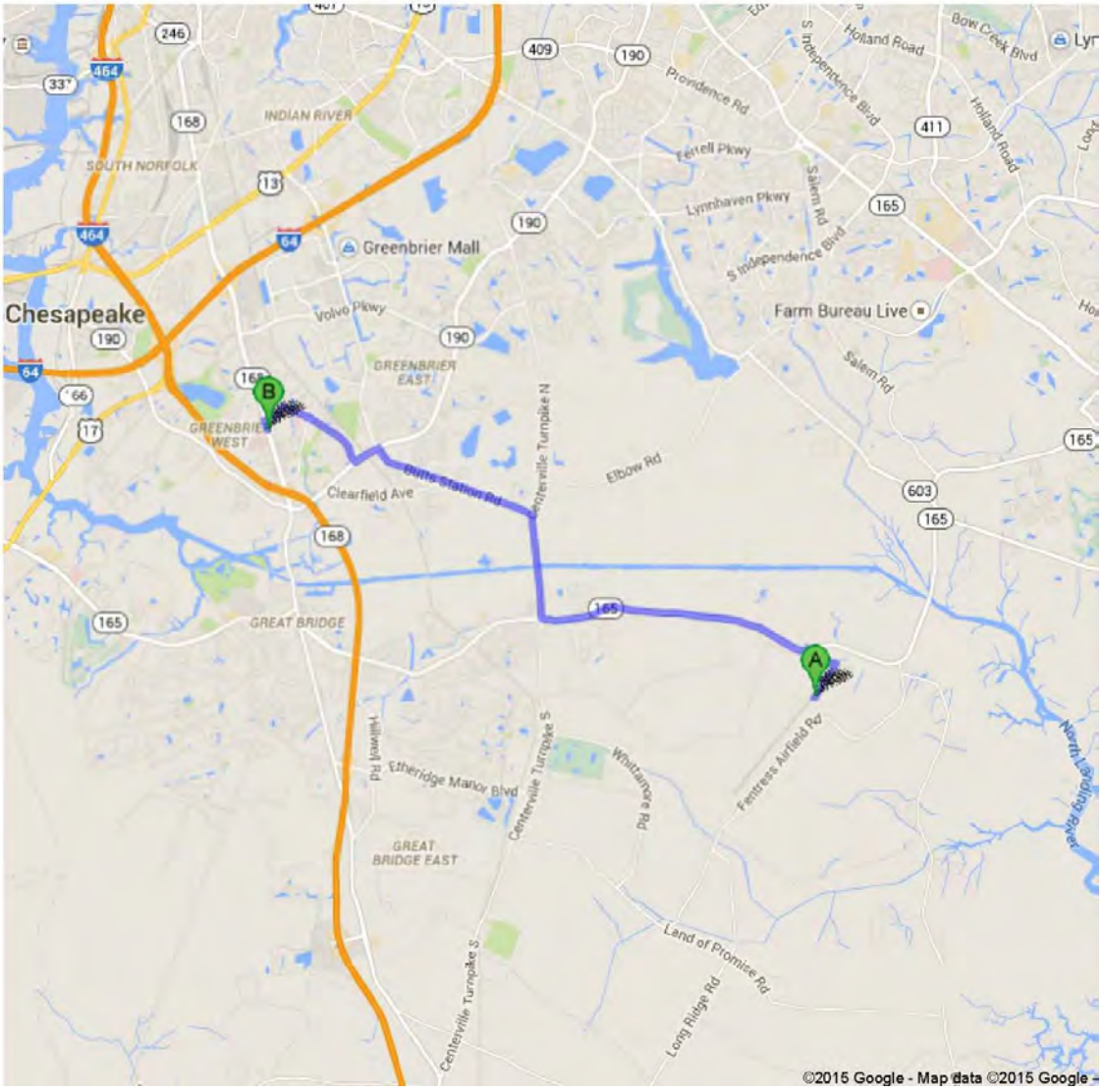
Fentress Naval Air Landing Field
Chesapeake, VA 23322 - (757) 953-6246

	1. Head **northeast** toward **Bellpage Ave** About 1 min	go 0.5 mi total 0.5 mi
↰	2. Turn left onto **Bellpage Ave** About 54 secs	go 0.3 mi total 0.8 mi
↱	3. Turn right onto **Doolittle Ave**	go 0.1 mi total 0.9 mi
↰	4. Turn left onto **Mt Pleasant Rd** About 5 mins	go 3.5 mi total 4.4 mi
↱	5. Turn right onto **Centerville Turnpike S** About 2 mins	go 1.3 mi total 5.6 mi
↰	6. Turn left onto **Butts Station Rd** About 3 mins	go 2.1 mi total 7.7 mi
↰	7. Turn left onto **Kempsville Rd** About 47 secs	go 0.3 mi total 8.0 mi
↱	8. Turn right onto **Green Tree Rd** About 1 min	go 0.8 mi total 8.8 mi
↱	9. At the traffic circle, take the **1st** exit onto **Old Oak Grove Rd**	go 0.4 mi total 9.2 mi
↰	10. Turn left onto **Knell's Ridge Blvd** About 55 secs	go 0.3 mi total 9.5 mi
↰	11. Turn left onto **N Battlefield Blvd** Destination will be on the right	go 0.1 mi total 9.6 mi

736 N Battlefield Blvd, Chesapeake, VA 23320

Google

Directions to 736 N Battlefield Blvd, Chesapeake, VA 23320
9.6 mi – about **17 mins**



Naval Support Activity Hampton Roads, Northwest Annex
Off-Installation
Chesapeake Regional Medical Center
736 North Battlefield Boulevard
Chesapeake, Virginia 23320

(757) 312-8121

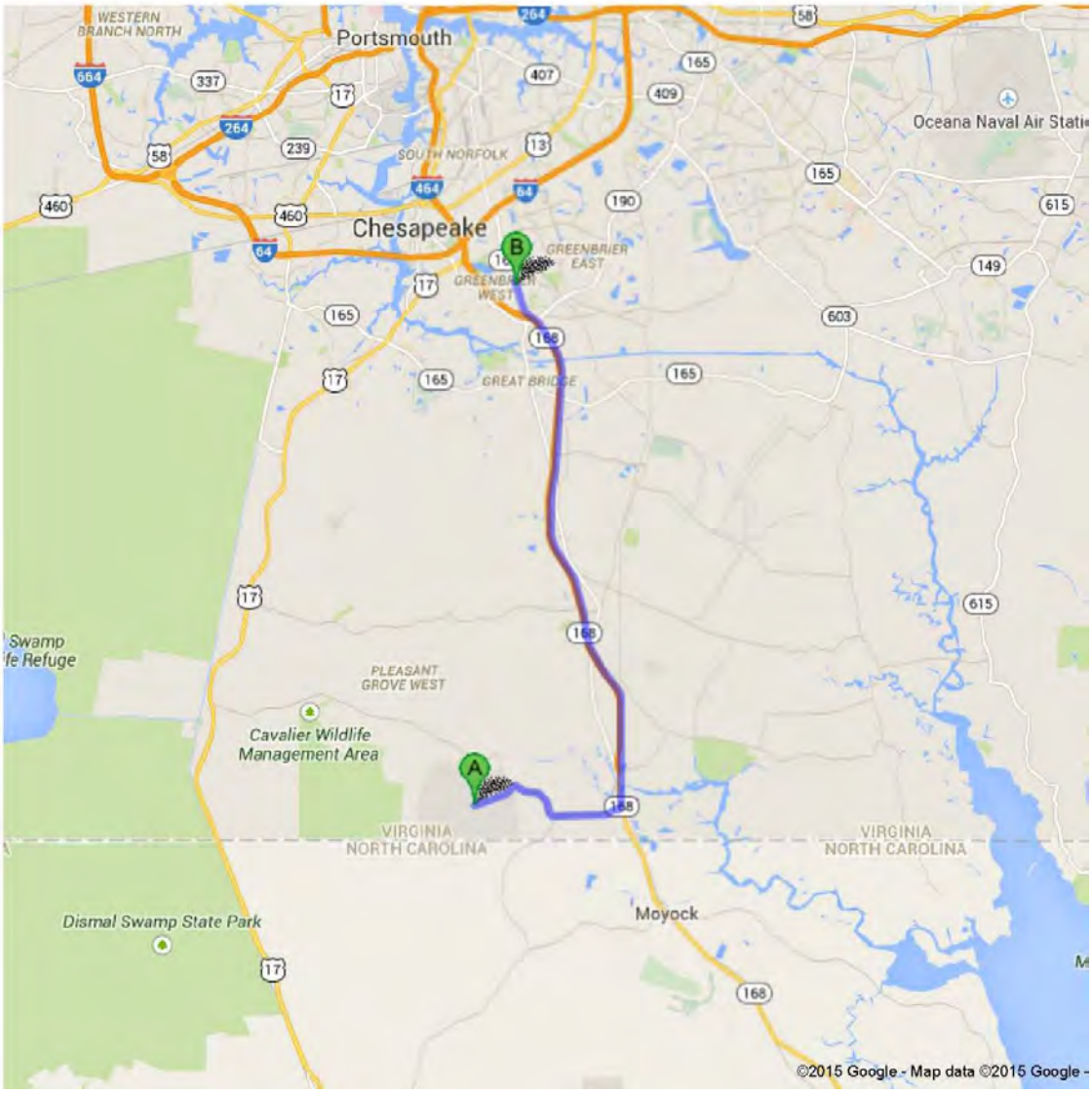
navy northwest security group

	1. Head **east** on **Milepost Rd** About 2 mins	go 0.8 mi total 0.8 mi
	2. Slight left onto **Relay Rd** About 2 mins	go 0.3 mi total 1.1 mi
	3. Turn right onto **Ballahack Rd** About 4 mins	go 3.0 mi total 4.1 mi
	4. Turn left onto **Old Battlefield Blvd**	go 0.2 mi total 4.3 mi
168	5. Turn left at the 1st cross street onto **VA-168 N/Battlefield Blvd S/Chesapeake Expy** Continue to follow VA-168 N Partial toll road About 13 mins	go 12.6 mi total 16.8 mi
	6. Take exit **13A** for **Battlefield Blvd N** toward **VA-168 BUS**	go 0.3 mi total 17.1 mi
168	7. Merge onto **VA-168 BUS N/N Battlefield Blvd** About 1 min	go 0.8 mi total 17.9 mi
	8. Make a U-turn at **Knell's Ridge Blvd** Destination will be on the right	go 0.1 mi total 18.0 mi

736 N Battlefield Blvd, Chesapeake, VA 23320

Google

Directions to 736 N Battlefield Blvd, Chesapeake, VA 23320
18.0 mi – about **24 mins**



ATTACHMENT C – MEDICAL DATA SHEET

Tetra Tech CES, Inc.

Medical Data Sheet

(Form to be completed by all field personnel)

This brief medical data sheet shall be completed by all on-site personnel and will be kept on-site by the Project Manager or ESS as a project record during site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Name: _____

Home Phone: _____ Spouse's Name: (if applicable) _____

Age: _____ Height: _____ Weight: _____ Blood Type: _____

Number of Dependents: _____

Name and Phone Number of Emergency Contact:

_____

Drug or Other Allergies: _____

Do You Wear Contacts? _____

Provide List of Major Previous Illnesses or On-going Medical Conditions:

_____

What Medications are you Presently Using?

_____

Do you have any Medical Restrictions?

_____

Name, Address, and Phone Number of Personal Physician:

_____

BIODIVERSITY RESEARCH INSTITUTE
innovative wildlife science

Safety and Accident Prevention Plan

Table of Contents

1.0 INTRODUCTION

Biodiversity Research Institute (BRI) places a high value on its employees, and is committed to providing a safe and healthy workplace. BRI believes that its employees have a right to know about health hazards associated with work environment, and it's every ones responsibility to become familiar with, have knowledge of, and take responsibility for potential safety risks.

The Safety and Accident Prevention Program seeks to prevent injury before it happens by involving all staff in identifying and eliminating hazards that before they develop, and minimize the impact if an injury should occur. BRI will always have to prepare for, respond to, and recover from disasters resulting from natural, human-based, or technology-based events. The key to success is in adopting a standardized approach that provides common program elements, techniques, and processes. This plan applies to all BRI employees and provides customizable forms to incorporate into field projects.

This plan hinges on employees adopting three essential values:

1) No task is so important that employees must risk their safety in order to get the job done.

BRI employees often work in challenging environments that require quick thinking and innovative problem solving. However, despite timeline pressures, inclement weather, or the desire to "get the job done", BRI expects its employees to always put safety first while doing their job.

2) Accidents expose all BRI Employees to risk.

Recall the old saying "haste makes waste" and consider the impact when decision to shortcut safety results in a serious injury that takes a key researcher out of commission. This incident affects more than the injured employee. Not only will the research be compromised as the team scrambles to find a replacement, but BRI may be faced with increased insurance premiums and/or penalty fines. Additional costs eventually are passed on to all employees. Loss of revenue for the company could result in layoffs. A good safety record may make the difference between BRI being selected by a funding agency over an equal competitor.

3) Accidents happen to good people.

Whether tethered to a desk, skimming on the water, or flying in the clouds, every BRI employee is exposed to safety-related issues every day. For those who live by "it can never happen to me" – think again. The laws of probability are working against this tenet since accidents will occur without warning despite preventative measures.

ABOUT THIS PLAN

This plan is divided alphabetically into several sections with accompanying appendices for field staff to use on a project-by-project basis. Please familiarize with the information

contained within this plan, ask questions, and consider how various aspects are applicable to your specific work.

It is the intention of BRI to comply with all applicable Occupational Safety and Health Administration (OSHA) regulations. This plan describes the processes and procedures used to mange occupational safety and health issues at BRI, and identify the most critical regulatory requirements.

AUTHORITIES

In the development of this plan, several authorities were consulted.

- U.S. Fish and Wildlife Service (USFWS)
- U.S. Coast Guard (USCG)
- American Canoe Association (ACA)
- Occupational Safety and Health Administration (OSHA)
- National Institute for Occupational Safety and Health (NIOSH)
- Centers for Disease Control and Prevention (CDC)
- National Fire Protection Association (NFPA)

2.0 RESPONSIBILITIES

BRI's Leadership Team holds the authority and responsibility for the over-all implementation of this program, and is assisted by Program Directors, the HR Manager, and the Risk and Compliance Advisor in its implementation. This section identifies who is responsible for implementing each element of BRI's Safety and Accident Prevention Program. The actual performance of activities described in this section may be delegated to other, but ultimate responsibility for ensuring that each program element is implemented correctly remains with the individuals identified below.

PERFORM FORMAL SAFETY WORKPLACE INSPECTIONS

Conduct Safety Inspections using the "Walk-Through Inspection Checklist" (see Appendix 1). The inspections must be performed quarterly. File the completed checklists in the Safety Inspections folder.

BRI Leadership Team and appointed staff

TRACK CORRECTIVE ACTIONS TO BE COMPLETED

A need for action to correct workplace safety or health deficiencies may be identified and reported through formal workplace inspections, suggestions by management or employees, and accident investigations. BRI will ensure that the person responsible for completing each corrective action is clearly documented and reports to the Leadership Team any required corrective actions that are not completed in a timely manner.

BRI Leadership Team and appointed staff

INJURY REPORTING AND RECORDING

Injuries and illnesses are recorded in accordance to OSHA requirements. If a work related injury or illness occurs, the Program Director should immediately inform the HR Director and complete the Report of Injury or Illness form (Appendix 1) within 24 hours of the incident. Sharps related injuries are noted so they can be separated out if necessary. The OSHA Form 300-A form from February 1 – April 30 is posted in common work areas as required by law. Note: if the work-related injury or illness involves a fatality or hospitalization of an employee, BRI may be required to notify OSHA within 8 hours.

Program Directors, HR Department

ACCIDENT INVESTIGATIONS

Accident investigations for work related injuries, illnesses, and near miss accidents are conducted as soon as possible following the event. These investigations are required by this program and must be completed with 24 hours of the incident. See Appendix 1 for the Accident/Injury and Near Miss Incident Review form. To ensure proper documentation, completed investigations are filed in the Accident Investigations folder of the Safety Program files. Additional guidance on how to perform accident investigations is provided in Appendix 8.

Program Directors, HR Department

CONDUCT SAFETY MEETINGS

Safety meetings to discuss safety related topics are conducted quarterly, at the beginning of each project and/or field season, or with the addition of new staff. An initial safety meeting that covers all potential hazards and expected response is required for new employees. Subsequent meetings should include discussion of injuries and near misses that have occurred since the last meeting, and how to prevent future incidents.

Meetings need to have a written agenda, date, names of employees who attend, and notes of any decisions. To ensure that any safety issues that were brought up during the meeting are forwarded to the correct person for resolution, file documentation of all safety meetings in the Safety Meeting folder for review by the Leadership Team.

Program Directors, Field Team Leaders, Leadership Team and appointed staff

EMPTY SAFETY SUGGESTION BOX

BRI has provided a Safety Suggestion Box at each facility (in the lunch area) and it will be checked at least weekly. An online version of the Safety Suggestion Box is located on BRI's intranet website. The Leadership Team reviews and determines the appropriate action on all suggestions received. All suggestions, and subsequent actions, will be filed in the Safety Suggestions folder.

Leadership Team and appointed staff

SUPERVISOR and MANAGER SAFETY TRAINING

All supervisors and managers must be aware of their responsibilities under the Safety Program, and all supervisors and managers must be aware of the hazards to which their employees may be exposed and the controls necessary for their employees to work safety.

Leadership Team and appointed staff

SUPERVISOR HEAT STRESS TRAINING

All supervisors with employees working in hot environments must receive training on the hazards of heat stress and, understand the procedures they are to follow if one of their employees develops a heat related illness. This training will be documented in the Safety Training folder.

Leadership Team and appointed staff

NEW EMPLOYEE TRAINING

All new employees are supplied with a copy of the Code of Safety Practices (Appendix 2) and any additional training specific to their work assignment(s). All BRI employees also receive additional training when they are given new job assignments with additional hazards, when new substances, processes, procedures or equipment are introduced into the work area, and when new workplace hazards are recognized. The employee must date and sign a copy of the safety training certification, which is placed the completed form in the employee's personnel file.

Program Directors and their appointed staff

PROJECT SPECIFIC TRAINING

Each Program Director is responsible for ensuring the safety of his/her crew. Each employee shall receive a safety orientation by his/her immediate supervisor when:

- First hired
- First drafted to work and a specific project

Each safety orientation shall cover the following points:

- A description of potential hazards associated with the project and related prevention strategies;
- How and when to report injuries;
- Where first aid supplies are located;
- How to report unsafe conditions and/or practices;
- What to do in an emergency;
- Identification of hazardous animals, plants or chemicals;
- Use and care of required personal protection equipment (PPE).

It is advisable that Program Directors take time to develop project job assessment plans (JSAs). This may be a requirement of the funding agency, and template is presented in Appendix 1, which may be modified for a specific project. See Appendix 6 for additional directions on how to complete a JSA.

Project Directors

START-UP SAFETY TRAINING

Ensure that all employees receive initial safety training when this Safety and Accident Program is first established.

Leadership Team

PROVIDE PERSONAL PROTECTIVE EQUIPMENT

BRI is committed to providing adequate supplies of the personal protective equipment listed in the Code of Safe Practices (Appendix 6) and making sure they are readily available for use by employees.

BRI is required to protect employees from exposure to potentially infectious material, and provide PPE in the appropriate sizes at no cost to employees. The equipment provided should not permit blood or other potentially infectious materials to pass through to or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions for the full duration of use. The types of equipment which may be provided include, but are not limited to gloves, gowns, laboratory coats, face shields, masks, eye protection, mouthpieces, resuscitation bags, pocket masks, or other ventilation devices. The equipment must be kept clean and be repaired, replaced, and/or disposed of when necessary at no cost to the employee. Hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives are available for employees who are allergic to the standard gloves.

Project Directors

SHARPS CONTAINER DISPOSAL

Ensure that sharps containers are replaced and properly disposed of as necessary.

Program Directors, Lab Manager

HAZARD, CONTROL, and PERSONAL PROTECTIVE EQUIPMENT CHANGES

This Safety Program shall be updated to reflect any changes in the hazards to which employees are exposed, the engineering controls used to protect them from those hazards, or personal protective equipment they use.

Leadership Team and their appointed staff

PERFORM ANNUAL REVIEW

Review the effectiveness of this program every year by completing the "Safety Program Review Checklist" (Appendix 1). Results are presented to the Leadership Team, and placed the completed checklist in the Safety Program Reviews file.

Leadership Team's appointed staff

MAINTAIN SAFETY PROGRAM FILES

Ensure that all the documentation generated by this program is properly filed.

In addition, BRI's Leadership Team has the responsibility of:

- Approving this Safety and Accident Prevention Plan.
- Providing adequate resources.

- Setting a good example.
- Assign staff to monitor safety conditions.
- Follow-up on unsafe condition reports.
- Report all work-related injuries and illnesses.
- Enforce Code of Safe Practices

DISCPLINE

Discipline for employees who do not comply with the Code of Safety Practices (Appendix 2) or behave unsafely includes:

- Verbal warning and retraining for first offense
- Written warning for second offense (copy placed in employees' personnel file)
- Suspension without pay or termination for subsequent offenses.

3.0 SAFETY COMMUNICATION

BRI uses the following methods to communicate with employees regarding safety related issues. Safety communication will be in a form that is understandable to every employee.

- Safety Meeting
  - Presented quarterly during regular staff meetings
  - All staff are required to attend
- Safety Suggestion Box
  - Located in the lunch room at each building and online
  - Staff are encouraged to submit suggestions
  - Suggestions may be made anomalously if desired
- Safety Training
  - All employees will receive safety training prior to starting work
- Safety Inspection
  - All supervisors must continuously (daily) observe their work area for unsafe actions and/or conditions and correct any deficiencies.
  - Formal safety inspections using checklists provided in Appendix 1 are conducted quarterly.

4.0 PERSONAL PROTECTIVE EQUIPMENT

Employees must be trained on the proper use of all personal protective equipment (PPE) they use when they are first given an assignment that requires PPE. If they are observed using the equipment incorrectly, it is the responsibility of ALL BRI employees to instruct them on the correct usage. While most PPE is specific to programs and managed by the Program Director, some PPE is communal and viewed as a shared resource.

5.0 ANNUAL REVIEW

BRI will review the effectiveness of this Safety Program at least annually and correct any deficiencies noted during the review.

6.0 RECORDS RETENTION

Records documenting the administration of this Safety Program will be retained for at least three (3) years.

The following will be retained for at least five (5) years:

- Training documentation
- Accident investigation records
- Safety inspection
- OSHA 300 log, summary and incident reports

Vaccination and post-exposure follow up records will be retained for the duration of employment plus 30 years. All records containing employee medical information will be kept strictly confidential.

7.0 LIST OF APPENDICES

Appendix 1 FORMS
- Employee Training Form
- Float Plan
- Field Check-Out/Check-In Procedures
- Report of Injury or Illness
- Accident/Injury and Near Miss Incident Review
- General Hazard Identification and Risk Assessment

Appendix 2 CODE OF SAFETY PRACTICES
- Code of Safety Practices
- Basic Safety
- Personal Protective Equipment
- Office and Shop Safety
- Field Safety

Appendix 3 CHEMICAL HYGINE PLAN
- Overview
- Hazard Determination
- MSDS
- Labels and Warnings
- Training
- Written Hazard Communication Plan
- Trade Secrets

Appendix 4 EMERGENCY ACTION PLAN
- Emergencies
- Incident Command System
- Fire Emergency
- Medical Emergency

APPENDIX 1

FORMS

Table of Contents

EMPLOYEE TRAINING FORM

Employee Training Requirements, Biodiversity Research Institute

Employee Name:	
Primary Trainer:	
Item	**Date Completed**
Code of Safe Practices – Provide the employee with a copy of the Code of Safe Practices (Appendix 2). Explain every item in the Code of Safe Practices to the employee and answer any questions they have. Remind them that their signature below is affirmation that they read the Code of Safe Practices.	
First Aid – Show employee the location of the first aid kit, and explain the procedure for calling outside help in the event of an emergency.	
Evacuation Plan – Show employee how to leave their work area in an emergency. Explain the system used to notify employees of an emergency. Show the employee where to assemble in the event of a building evacuation. Review the emergency action plan (Appendix 4) with the employee.	
Assignment Specific Hazards and Safety Procedures – Train employee on any additional hazards and safety procedures required for their specific work assignment.	

I certify that I have received all of the training indicated above:

Signature	Printed Name	Date

Note to employee: Cross out and initial any items you have not yet been trained on.

FLOAT PLAN

BRI FLOAT PLAN

1 Name and cell phone number of person filing the plan. _____

_____

2 Boat Description

Registration # _____ Hull Type _____

Manufacturer _____ Hull Color _____

Length _____ Trim Color _____

_____

3 Engine(s) _____

Type _____ H.P. _____

Engines _____ Fuel Capacity _____

4 Survival Equipment

□ PFD's □ Flares □ Mustang Suit □ Mustang Jacket

□Paddles □ Anchor □ Spot Tracker Spot #_____

5 Radio? □ Yes □ No

Type _____ Frequency _____

6 Persons on board

Name	Age	Phone

7 Do any of the persons onboard have a medical problem?

□ Yes □ No

If Yes, Explain _____

8 Trip Details

Leaving at: _____ am/pm

Going to: _____

Expected back: _____ am/pm

9 Other pertinent information: _____

FIELD CHECK-OUT/CHECK-IN PROCEDURES

All biologists involved in this project are required to adhere to this check-out/check-in procedure each and every time they embark on field work. Please read and understand the following directions, and ask questions of your supervisor on points that you find unclear. The Check-OUT/Check-In list should be posted in a common area and made visible to all staff.

Date: Please use mm/dd/yy format.

Name(s): List the full name(s) of all biologists in your party, use multiple lines if necessary.

Departure: This is the time you'll depart; use 2400 hr time format.

Destination: Briefly describe your destination. This could be a transect number, trail name, etc. BRI in Gorham Maine should have a copy on file (with details) of such destinations, and a copy should be posted onsite for reference by other team members.

Transport: List the vessel/vehicle you'll be using for the day.

Communications: List the forms of communication you'll be carrying (cell phone numbers, SPOT number, etc.).

Return: This is the time you expect to return; use 24 hour time format.

Checked In: Place a check in this column once you've returned.

Date	Name(s)	Departure	Destination	Transport	Communications	Return	Checked In
5/15/12	Jonny on the Spot	0800	Sebago Lake – south end	Boat #3	205.752.3366 (cell)	1400	

REPORT OF INJURY OR ILLNESS

Employee Name (Last, First, MI)			Incident Number	
Mailing Address		City	State	Zip Code
Phone		E-mail	DOB	
Job Title		Current Supervisor	Hire Date	
Incident Location	Incident Date	Time of Incident	State Incident Occurred In	

Description of Incident (*describe sequence of events, object or exposure that directly caused injury or illness*)

Form Completed By	**Date**

Release of Medical Information: I certify that the above information is true to the best of my knowledge and I authorize the release to my employer and workers' compensation company all records relevant to my disability and my claim for disability or workers' compensation benefits, including but not limited to medical diagnosis, prognosis, treatment, and periods of hospitalization. It is understood that the company will use the information to verify my disability and determine my eligibility of appropriate benefits. This authorization applies to physicians and other health care providers, hospitals, clinics, insurance companies, workers' compensation carriers, and organizations administering benefit programs. This authorization will remain in effect throughout my claim for workers' compensation benefits. I understand that I have the right to revoke this authorization in writing. A photocopy of this authorization will be as valid as the original.

Employee Signature	**Date**

Incident Details				
Date of Incident	Time of Incident ☐ AM ☐ PM		Date Reported	Reported To
Incident Location (area)			On Employer Premise	☐ Yes ☐ No
Witness(es)				
Employee lost time to injury	☐ Yes ☐ No		First Aid Given	☐ Yes ☐ No
Date Worker Left Work	Time Worker Left Work		Date Worker Returned	
Medical Facility			Doctor	
Follow Up Appointment Scheduled				☐ Yes ☐ No
Time Off Authorized by Physician	☐ Yes ☐ No		If Yes, How Many Days	
Treatment Given	☐ Prescription	☐ Irrigation	☐ Sutures	☐ Tetanus Shot
☐ Ace Bandage	☐ Brace	☐ Cast	☐ Remove Foreign	☐ None
☐ Other:				

Part of Body Injured (mark all that apply)									
☐ Head		☐ Arm	R L	☐ Trunk	R L	☐ Hip	R L	☐ Foot	R L
☐ Face		☐ Elbow	R L	☐ Shoulder	R L	☐ Thigh	R L	☐ Toe	R L
☐ Eye	R L	☐ Forearm	R L	☐ Chest	R L	☐ Knee	R L	☐ Ribs	R L
☐ Nose		☐ Hand	R L	☐ Back	R L	☐ Leg	R L	☐ Skin	R L
☐ Neck		☐ Finger	R L	☐ Abdomen	R L	☐ Ankle	R L	☐ Other	R L
Other:									

Nature of Injury (mark all that apply)				
☐ Abrasion	☐ Puncture	☐ Chemical	☐ Inhalation	☐ Burn
☐ Bruise-Crushed	☐ Fracture	☐ Hearing	☐ Fatality	☐ Other
☐ Laceration	☐ Poisoning	☐ Sprain	☐ Heat/Cold	☐
☐ Amputation	☐ Dermatitis	☐ Strain	☐ Foreign Object	☐
Other:				

Cause of Injury (mark all that apply)				
☐ Body Motions	☐ Hot/Cold	☐ Flame/Smoke	☐ Ladders	☐ Slip/Trip/Fall
☐ Bldg/Structure	☐ Conveyors	☐ Furniture	☐ Machines	☐ Flying Object
☐ Chemicals	☐ Electrical –HV	☐ Hand Tool	☐ Notices	☐ Flash
☐ Vehicles	☐ Electrical - LV	☐ Hoisting	☐ Particles	☐ Other
☐ Falling Objects				
Other:				

Cause of Incident (mark all that apply)				
☐ Equipment	☐ Material Handling	☐ Excessive Speed	☐ Poor Housekeeping	☐ Horseplay
☐ Lack of Attention	☐ Slippery Surface	☐ Procedure Failure	☐ Fatigue	☐ Other
Other:				

Supervisor Signature:	**Date:**

Return completed form to:

Catherine S. Flegel, Science Operations Director
Biodiversity Research Institute
652 Main Street, Gorham, ME 04038
Phone: 207.839.7600 x212
catherine.flegel@briloon.org

ACCIDENT/INJURY and NEAR MISS INCIDENT REVIEW

Incident Summary		
Incident Number	Location	Date and Time
Investigator's Name		
Employees and Managers involved		
Description of incident; Controls and Personal Protection Equipment in Use/Not in Use		

Incident Type		
☐ Vehicle	☐ Equipment	☐ Injury / Medical
☐ Boat	☐ Near Miss	☐ Injury / Non-Medical

Contributing Factors		
☐ Weather related	☐ Retraining needed	☐ PPE damaged
☐ Outside Influence	☐ Did not follow Policy, Procedure, Rules	☐ Equipment failure
☐ Poor Judgment	☐ No Policy, Procedure, Rule in place	☐ Equipment misused
☐ Inattention to Detail	☐ Circumstances beyond control	☐ Tool available, not use
☐ Improper training	☐ PPE not available	☐ Tool not available
☐ No training	☐ PPE not used properly	☐ Broken tool

Summary	
Primary Cause	
Corrective Action	
I agree with the above incident description **Investigator's Signature**	**Date**

Return completed form to:

Catherine S. Flegel, Science Operations Director
Biodiversity Research Institute
652 Main Street, Gorham, ME 04038
Phone: 207.839.7600 x212
catherine.flegel@briloon.org

GENERAL HAZARD IDENTIFICATION AND RISK ASSESSMENT

Workplace :	Contract Code:
Risk Assessor (s):	Assessment Date:
Specific Task Related to Hazard :	

Section 1.	**Hazards: Potential Damaging Energies**				
Work Environment		**Radiation**		**Biological**	
Adequate access	☐	Ionizing radiation	☐	Microbiological	☐
Air-conditioning	☐	Non-ionizing radiation	☐	Animal tissue / Fluids	☐
Confined spaces	☐			Human tissue / Fluids	☐
Lighting	☐	**Kinetic Energy**		Allergenic	☐
Mental stress	☐	The body hitting objects	☐	Other Biological	☐
Ergonomics	☐	Hit by moving objects	☐		
		Explosion	☐	**Chemical / Hazardous Substance**	
Temperature / Weather Effects		Penetrating objects	☐	Liquids	☐
Heat	☐	Vibration	☐	Fumes	☐
Cold	☐	Acoustic / Noise	☐	Gases	☐
Rain / Flood	☐			Vapors / Mists	☐
Wind	☐	**Energy**		Solids	☐
Pressure (Diving / Altitude)	☐	Electrical	☐		
Lightning	☐	Gravity	☐	**Manual Handling**	
Smoke	☐	Falls / Trips / Slips	☐	Lifting / Carrying	☐
		Falling objects	☐	Pushing / Pulling	☐
Health and Security	☐			Posture	☐
Food	☐	**Mechanical**		Reaching/ Overstretching	☐
Poisoning or Contamination	☐	Vehicles	☐	Repetitive movement	☐
Intoxication	☐	Mobile and Fixed plant	☐	Bending	☐
Dehydration	☐	Powered Equipment	☐		
Violence	☐	Non-Powered Equipment	☐	**Miscellaneous**	
Working alone	☐			Working at heights	☐
Bites / Stings	☐			Working alone	☐

Section 2. - Summary of Identified Hazards			
1.		9.	
2.		10.	
3.		11.	
4.		12.	
5.		13.	
6.		14.	
7.		15.	
8.		16.	
Any specific circumstances (describe):			
Persons at Risk: (list)			

Is the risk (Tick one)	
	☐ Minimal risk exposure
	☐ Adequately controlled. No further action required
	☐ Inadequately controlled. Further Action/Investigation Required. Proceed with Risk Assessment (Section 3)
	☐ Covered by Regulation/Standard/Code Specify:

Section 3. – Risk Assessment (List identified hazards and detail measures taken to address the hazards) This form is to be expanded electronically or additional information attached where required

Controls to be considered from the following hierarchy of control

1. Elimination (is it necessary?)
2. Substitution
3. Isolation (restrict access)
4. Engineering (guarding, redesign)
5. Administration (training. SOP's,)
6. Personal Protective Equipment (PPE) e.g. (gloves, leather apron, coveralls, respirator) etc

Identified Hazards Exposure	Risk assessment		Risk Rating	Required Controls	Controls Implemented	
	Consequences	Likelihood				
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐
					Yes ☐	No ☐

Section 4 – Implementation Plan			
Control Option	**Resources**	**Person(s) Responsible**	**Proposed Implementation date**

Section 5 – Consultation			
Have relevant staff been consulted in relation to this risk assessment? Yes ☐ No ☐ If yes, indicate who was consulted.			
Name:	Date:	Name:	Date:

Section 6 – Comments and Endorsements		
Name:	Signature:	Date:
Assessment Approval: I am satisfied that the risks are not significant and/or adequately controlled and that resources required will be provided. Name:	Signature:	Date:
Position Title:		

Risk Assessment Matrix

PRIORITISING HAZARDS AND RISKS (SEE EXAMPLE ON PAGE 13)

Probability	**Consequence**			
	Negligible	**Marginal**	**Critical**	**Catastrophic**
Certain	High	High	Extreme	Extreme
Likely	Moderate	High	High	Extreme
Possible	Low	Moderate	High	Extreme
Unlikely	Low	Low	Moderate	Extreme
Rare	Low	Low	Moderate	High

HAZARD CONSEQUENCE RATING TABLE

Catastrophic	Multiple deaths
Critical	One death or multiple minor injuries
Marginal	One severe injury or multiple minor injuries.
Negligible	One minor injury

PROBABILITY RATING TABLE

Certain	Exposure to hazard likely to occur frequently (91-100%)
Likely	Exposure to hazard likely to occur but **not** frequently (90-76%)
Possible	Exposure to hazard may occur, but probably is low (75-24%)
Unlikely	Exposure to hazard unlikely to occur (25-2%)
Rare	Exposure to hazard so unlikely that it can be assumed that it will not happen (<1%)

RISK PRIORITY TABLE

Risk Priority	Definitions Of Priority	Suggested Time Frame
High	Situation critical, stop work immediately or consider cessation of work process. Must be fixed today, consider short term and/or long term actions.	***Now***
Medium	Is very important, must be fixed this week, consider short term and/or long term actions.	**This Week**
Low	Is still important but can be dealt with through scheduled maintenance or similar type programming. However, if solution is quick and easy then fix it today. Review and/or manage by routine procedures.	**1 - 3 Months**

Risk Assessment Matrix Example

Risk is the amount of harm that can be expected to occurring during a given time period due to specific harm event, such as an accident. The level of risk can be statistically calculated by multiplying the probability that harm could occur, by the severity of the harm. A risk matrix (as seen on page 11) defines the various levels of risk as the product of harm probably categories and harm severity categories. Project managers should tailor each risk matrix to their own project and ensure the job assessment is signed. An example for a BRI bird mist netting project would be:

Probability	**Consequence**			
	Negligible	**Marginal**	**Critical**	**Catastrophic**
Certain	Stub toe on trail			
Likely		Cut hand setting up nets, Twist ankle on trails,		
Possible		Minor car accident on way to site		
Unlikely			Major car accident on way to site	
Rare				Tornado hits site while working

APPENDIX 2

CODE OF SAFE PRACTICES

Table of Contents

CODE OF SAFETY PRACTICES

BASIC SAFETY

Follow all Safety Rules – All employees must work safely and follow all safety rules.

Safety Program – BRI's Safety and Accident Prevention Program describes the policies and procedures BRI uses to provide you with a safe workplace.

Report Unsafe Conditions or Actions – All employees must immediately report unsafe conditions or near misses to Program Managers, Field Coordinators, the Executive Director, Deputy Director, or the Science Operations Director. A near miss is an incident where someone could have been hurt but wasn't this time. It is important to correct unsafe conditions or procedures before someone is hurt.

Report all Injuries – Employees must report all injuries (no matter how minor) to their supervisor so that arrangements can be made for medical or first aid treatment. This includes illness or aches and pains that employees think may be work related and that don't go away normally. Needle sticks or contact of your broken skin or mucous membranes with potentially infectious materials counts as "injuries" which must be reported.

Do not disturb or clean-up the scene of a serious accident (except to aid injured people or make the area safe) until an accident investigation has been completed.

Don't Work When Impaired – Employees shall not work when impaired by fatigue, illness, medication, or intoxicating substances such as alcohol. The use of illegal drugs is strictly prohibited.

Housekeeping – Keep your work area tidy and free from unnecessary clutter and trip hazards. Clean up spills as soon as possible. Keep solvent waste, oily rags, and flammable liquids in labeled fire resistant covered containers until removed from the work-site.

No Horseplay – Horseplay is forbidden.

Threats and Violence are Prohibited – Violence, threats of violence, and physical intimidation are prohibited.

Employees who feel that a BRI employee or client is potentially violent should immediately report their concerns to any manager or supervisor. Employees who experience violence on the job, or are threatened or experience physical or verbal intimidation should report this to their supervisor immediately.

PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment (PPE) used in your work area is listed below. Do not perform any tasks which require the use of PPE until you've been shown how to use it correctly. During your initial safety training you will be told which work tasks require the use of PPE and how to obtain the equipment you need.

- U.S. Coast Guard (USCG) approved flotation vests – employees are expected to wear USCG approved life vests when in a boat for work-related activities.
- USCG approved survival suits – supervisors will determine if conditions require USCG approved survival suits when boating in colder weather or on the ocean.
- Safety glasses with side protection (ANSI Z87.1)
- Safety goggles (ANZI Z87.1) – wear as required.
- Ultra-violet safety glasses (ANSI Z87.1) – are required with using UV florescence torches
- Latex disposable gloves – when handling, or expecting to handle, potentially infectious materials.
- Nitrile disposable gloves – when handling, or expecting to handle, potentially infectious materials; an alternative when employees are allergic to latex.

Eyesight is Precious – Always wear your eye protection when required. There are many types of eye protection available, tell your supervisor if your eye protection distorts your vision or gives you headaches.

Chemical Protective Gloves – Each kind of glove only provides protection against certain chemicals; always make sure that the chemicals you are using can't go through the kind of gloves you are wearing. No glove provides a perfect chemical barrier; always try to minimize the amount of chemicals that gets on your gloves. Avoid touching your skin or clothes with contaminated gloves. Never touch or allow others to touch objects with bare hands after handling them with contaminated gloves. Decontaminate objects which you have handled with contaminated gloves as soon as possible.

Latex Allergy – Some people may become allergic to latex rubber. Alternative gloves are available, and the allergy usually gets worse if you continue using latex gloves. For these reasons, inform your supervisor immediately and switch to another type of glove if you have any reaction to latex gloves.

Disposable Gloves – Do not re-use disposable gloves. Use the following technique to remove gloves without contaminating your hands.

1. Pinch one of the gloves at the cuff of the glove near the wrist.
2. Peel the glove off by pulling it off our hand turning it inside out.
3. Place the glove you just removed in the hand that still has a glove on, taking care to touch only the clean inner side of the just removed glove.
4. Slide your index finger under the remaining glove, and use your finger to turn the glove inside out over the previously removed glove. Take care to touch only the clean inner side of the glove with your bare hand.
5. Dispose of the gloves and wash your hands with soap and warm water.

BRI employees may be exposed to blood or other potentially infectious materials. Exposure with human blood and/or pathogens may occur through:

- Accidental needle sticks while drawing blood from wildlife.
- Tactile exposure with body fluids through an open wound of a coworker while providing first aid.

All body fluids should be considered potentially infectious materials and to avoid/minimize exposure, BRI staff must take the following precautions:

1. Always wash your hands immediately or as soon as possible after removing gloves or other PPE. Always wash your hands or any other skin with soap and water, or flush mucous membranes (e.g., eyes, mouth, and nose) with water immediately or as soon as possible following contact with a potentially infectious material. If you can't wash or flush immediately, use antiseptic hand cleaners or towelettes and wash as soon as possible.
    a. Antiseptic soap is provided in the restrooms of every BRI facility.
    b. Antiseptic hand cleansers or towelettes are provided in each field first-aid kit, and hands should be washed with soap and running water as soon as feasible.

2. Do not bend, recap or remove needles or sharps. Always place used sharps in an appropriate sharps container immediately or as soon as possible after use. Never reach into a sharps container for any reason. Securely close sharps containers before moving them. Report or replace sharps containers which are nearly full as instructed by your supervisor.

3. Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where you may be exposed to potentially infectious materials and while providing first aid. Never place food or drink in or on refrigerators, freezers, shelves, cabinets, or counter-tops where potentially infectious materials are stored or handles.

4. Always minimize splashing, spraying, spattering, and generation of droplets when performing procedures involving potentially infectious materials. Mouth pipetting/suctioning of blood or other potentially infectious materials is prohibited.

5. Always place specimens of potentially infectious materials in closable, puncture resistant, labeled or color-coded containers. If the outside of the primary container becomes contaminated or the specimen may puncture the primary container, place the primary container in a second, labeled or color-coded container.

6. Always decontaminate equipment you have used with potentially infectious materials before giving it to another employee or releasing it for servicing. If it is not possible to decontaminate the equipment, put an easily visible label that describes what parts remain contaminated on the equipment.

7. Always wear PPE when required. All PPE will be provided to you at no cost.

8. Gloves must be worn when it can be reasonably anticipated that you may have hand contact with potentially infectious materials, mucous membranes, or non-intact skin, are drawing blood, if you will be handling or touching contaminated items or surfaces, or if you are handling potentially contaminated laundry or waste.

9. Masks in combination with eye protection devices are required whenever you may be exposed to splashes, sprays, spatter, or droplets of potentially infectious materials and eye, nose, or mouth contamination can be reasonably anticipated.

10. Appropriate protective clothing (e.g. gowns, aprons, lab coats) may be required depending on the task and degree of exposure anticipated. Always immediately remove garments soiled by potentially infectious materials as soon as possible and place them in the designated container.

11. Change disposable glove immediately or as soon as possible if they are contaminated with potentially infectious materials, are torn or punctured, or lose the ability to function as an effective barrier. Remove all PPE before leaving the work area. Place PPE in the designated area or container for storage, washing, decontamination, or disposal. Never wash or reuse disposable gloves or any disposable equipment.

12. Clean equipment or surfaces which are overtly contaminated with potentially infectious materials immediately or as soon as possible.

13. Never clean up broken glassware by hand; use a brush and dust pan, tongs, forceps or other mechanical means.

14. Inform your supervisor immediately if potentially infectious material contacts your eyes, gets in your nose or mouth, or gets on your skin where there is a cut, rash, or any other skin problem. Inform your supervisor immediately if you are stuck or cut with a sharp that is contaminated with potentially infectious materials. The incident must be

documented, investigated, and you are entitled to receive confidential medical follow-up at no cost.

Sharps Safety – Always use all available safety covers built into sharps. Dispose of used sharps promptly in appropriate sharps disposal containers. Do not re-cap used needles. Report all needle sticks and other sharps-related injuries promptly to your supervisor.

Vaccinations and Boosters – If conditions prevail, BRI employees are eligible for vaccinations and/or boosters (i.e., Hepatitis B, rabies) at no cost to the employee.

Ticks and Lyme disease – Field biologists, especially those working in the northeast, should take precautions against being bitten by deer ticks. Black-legged and western black-legged ticks transmit Lyme Disease, an infection caused by *Borrelia burgdorferi*, a type of bacterium called a spirochete. When bitten, the bacterium travels through the bloodstream, establishes itself in various body tissues, and can cause a number of symptoms. Report tick bites and seek medical attention if the following occur:

- An expanding rash radiates from the site of a tick bite.
- A bull's-eye rash appears around the site of the tick bite.
- Swelling of the lymph glands occurs near the tick bite.
- Headaches occur.

If in doubt, always have a tick bit investigated by a medical professional. BRI's Workers Compensation plan covers the expenses if the tick bite occurred while working for BRI.

Plan Updates – BRI's Potentially Infectious Materials Exposure Control Plan will be reviewed and updated annually. Each employee will subsequently receive an updated copy electronically.

Records – Medical records relating to blood borne pathogens and/or potentially infectious materials (and any other medical issue) will be kept in BRI's medical files (locked) for 30 years. Medical records are kept under lock and key separate from other personnel files.

Training – BRI provides training on potentially infectious materials when:

- Employee is first hired, with retraining within a year.
- Employee is assigned to a project where exposure is likely.

Training is documented via BRI's Employee Training Documentation Form, and this form will reside in the employees personnel file for three years.

OFFICE and SHOP SAFETY

Computer Ergonomics – Employees should take the time to set up their computer comfortably. The keyboard and monitor should be directly in front of them so that they can work without twisting. The keyboard should be just below elbow height when sitting with their shoulders and

arms relaxed at their sides. The top of the monitor should not be above eye level. If necessary, employees should raise their seats and use a foot rest if their feet don't rest flat on the ground.

Employees should request a split keyboard or alternative mouse if their existing equipment generates wrist or arm discomfort.

Employees should arrange their work space so that there is not excessive glare on their monitor screen from lights and windows.

Food – Eating, drinking, smoking, applying cosmetics or lip balm, and handling contact lenses are prohibited in work areas where potentially hazardous or biological samples are stored or handled. Food and drink is not kept in refrigerators, freezers, shelves, cabinets, or on countertops or bench tops where biological materials are stored or handled.

Safe Lifting – Use mechanical devices, such as carts, to lift and carry heavy objects whenever possible. If necessary, have another person help lift a heavy item. Bend your legs (instead of your back) and avoid twisting your neck and back while lifting. Store heavy objects at waist level, not on the floor or overhead.

Keep Hand Tools in Good Condition – Replace chisels, punches and other impact tools with mushroomed shafts. Replace hammers with loose heads and any tool with loose handles. Keep tools reasonably clean to prevent your hands from slipping while using them. Do not use wrenches when the jaws are worn to the point that slippage occurs. Wooden handles should be free of splinters and cracks. Keep cutting tools sharp.

Guarding – never use any machine or portable power-operated tool unless all guards are in place and fully operational.

Electrical Safety

While most BRI staff will not encounter electrical issues during the course of their work, electricity can be a serious work place hazard, capable of causing both employees injury (shocks, electrocution, fires, and explosions) as well as serious property damage. By providing awareness training, BRI hopes to minimize the risk for such incidents.

BRI employees must be trained and authorized to perform electrical work. Evidence of their training must reside in their personnel file. All other BRI employees (most) who have not been trained to perform electrical work are not authorized.

Safe electrical work safety practices include:

- Make sure all electrical distribution panels, breakers, disconnects, switches, and junction boxes are completely enclosed. Shut the breaker panel door when finished.

- Always assume a circuit and/or piece of equipment is energized (whether it is or not).

- Move work and tools away from such circuits/equipment, which may be energized, thereby reducing the risk of shock or injury. For example, work benches should be located away from the breaker panel.

- Minimum approach distance, for qualified employees only, are:
  300 V and less – avoid contact
  Over 300V, but not over 750V – 1'-0"
  Over 750V, but not over 2kV – 1'-6"
  Over 2kV, but not over 15kV – 2'-0"
  Over 15kv, but not over 37kV – 3'-0"
  Over 37kV, but not over 87.5kV – 3'-6"
  Over 87.5kV, but no over 121kV – 4'-0"
  Over 121kV, but not over 140kV – 4'6"

- When working in an enclosed area, BRI will provide the necessary insulating materials or barriers to ensure employees are not exposed to potential electrical hazards.

- Always assume parts of electrical equipment are energized and treat them as live, unless otherwise noted.

- If a part is locked out or tagged by an electrician, do not touch it.

- If a repair or alteration is needed and no qualified and authorized employee is available, contact a qualified electrician using BRI's normal procurement procedures.

- Be aware of overhead lines – especially when working in the field. This includes vehicles, boats, mist nets, and all other equipment.
  - Keep a minimum distance of 10 feet for 50kV lines, and an additional 4" for every additional 10kV.
  - Scout bat sites in the daylight prior to selecting sites for mist nets and avoid areas with overhead lines and/or electrical equipment.
  - Always illuminate the area when setting up nets.
  - Always illuminate dark areas before touching, operating, or assessing electrical equipment or devices.

- Do not wear jewelry or other apparel that is capable of conducting electricity when working near energized equipment. Always wear non-conductive apparel, or render conductive apparel non-conductive by wrapping or insulating it (i.e., gloves of fingers with rings).

- Inspect Power Cords – Never use electrical equipment unless the power cord and ground plug (if present) are in good order. Never use equipment that shocks you, even the small shock from a minor short will get worse with time. Never use the electrical cord to

hoist, carry, or pull electrical equipment. Report all problems with electrical equipment to your supervisor.

Ladders

The following rules apply when using step and portable extension ladders while conducting BRI business.

Ladder Condition and Design

- Step ladders (self-supporting) and extension portable ladders (not self-supporting) – must be capable of supporting at least four times the maximum intended load.
- The rungs, cleats and steps on all ladders must be parallel, level, and uniformly spaced when the ladder is in use.
- Steps should be spaced not less than 10 inches apart, and no more than 14 inches apart.
- Ladders should be inspected regularly and maintained free of oil, grease, and other slipping hazards. They should also be free of defects that may snag clothing of the person climbing the ladder. Any ladder that is defective should be tagged and placed out of service.
- All portable ladders will have non-conductive side rails.

Ladder Use

- Do not use a ladder for any other purpose other than the one for which is was designed, and make sure it is securely placed on level ground away from hazards.
    - Do not use it in a horizontal position (scaffolding)
    - Do not place it on top of barrels or other unstable platforms
    - Keep ladders well away from electrical service and other energized parts.
    - Do not place ladders on slippery or slanted surfaces.
- Ladders should not be loaded beyond the maximum intended load for which they were built, or beyond the manufacturer's rated capacity.
- Do not stand on the top two rungs of a ladder. If the ladder is too short to accommodate the job, get a different ladder. The top of the ladder should extend three feet above the upper landing surface.
- Always face the ladder when ascending and descending.
- Use at least one hand to grasp the ladder when progressing up and/or down the ladder.
- Do not carry any object or load that could cause you to lose balance and fall.
- Place extension ladders such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder.

FIELD SAFETY

Check-out/Check-In Procedures

All field activities should develop and adhere to a check-out/check-in procedure each and every time they embark into the field. While this form can be customized (see Appendix 1 for an

example), they must be written and readily available to all staff. A Check-out/Check-in form should include:

- Date (mm/dd/yy)
- Name(s) of staff
- Departure time (2400 time)
- Destination (route #, coordinates, local name)
- Transport (boat #, canoe #, kayak #, truck #, aircraft tail #, or on-foot)
- Communications (cell phone #, radio, SPOT #)
- Expected return time (2400 time)
- Actual return time (2400 time)

Working Alone

For any employee working alone, a job hazard assessment (Appendix 1) must be conducted to evaluate the risk of working alone and measures in place to assure additional safety. This plan must address check measures, such as those listed above, to be in place before work begins.

Communications

BRI field staff should carry at least one form of communication with them while in the field. Type and associated contact information (phone number, device number) must be entered onto the "Check-out/Check-in" form. Various forms of communication devices include:

- Personal cell phone –many staff use their personal cell phones and must submit a request for monthly reimbursement to the Deputy Director before reimbursement can be issued via your paycheck.
- SPOT Tracker – BRI maintains three (3) SPOT Trackers, a GPS-based device equipped with a SOS feature that when triggered, notifies GEOS, a 24/7 monitoring company. SPOTS are also programmed by project to send predetermined messages (e.g. "Scoter crew is on the water" and "Scoter crew is done for the day") that are sent to specific staff. SPOTS are used by field teams in remote locations where cell service is non-existent, in a marine environment where the boat is not equipped with alternative tracking equipment, and while conducting field work outside of the U.S. See the Risk & Compliance Advisor to reserve your SPOT.

Project Directors and their field crew leader(s) should develop a communication plan specific to their project that covers:

- Frequency of check-ins
- Contingency plan(s) if field crew fails to return by the prearranged time

Boating

BRI owns several Class A (less than 16 feet) and Class 1 (16' to less than 26') vessels; some are equipped with outboard motors. Much of BRI's field work involves operating a boat, canoe or kayak, and it's important that the operator be familiar with how to operate, maintain, and

repair their vessel well in advance of launching it into the water on the first day of their field season.

Training

BRI biologists, even seasoned professionals, working on Maine waters should thoroughly review Maine Boater's Guide, an online publication published by the Maine Department of Inland Fisheries and Wildlife.

Visit: http://www.boat-ed.com/maine/handbook/book.html

While there are no required mandatory boating or water safety course educational requirements for the State of Maine, other states may have requirements.

Visit: http://www.americasboatingcourse.com/abc_website/state_boating_law.htm#me

Complete any necessary boating and/or water safety courses (most are online) well in advance of deploying into the field.

Float Plan

BRI advises crews operating boats, canoes, and/or kayaks to file a float plan. This simple act may be the one determining factor between others finding and assisting crews in the field when an emergency occurs. Do not underestimate the importance of leaving a float plan with are responsible person who remains on shore. An example of a float plan is presented in Appendix 1. If field work is routine, BRI should have a basic float plan on file, and the field staff should maintain an onsite check-out/check-in procedure. Carrying and using a functional SPOT Tracker may act as a substitute for filing a float plan.

PPE

When working on the water, in a boat, canoe, or kayak, BRI employees are expected to wear a USGC approved life vest. USCG approved survival suits are available when working in colder weather or on the ocean. Your supervisor will determine if conditions require that they be worn.

Boat Supplies

All BRI boats are equipped with first id and emergency kits including flares and air horns. These items are housed in water tight boxes. Each boat should also have a suitable anchor, spare prop, basic tool kit, and two paddles. It is the operator's responsibility to make sure these items are present and in good order. Leaving shore without any of these safety items in good working order is the responsibility of the operator.

Operation and Maintenance

These vessels and their associated equipment (trailers, radios, batteries, PFD's, etc.) are an investment that can generate costly repairs if not operated and maintained correctly. Since

these vessels are a resource shared by all BRI programs, Project Directors are ultimately responsible for the care and maintenance of them and the associated equipment while in their possession. It is advisable that Program Directors adopt the approach that every crew member is responsible, properly trained, and take an active role in the care of each vessel. At a minimum, the following should be reviewed by all members of the crew before deploying into the field.

- Pre-departure check
  - Steering and throttle controls – are they working properly?
  - Bilge water – drain if present, making sure plug is replaced securely
  - Fuel – are tanks full?
  - Lights – are they working properly?
  - Oil/Fuel leaks – any present? If so, fix immediately.
  - Hose connections/clamps – check for leaks/cracks and replace/tighten if needed
  - Fire extinguishers – are they fully charged?
  - Radio/GPS – are they operating correctly?
  - Batteries – are they fully charged?
  - First Aid Kit – is it restocked and onboard?
  - PFD's – are there enough and are they in good condition?
  - Emergency Kit – is it restocked and onboard?
  - Float Plan – FILL ONE OUT AND LEAVE WITH A RESPONSIBLE PERSON

- Towing
  - Check seating of trailer hitch on the ball
    - Make sure the ball and trailer hitch is within the limits recommended by the trailer/boat/and vehicle manufacturer.
    - Make sure the trailer hitch is locked onto the ball
    - Use a padlock or tailoring pin
  - Check lights – are they operating correctly?
  - Check for a license plate on the trailer
  - Check wheel bearings – are they full of grease or oil?
  - Secure load
    - Check bow strap, stern straps and transom cover
    - Make sure nothing will fly out of the boat while in transit
      - Check paddles, boat bumpers and ropes
      - Arrange cooler so lid opening faces back of boat
  - Adjust mirrors as needed

Working Over Water

If a project requires BRI employees to work over water, at a minimum, the following safety precautions must be taken:

- Include the hazards of working over water as part of the project safety meeting.

- Be sure each employee has read and signed a description of the tasks to be performed while working over water. This documentation will be kept for 3 years.
- Have available, ring buoys with at least 90 feet of line, placed no more farther than 200' apart
- Provide U.S. Coast Guard-approved life jacket or buoyant work vest.
- Have a small boat available onshore in case an employee falls into the water and a water rescue is needed.
- Working over water, or near water alone where the possibility of drowning exists is prohibited.

Weather Conditions

Consult the weather forecast BEFORE leaving shore. Do not operate a boat in foggy conditions were you lose sight of the shoreline unless you have the appropriate navigation equipment that allows you to see your location and oncoming traffic. If hazardous wind and waves develop, if possible, boat close to the shoreline least exposed to the wind. If conditions deteriorate, immediately put to shore and wait for the wind to subside. Boating early in the morning and toward evening is the best practice when trying to avoid choppy conditions. Monitor thunder closely as lightening can strike 10-20 miles from the center of a storm cell. When you hear thunder, proceed immediately to shore and seek shelter (away from trees if possible). Delay your boating trip when a storm or front is predicted to move through your area. In all cases where your trip is interrupted by foul weather and you are forced to "wait it out" notify your base camp of your status, especially if you will fail to make your check-in time. Be aware, do not key hand-held 2-way communications during a thunderstorm.

Fuel

When departing, check that there is adequate fuel for your planned travel time and distance, including a generous reserve in case it's needed.

Vehicles

Drivers Safety Policy

The safety and well-being of our employees are of critical importance to the organization; therefore, we each have a responsibility not only to protect ourselves when on the road but also to do our part to protect those around us. Employees who are required to drive on company business at any time will be expected to consistently follow all the procedures noted in this policy.

1. Employees are expected to wear seat belts at all times while in a moving vehicle being used for company business, whether they are the driver or passenger.
2. Employees are prohibited from driving while under the influence of alcohol, drugs, or other substances that in anyway impair driving ability.

3. Employees are expected to follow all driving laws and safety rules, such as adherence to posted speed limits and directional signs, use of turn signals, and avoidance of confrontational or offensive behavior while driving. The allowable use of cell phones while driving varies by state.
4. Employees who drive commercial vehicles or who are otherwise subject to separate rules and regulations such as those dictated by state or federal laws are expected to adhere to all policies and regulations associated with the appropriate law or regulation that applies.
5. Employees must promptly report any accidents in accordance with established procedures. Employees must also appraise their supervisors of any damages to BRI vehicles.
6. Employees must inspect their vehicle prior to use. Report any malfunction to your supervisor. If the malfunction involves the clutch, braking system, lighting, or control system, the vehicle may be locked-out/tagged out until repaired. For vehicles equipped with backup warning signal alarm, make sure it is working properly before taking the vehicle. All BRI vehicles must be maintained and safe to operate.

Vehicle Usage

The purpose of this policy is to ensure the safety of those individuals who drive company vehicles and to provide guidance on the proper use of company vehicles. The term "*vehicle*," as used in this policy, includes, but is not limited to, cars, trucks, snowmobiles, and boats. This policy also applies to rental vehicles, which may have additional requirements. BRI expects each driver to drive in a safe and courteous manner pursuant to the Driver and Boating safety rules, as well as follow any applicable rental agreement. Employees who need a vehicle for an extended field assignment may be assigned a company vehicle for their use. All other employees needing transportation for company business may use vehicles from the pool.

BRI and rental vehicles should only be operated in the manner in which they were designed and intended for, and loads should not exceed the manufacturer's recommendations or local load limits. All loads will be secured safely before the vehicle is underway.

When fueling, the engine should be shut off. Make sure the filler nozzle is in contact with the tank to reduce to the possibility of a spark. Never smoke or have an open flame nearby when fueling a vehicle. To avoid the chance of ignition from smoking by others do not have other individuals in the back of the truck or, if hauling, the boat or trailer while fueling. Use of cell phones may increase the chance of sparks, so keep cell phones out of operation while fueling.

BRI vehicles are intended solely for company use. With the exception of extended field assignments, where a BRI vehicle is your only source of transportation, BRI vehicles are not for personal use.

Employees are required to wear eye protection when operating snowmobiles.

Driver Criteria & Administration

Employees must have a valid and current driver's license to operate a company vehicle. Employees holding jobs requiring regular driving for business as an essential job function must, as a condition of employment, be able to meet the driver approval standards of this policy at all times. For all other jobs, driving is considered only an incidental function of the position. Employees are expected to drive in a safe and responsible manner and to maintain a good driving record. Criteria that may indicate an unacceptable record includes, but is not limited to:

- Three or more moving violations in a three-year period.
- Recurring chargeable accidents. Chargeable means that the driver is determined to be the primary cause of the accident through speeding, inattention, etc.
- Any combination of accidents and/or moving violations.

Driver Guidelines and Reporting Requirements

1. Company vehicles are to be driven by authorized employees only, or in case of repair testing, by a mechanic. Spouses, other family members, or other non-employees, including independent contractors, are *not* authorized to drive company vehicles. In no case should subcontractors or their employees drive BRI vehicles. Volunteers may drive BRI vehicles in cases of special exceptions dictated by BRI business needs.
2. Passengers are generally limited to those individuals who need to ride in the vehicle to conduct employer business, such as other employees, independent contractors, volunteers, collaborators, etc. In the event of an emergency, non-employee family members may be passengers. If this occurs, please understand the following: Employees who use the vehicle to transport non-employees (for example, to pick up a child from day care) must understand that they are liable for any damages, payments, or costs that exceed the limits of employer insurance coverage, and such use indicates acceptance of any liability not covered by company insurance. **NOTE: Children age 12 and under should never ride in a front passenger seat.** If an employee's child, age 12 or under, is transported in a company vehicle, the child should ride buckled up in the rear seat. They should use child safety seats, booster seats, or safety belts appropriate to their age and size. Passengers should ride only in seats equipped to accommodate passengers.
3. Any employee who has a driver's license revoked or suspended shall immediately notify his or her supervisor and Human Resources, and immediately discontinue operation of any company vehicle, if applicable.

4. Accident Procedures:
    a. Accidents are to be reported as soon as possible, in all cases, without fail. All accidents in company vehicles, regardless of severity, must be reported to supervisor, Executive Director, Deputy Director, and the Science Operations Director.

b. Accidents involving other vehicles, people or property must also be reported to the police by the employee.

c. Accidents involving personal injury to an employee must be reported to Human Resources for Worker's Compensation purposes.

d. To help staff in a stressful situation, we are providing a vehicle accident form for your benefit. It will guide you in obtaining all the critical information BRI and its insurance companies need in the event of an accident. In the event of an accident, complete the form located in the glove compartment.

e. Do not discuss the accident with anyone at the scene except the police. Do not accept any responsibility for the accident. Don't argue with anyone.

f. Provide the other party with your name, address, driver's license number and insurance information.

g. Accidents in personal vehicles while on company business* ***must*** follow these same accident procedures

5. Drivers must report all ticket violations received during the operation of a company vehicle, or while driving a personal vehicle on company business* to their supervisor and Human Resources as soon as possible. Employees are responsible for any driving infractions or fines as a result of their driving.

6. Motor Vehicle Records will be obtained on all drivers upon hire. A driving record that fails to meet the criteria stated in this policy, or is considered to be in violation of the intent of this policy by the Leadership Team, will result in a loss of the privilege of driving a company vehicle.

* *Company business is defined as driving at the direction, or for the benefit, of employer. It does not include normal commuting to and from work.*

General Rules and Regulations for the Use of Company and Rental Vehicles

1. It is the responsibility of the assigned driver to inform the Office Administrator of any vehicle maintenance needs or safety problems.

2. Employees will be held accountable for maintaining proper fluid levels and tire air pressure. If you have checked out the vehicle for a longer period of time, present the vehicle for repair, service, or adjustment whenever such is needed, and preventative maintenance when time is due.

3. Employees will be held accountable for consulting the manufacturer specifications, securing loads within legal limits, and making sure vehicles are of the correct size and design for the intended use.

4. An updated copy of the employee's driver's license must be kept on file at all times with Human Resources.

5. Copies of the Vehicle Registration, a Copy of the Insurance Card, and a Vehicle Accident Report Form must be kept in the vehicle at all times.

6. Pool vehicles are to be left with no less than a half a tank of fuel when returned. If there is less than half a tank when returning, please fill the vehicle.

7. Vehicles are to be kept reasonably clean. It is the responsibility of the driver to clean out the vehicle upon return and run it through the car wash if needed. Any costs for cleaning the interior/exterior of a vehicle are reimbursable.

8. Smoking is not allowed in BRI vehicles.

Extreme Environmental Condition Safety

Heat

Heat illness prevention applies to field crews working out-of-doors, and requires Project Managers to consider the following regarding their projects:

- Training for themselves and their employees
- Providing potable water on the worksite
- Providing access to shade
- Having local procedures in place to handle a heat-related illness

Prior to the field season, Project Managers should undergo heat-related illness training and:

- Assess weather conditions at their intended field sites
- Take note of high humidity
- Try to schedule outdoor work during the cooler part of the day
- For strenuous tasks, rotate staff.

Prior to working in warm weather, Project Managers, field supervisors and field employees will review the following heat illness prevention procedures:

- Review the environmental and personal risk factors for heat illness;
- Discuss the importance of consuming water throughout the work day;
- The importance of acclimatization to conditions at the worksite;
- Discuss common signs/symptoms of heat illness;

- Discuss the importance of reporting signs/symptoms of heat illness to the field supervisor;
- Emergency response procedures specific to their worksite.

Risk Factors include:

- Environmental
  - Weather conditions
    - Temperature
    - Humidity
    - Air movement
    - Radiant heat (sunshine)
    - Conductive het (ground)
  - High intensity and/or duration of physical activity
  - PPE/clothing
- Personal
  - Poor physical conditions
  - Age
  - Degree of acclimatization
  - Water consumption
  - Some medications
  - Alcohol/drugs

Water Consumption - Drink plenty of water when working in hot environments. It's best to drink small amounts frequently (up to four (4) cups/hour). Take it easy when you first start working in a hot environment. It takes your body at least a week to get used to working in elevated temperatures. BRI provides potable water in coolers for field staff.

Acclimatization – It takes 4-14 days for people to adapt to outdoor conditions. BRI employees, when working in environmental conditions that are not standard should do the following:

- Start slowly – do not overexert yourself until you've adjusted.
  - Supervisors should adjust work schedules and intensities during the first two weeks of each new or returning employee begin work date.
- As needed, take frequent breaks in the shade (or in shade that's provided), especially when ambient temperatures rise above 85^0F
- Drink plenty of water

Common Signs –

- Heat Exhaustion – caused by excessive loss of water and salt through sweat
  - Headaches, dizziness, lightheadedness or fainting
  - Weakness and moist skin
  - Muscle cramps

    - Mood changes such as irritability or confusion
    - Upset stomach or vomiting
- Heat Stroke – caused by a total breakdown of the body's cooling system
    - Sweating stops – skin is hot, red, and dry
    - Mental confusion, losing consciousness
    - Fainting
    - Seizures or convulsions
    - This is a medical emergency – can be life threatening

Reporting signs/symptoms - All BRI field supervisors are trained on how to recognize and prevent heat exposure as part of their first aid training, and will be monitoring the condition of field employees. Tell your s**u**pervisor if you or a co-worker experiences extreme weakness or fatigue, giddiness, nausea, or headache or if your face becomes pale or flushed. These are symptoms of **heat exhaustion** and anyone with these symptoms should rest in a shady or cool area. If shade is not available, ask your supervisor and they will provide shade. You will not be punished in any way if you experience heat stress and must rest. Watch out for your coworkers; sometimes a person with heat stress does not realize it themselves.

If you or a co-worker stops sweating and experiences mental confusion, delirium, loss of consciousness, convulsion, or coma this may be heat stroke. Immediately soak the person in cool water and fan them. The person must go to the hospital or medical clinic as soon as possible. A person with **heat stoke** may die without medical attention.

Local Emergency Response - Field supervisors, as part of their morning tail-gate review of the workday, will remind employees of what to do when a heat-related illness occurs. At a minimum, the following should be reviewed:

- Identify employees carrying cell phones (for calling 911)
- The location of the nearest hospital or clinic
- While waiting for help:
    - Move the affected individual to a cooler area.
    - Give them a small cup of water (if conscious and not nauseous).
    - Loosen and/or remove clothing.
    - Fan and mist the individual with water.
    - Apply a water-soaked towel (or ice-pack wrapped in towel) to head and ice pack to arm pits.
- Call the field supervisor immediately.
- Do not let anyone with any of these symptoms return home or to the field camp unattended without a medical evaluation.
- Supervisors must report each incident on BRI's Report of Injury or Illness form (see Appendix 1)

Cold

If you or a co-worker experiences uncontrollable shivering and the sensation of coldness, a slower heartbeat and weak pulse, slurred speech, memory lapses, or extreme sleepiness, you may be suffering from hypothermia (low body temperature). Anyone suffering from hypothermia should rest in a warm environment right away.

When working in cold environments for extended periods of time, watch for the symptoms of frostbite in your hands, feet and face. These include burning, numbness, tingling, itching, or cold sensations. Skin with superficial frostbite may appear white and frozen, but it retains some resistance when pressed. Skin with deep frostbite is hard.

Ice

In cold environments, be sure to watch for ice on walkways and floors. Do not walk on slippery ice. Remove ice build-up from floors and walkways if necessary.

Sun

Protect your skin and eyes from the sun by using hats, sunglasses, sunscreens, and covering you skin with clothing. Ultraviolet light in sunlight causes skin cancer.

Project Specific Safety

Additional Information

Your supervisor will provide additional information regarding hazards or working procedures specific to your work area.

Never start working on a task until you have been fully trained on the safety requirements and your supervisor has cleared you to begin.

Fit for Duty

For each BRI position, the physical requirements necessary to complete the tasks related to the position are clearly stated in each employee's hiring documents. Should the employee's position title change, or the demands of his/her current position change, BRI will review the position's written description and the new physical requirements with the employee and provide training if necessary.

Drug-Free Workplace Policy

In compliance with the federal Drug-Free Workplace Act of 1988, BRI employees, including those working on a Federal Grant, must abide by the following statement. The unlawful manufacture, distribution, dispensation, possession or use of controlled substances is prohibited in the workplace, in the field, or at any BRI activity.

Employees are prohibited from working while under the influence of drugs, and are expected to report to the workplace with no alcohol or illegal substances in their body. In addition, any drug or alcohol activity that adversely affects job performance or job safety, or that discredits BRI is prohibited.

Use of legally prescribed drugs on the job is allowable only if they do not impair the employee's ability to perform the essential functions of their job effectively and safely without endangering themselves or others. BRI may request to do an evaluation of safety for the effects of some prescribed drugs.

> Note: Some funding agencies may require drug and alcohol screening as part of their contractual agreement with BRI. In such cases, BRI employees may be required to undergo pre-project, post-accident, or random testing as required by the funding agency.

Any violation of the above provisions will result in the employee being subject to disciplinary action, up to and including termination for misconduct. BRI also reserves the right to request that any employee undertake either drug counseling or a full rehabilitation program if a violation of the above provision occurs. Any employee exhibiting observed behaviors suggesting a violation of this policy may also reassigned or sent home.

In addition there are conditions that must be met if the employee is convicted of, or pleads "No contest" to a drug related criminal charge. The employee must, within five days, notify BRI of this. BRI will then take appropriate action, up to and including termination, or require the employee to participate in a recognized drug rehabilitation program.

If questions arise about this policy or issues related to drug or alcohol use at work, employees are encouraged to speak with the Executive Director or Deputy Director without fear of reprisal.

SAFETY AND ACCIDENT PREVENTION

APPENDIX 3

CHEMICAL HYGIENE PLAN

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OVERVIEW

While BRI's Mercury Laboratory may be the first location that comes to mind when referencing chemicals, there are other areas, such as the garage and museum, where chemicals are present. In order to comply with OSHA's 29 CFR 1910.1450, or what is also known as the Laboratory Standard, the following guidelines should be followed. The laboratory standard applies to labs that:

- Use hazardous chemicals
- Serve as a workplace where relatively small amounts of hazardous chemicals are used on a nonproduction basis
- Hazardous chemicals are manipulated on a laboratory scale
- Use of multiple chemical procedures or chemicals
- Have procedures that are not part of a production process
- Use protective practices and equipment to minimize the potential exposure to hazardous chemicals

OSHA's Hazard Communication Standard (29 CFR 1910.1200), also known as the Right-to-Know Law ensures that chemical hazards in the workplace are identified and evaluated, and that information concerning these hazards are shared with employers and employees. This is accomplished through a hazard communication program that includes:

- Determination of hazards
- Container labeling and other forms of warning
- Material Safety Data Sheets (MSDS)
- Training
- Written hazard communication plan
- Trade secrets

HAZARD DETERMINIATION

The hazard determination requires employers to identify and evaluate all chemicals used in the workplace. All Project Managers need to conduct this hazard determination for their work area and/or project. This evaluation falls into two categories:

- Listed hazards – those included in one of the following references: OSHA 29 CFR 1910.1000 tables, American Conference of Governmental Industrial Hygienists Threshold Limit Values (TLV), The National Toxicology Program, or the International Agency for Research on Cancer (see Appendix B).
- Defined hazards – physical or health hazards, such as combustible liquids, oxidizers, corrosives, and reproductive toxins and non-toxins.

MSDS

Once all the chemicals have been evaluated and identified, document them in an inventory list and obtain an MSDS for each of them. MSDS are available from the chemical supplier or manufacturer. They contain specific chemical hazard information, such as health hazard, routes of entry, exposure limits, safe handling precautions, spill clean-up, personal protective equipment, emergency and first-aid procedures, and the name, address and telephone number of the chemical manufacture. All information must be in English, collected alphabetically in a binder, and displayed in highly visible place accessible to all employees. If this collection of MSDS sheets is moved, all BRI employees should be informed of its new location via an email.

The inventory list of hazardous chemicals will be posted at each work area where it occurs, with directions of where the MSDS binder is currently located.

LABELS AND WARNINGS

Hazardous chemicals in the workplace need to be clearly labeled. The label should contain the identity of the materi3al, appropriate hazard warnings, and the name and address of the manufacturer. Again, all labels should be in English.

If a container is unlabeled, automatically assume it contains a hazardous material and contact the local transfer station on guidance on how to dispose of it. Hazardous chemicals are sometimes present in unlabeled areas, such a hoses (antifreeze). If unsure, please consult your Project Manager a certified mechanic.

When working on a site where other subcontractors are working, inquire if they have hazardous materials onsite and ask for a copy of their written chemical hygiene plan. Inform them that the work BRI performs does not include the use of hazardous chemicals.

TRAINING

BRI is obligated, by law, to provide employees with the necessary information and train them in the use and handling of hazardous chemicals in their work area at the time of their initial assignment or whenever a new physical or health hazard is introduced. Training includes:

- Methods and observations used to detect the presence or release of the chemical
- Associated physical and health hazards
- Protective measures
- Labeling
- MSDS information

BRI will achieve this training through the quarterly staff meetings and project-specific meetings.

WRITTEN HAZARD COMMUNICATION PLAN

The written hazard communication plan must fully documents the actions BRI has taken to comply with OSHA regulations pertaining to chemical hazards. It should list the responsible person(s) for each area of the program, and a copy made available to all staff. The written plan will be updated annually, or when a significant change has occurred. Updated plans will be shared with staff electronically. If a new hazard is identified, the plan will be updated, staff notified electronically, the MSDS binder will be updated, and the inventory list updated. Non-routine activities that may subject employees to hazardous chemicals will be reviewed with the affected employees prior to implementation, and added to the written chemical hygiene plan for future reference.

TRADE SECRETS

This final category involves manufacturer Trade Secrets. A chemical manufacturer may withhold the chemical identity, including the chemical name or other specific information, from the MSDS. However, under special conditions, this secret information may be obtained by health care professionals. BRI needs to be aware of the possibility of trade secrets.

APPENDIX 4

EMERGENCY ACTION PLAN

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EMERGENCIES

Emergencies vary from urgent situations to disaster and tragedy. While the latter is unlikely, there is a high probability that BRI staff will encounter and need to respond to less critical emergencies. Emergencies are just as likely to occur in the office as they do in the field, and this section contains strategies for both. Being prepared is the best defense, and knowing in advance the details on where to gather, who to call, and what to do will help mitigate the negative consequences of an emergency.

INCIDENT COMMAND SYSTEM

The Incident Command System (ICS) is a standardized, on scene, all-hazard incident management concept adopted by the United States in the 1970s in response to massive wildfires in California. Due to its flexibility, the ICS is used at any scale (local to federal) to provide a common framework for a standard response and operation procedures to reduce problems and the potential for miscommunications during incidents.

First on the Scene

The ICS is based on a "first-on-scene" concept where the first responder on the scene is in until the incident is resolved, or the initial responder transitions incident command to an arriving, more qualified individual.

So what does this mean? When a BRI employee is the first on the scene of an emergency, he/she is essentially the Incident Commander until someone more qualified or an agency, such as the fire department, emergency medical transport (EMT), U.S. Coast Guard, or law enforcement, arrives and takes over making the decisions. If multiple BRI staff members are present, the one with the most experience and/or training (not necessarily the supervisor or field crew leader) assumes the role of incident commander.

FIRE EMERGENCY

Fires are generally categorized as:

- Structural – fire that involves a building
- Wildfire – vegetation catches on fire through several sources of ignition, including lighting strikes, arson, accidental (discarded cigarette), or intentional (prescribed fire out of control).
- Vehicular – a piece of machinery, usually a car or truck, is on fire.

Sometimes the only indication of fire is heat or smoke. Do not ignore these early warning signs of a potentially deadly situation. In structures, explosions sometimes start or can accompany

fires. Explosions are a rapid and powerful combustion that feature a loud bang, blast waves, and flying debris.

Structural Fires

When a fire occurs within a building or structure, the plan is to evacuate occupants in a save, controlled, and efficient manner. Prior planning is the key to avoiding irrational behavior during a structural fire.

Alarms – In the event of a fire emergency, employees will be alerted by:

- Verbal announcement (shouting)
- In case of fire, shout: "Fire, fire, everyone out" as you make your way to the nearest exit.

Facilities

- 19 Flaggy Meadow Road, Gorham, ME 04038
- 652 Main Street, Gorham, ME 04038
- Other rented facilities (field housing)

Evacuation – In the event of fire or other emergency, ALL employees shall evacuate immediately by means of the nearest available marked exit.

- Always keep exits clear
- Move to the "Designated Area of Assembly" (see below)

Small Fires

- Portable fire extinguishers are provided in the workplace for employee use.
- Small fires are those that can be quickly controlled with little risk to staff. An example of a small fire it one occurring in a wastebasket.
- A small fire becomes a substantial fire that requires evacuation when ONE fire extinguisher is not enough to put the fire out.
- In the event of a small fire, any employee may use the extinguishers to extinguish the fire before evacuating.

Fully Involved Fires

- Fully involved fires are those that cannot be controlled by ONE fire extinguisher.
- Evacuate the building immediately while shouting a verbal announcement to other staff.
  - Stay low to the floor if smoke and flames are present.
  - Hot air can scorch lungs.
  - Smoke may contain toxic fumes.

  - Take short breaths.
  - Cover face with damp cloth.
  - Breathe through your nose.
- Check doors before opening.
  - Place your hand on the door face or handle.
  - If hot, DO NOT OPEN.
  - If cool, open door slowly, keeping your heard to one side to avoid any blast of hot air.

Critical Operations/Equipment – Critical operations shutdown procedures are NOT required, and no employees are authorized to delay evacuation for this purpose or to delay evacuation for the purpose of gathering up equipment.

Designated Area of Assembly - After an emergency evacuation, employees are to gather in the following locations:

- BRI West – gather in the side yard (off of Flaggy Meadow Road) to await further instructions and roll call.
- BRI East – gather in the front yard to await further instructions and roll call.

Vehicles - You may move your vehicle to a location away from the building.

- Park it such that it will NOT interfere with emergency response vehicles.
- DO NOT DRIVE AWAY.
- Report to your designated area of assembly to await further instructions and roll call.

Roll Call - will be conducted at the staging area.

- The fire monitor (see list below) will conduct roll call.
- The location of staff not present will be verified via cell phone.
- A list of names and possible location within the building of all unaccounted-for staff will be given to the responding fire department.

Fire Monitors - For further assistance with emergency evacuation procedures, the following individuals may be contacted:

- BRI West – TBD
- BRI East – Cathy Flegel (727.267.1854), Lynn Marchilli (207.450.6287)

Wildfires

Fire is a natural component in many ecosystems. However, these unplanned fires can pose a threat to life and property. When a wildfire occurs close to a BRI field site, the primary directive is to evacuate and/or cease field work until the area has been deemed safe by the Incident Commander. Wildfires display unusual behaviors that hard for even seasoned veterans to anticipate. BRI field staff DO NOT carry the appropriate safety gear to work in and around a wildfire.

If, while working in the field, you notice large amounts of smoke or see uncontained flames:

- Evacuate the area immediately.
- Call authorities (911) when you are in a safe place.

Vehicle Fires

Most vehicle fires begin through a mechanical or electrical failure, and usually the risk of death is low. Fires can also start during vehicular collisions or rollovers. The risk of death is higher since additional injuries and/or obstructed means of egress often accompany these types of accidents. Arson is the third way vehicles can catch on fire.

Although automobile manufacturers have engineered safety features into cars and trucks, the risk of an explosion still exists. Also, if a burning vehicle is parked off pavement, the surrounding vegetation could catch on fire, resulting in a wildfire.

Please follow these guidelines:

- Never leave a vehicle parked with the engine running over dry vegetation.
- Try to park on a mineral soil surface.

Boat Fires

All BRI boats are equipped outboard engines and BRI employee using the boats are responsible for making sure the onboard BRI-supplied Marine-grade fire extinguishers are operational and charged.

Fire Extinguishers

BRI provides portable fire extinguishers in the offices, in vehicles, and on boats. These extinguishers are visually inspected monthly, maintained annually, and are replaced as needed. At a minimum, BRI provides an annual training program for staff to familiarize them with:

1. The location of fire extinguishers
2. General usage of fire extinguishers

This topic will also be covered in Project specific training for field staff, conducted by the Project Manager at the beginning of each field season.

In general, follow these guidelines when using a fire extinguisher:

1. Do not use a fire extinguisher to fight a fire unless you are very confident the extinguisher will safely put the fire out. Instead, evacuate the building notifying others as you leave and summon the fire department if necessary.

2. When using a fire extinguisher, remember PASS

a. **P**ull the pin – this will allow you to discharge the extinguisher.
b. **A**im at the base of the fire – if you aim at the flames, the extinguishing agent will fly right through and do no good. You will want to hit the fuel base, which is located at the bottom of the flame.
c. **S**queeze the handle – depress the button that releases the pressurized extinguishing agent in the extinguisher.
d. **S**weep from side to side – until the fire is completely out. Start using the fire extinguisher from a safe distance away, then move forward. Once the fire is out, keep an eye on the area in case it re-ignites.

Do not use a fire extinguisher to fight a fire unless you are very confident the extinguisher will safely put the fire out. Instead, evacuate the building notifying others as you leave and summon the fire department if necessary.

MEDICAL EMERGENCY

A medical emergency is an unforeseen event that requires a prompt response. A victim's health and/or live may be at risk in the event of an injury or medical emergency. Your ability to respond promptly, make quick decisions, and attend to the victim until medical personnel arrive may make the difference between life and death. When you recognize an emergency, you must be prepared to take action, preferable with an overall plan in mind. The following guidelines are designed to help you "plan in advance" of an actual emergency.

If you experience a medical emergency and someone is injured, contact your supervisor once help has arrived and the victim is well attended by an emergency responder.

At the beginning of each field season, BRI requires Project Managers to identify remote field sites where access by 911 emergency responders or access to a clinic, hospital or physician is limited. For these projects, at least one BRI employee with valid first-aid training will be part of the field team, and will be available to provide basic first aid. Training, equivalent to training provided by the American Red Cross, will be provided to BRI employees at no cost.

Life-threatening Medical Emergencies

CALL 911 IMMEDIATELY

Life-threatening signs include when a victim:

- Is or was unconscious
- Has chest pains or pressure
- Is bleeding severely
- Has difficulty breathing
- Has pain or pressure in the abdomen
- Is passing blood or vomiting

- Has slurred speech, severe headache or seizures
- Has a head, neck or back injury
- Has a possible broken bone(s)
- Has been poisoned

Assess, Alert, Attend

When someone is hurt, the natural tendency is to rush in and assist. However, the first step is to **assess** the scene to determine if it is safe for you to help. Just a few things to look for include:

- Downed wires that may be a source of electricity
- Presence of a venomous snake and or rabid animal
- Unsafe substrate that could give way under your weight

Once you've assess that the area is safe, **attend** to the victim by gathering the following information:

If unconscious:

- Is the victim breathing?
- Does the victim have a pulse
- Is the victim severely bleeding?

If conscious - same questions as above plus:

- What happened?
- Where do they hurt?
- Do they know their name?
- What is their age?
- Do they have any medical conditions?

NOTE:

- **NEVER** administer CPR or First-Aid unless you are **CERTIFIED**.
- **NEVER** administer First Aid unless you obtain the **PERMISSION** of the victim.

Alert 911 if you determine the extent of their injuries warrants immediate help, and stay with the victim until medical help arrives.

First Aid Kits

All BRI field crews will have in their possession a first aid kit supplied with items relevant to the work they are performing. Prior to each field season, the Project Managers will appoint an

employee to review each kit and replace missing and/or outdated items. All first-aid kits will be watertight and clearly labeled.

Portable Eye-wash Station

If a project involves a risk of BRI employees being exposed to corrosive materials, then BRI will provide a portable eye-wash station at no cost to the employees.

WEATHER RELATED EMERGENCY

Lightening

While thunder and lightning storms occur year round, they are most common during the summer months. Since lightning often strikes well in advance of heavy rain, sometimes as far as 10-20 miles from the center of the storm, it's important to take action when you….

…first hear thunder:

- Look for shelter inside a home, large building, or hard-topped vehicle.
- If on the open water, go to land and seek shelter immediately.
- DO NOT seek shelter under tall trees.
- DO NOT key portable radios.
- Wait at least 30 minutes after the last thunder before leaving your shelter.

…feel your hair stand on end:

- Lightning is about to strike.
- Squat low to the ground on the balls of your feet.
- Place your hands over your ears and your head between your legs.
- DO NOT lie flat on the ground.
- This is a last resort when a building or hard-topped vehicle is not available.

…are with someone who is struck by lightning:

- Call 911
- Attend to victim (who carries no electrical charge)
- Check their breathing, heartbeat, and pulse.
- CPR may be needed.

Tornado

The National Weather Service issues two tornado messages:

- Tornado Watch – issued when conditions are favorable for a tornado

- Tornado Warning – issued when a tornado has been sighted and reported. The warning provides the last known location of the tornado, its speed, and its direction of movement.

During a tornado watch or warning:

- Monitor outside conditions.
- Cease outside activities if the wind picks up or the sky darkens.

If a tornado is seen or heard:

- If indoors:
  - Move away from windows.
  - Assemble in the most secure part of the building, generally an interior room with no windows.
  - Try to get under heavy pieces of furniture.
  - A corner of the room (even if it has a window) provides more protection than the middle span of a wall.
- If outside:
  - Do not stay in your vehicle.
  - Seek shelter inside a building.
  - Do not try to outrun the tornado.
    - Falling limbs/trees and downed power lines often occur before a tornado strikes.
  - Seek refuge in a ditch or culvert as a last resort.
    - Cover your head with your arms.

Communicating and Updating this Plan

This written plan will be updated annually, and updates shared with employees electronically. A copy of the plan will reside at each office, on BRI's server under PROGAMS, and on ADP, BRI's online payroll system. A review of plan will occur during at least one of BRI's quarterly staff meetings annually, and this plan is part of the new employee orientation.

APPENDIX 5

TRAVEL SAFETY

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FIELD ITINERARY

While each field project is unique, they all contain certain basic elements such as start and end dates, big ticket equipment, safety gear and a communication plan. Before entering the field, the Project Managers should share field itinerary details including, but not limited to:

- Project funding code
- Dates the field team will be deployed
- Names of all BRI field crew members
- A list of equipment (trucks, boats, trailers) that will be used
- Forms of communication (Spot Trackers, marine radio, personal cell phones)
- Additional safety equipment (i.e., Mustang suits, first aid kits, flares)
- A description of the field work
- Check-in/Check-out policy

Send this information to the Finance Administrator and the Science Operations Director. Finance will keep a copy of the information with all the financial records associated with the project as verification of participating staff and the correct contract code. The Science Operations Director will review and may request additional insurance, particularly for international field-oriented work, and request the field team use a SPOT Tracker and/or the information that is linked the MMSI number programmed into the boat radios.

Finally, the Executive Director or Deputy Director will use this information if BRI is contacted by an outside agency on your behalf, such as the U.S. Coast Guard or local law enforcement, while the BRI team is deployed in the field, or if the BRI field staff fails to check-in as agreed.

COMMUNICATIONS

While phone calls and emails help administrative staff in Gorham with logistics and billing, some projects require the field staff to remain connected to Gorham during the course of their travel via prearranged check-ins. The projects most likely to require this extra step include:

- International travel – where field work is required
- Travel into remote areas where cell phone service is spotty or nonexistent
- Solo field work
- Field work is of a dangerous nature

MULTIPLE FORMS OF COMMUNICATIONS

BRI staff in the field should not rely on just one form of communication. Cell phones, SPOT Trackers, and other communication devices should be housed in watertight containers while in the field. Communicating with your supervisor can be done in a variety of ways:

- Phone call – be sure to leave a message if your supervisor fails to answer
- Text message – use to notify a group of people
- Email – use to notify a group of people
- SPOT Tracker – can prearrange notifications by text and/or emails
- Rented satellite phone – use 2-stage calling; include contact numbers on field itinerary

BRI maintains a cell phone reimbursement policy for biologists who use their personal phones.

CHECK-IN POLICY

A daily check-in, usually at the end of the day, is preferred, but negotiable between the field staff and their supervisor. It is the supervisor's responsibility to have a check-in protocol established, preferably in writing, with their field staff BEFORE they enter the field.

Failure to check-in will trigger a series of responses from your supervisor, the Executive Director and the Deputy Director.

1) 12 hours after a failed check-in the supervisor must make multiple attempts to contact the employee/team.
    a. Given the emergency contact information obtained at the beginning of the project, the supervisor begins contacting BRI staff or other researchers working in the last known area where the missing employee/team were working.
    b. Direct them to look for, make contact with, and call back on the status of the missing employee/team.

2) 24 hours after a failed check-in, the supervisor must notify the Executive Director and Deputy Director.
    a. If no additional BRI staff or other researchers are working in the area, the Executive Director and Deputy Director will contact the nearest law enforcement and/or U.S. Coast Guard station and request assistance.
    b. If the missing employee/team is traveling internationally, the appropriate U.S. Embassy will be contacted. Family members will be notified.

3) After 48 hours, the Executive Director, Deputy Director, or their appointee will make arrangements to travel to the last known location of the missing employee/team. Family members will be kept informed.
    a. Searching will continue until the authorities discontinue search and rescue operations.

Note: in addition to the emotional toll, steps 4-6 will likely result in a financial cost to BRI. Search and rescue operations expenses are often passed on to the employer and/or family. Therefore, field biologists who disregard the check-in policy established between them and their supervisor for their field work may face disciplinary action.

RENTAL VEHICLES

BRI employees renting vehicles are covered under BRI's automobile insurance policy. There is no need to purchase additional insurance through the rental agency. A copy of a rental insurance card is available upon request from the Science Operations Director.

APPENDIX 6

PERSONAL PROTECTIVE EQUIPMENT

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AUTHORITIES

Personal protective equipment (PPE) is governed by the following authorities:

- 29 CFR 1910.132-133 and 135-138, Occupational Safety and Health Administration
- American National Standards Institute (ANSI) standards incorporated in the Occupational Safety and Health Act (29 CFR 1910).
- National Institute for Occupational Safety and Health (NIOSH) Personal Protective Equipment Guidance

JOB HAZARD ASSESSMENTS

Program Managers are responsible for conducting a thorough assessment to make sure all job hazards on their projects are identified, and take action to eliminate or reduce them. A job hazard assessment is a process of identifying real or potential safety and occupational health risks for specific jobs within the workplace that might require the use of PPE to protect employees. If the scope of work changes, the job hazard assessment must be revisited, re-evaluated, and employees retrained if necessary. These requirements also extend to subcontractors. Hazards must be ranked on basis of severity (see example in Appendix 1).

Program Managers should use the General Hazard and Risk Assessment form (see Appendix 1) when preparing a job hazard assessment. A copy of this form completed form will reside with the contract documents in BRI's Finance Office. If the project includes subcontractors, they will receive a copy of the job hazard assessment. BRI will provide training for Project Managers and others involved in preparing job hazard assessments.

Purchase of necessary PPE should be a budgetary consideration for both Program Managers (when developing a proposal and/or annual budget) and the Executive Team (when approving the annual budget). It is the Program Manager's responsibility to make sure their employees have proper PPE to protect them from workplace hazards, and are trained on how to select, use, maintain and clean the PPE.

Types of PPE that may be required are:

- **Electrical protective equipment** – e.g. insulating blankets, matting, covers, line hose, gloves, and sleeves made of rubber when exposed to electrical hazards.

- **Eye and Face Protection** – All persons must wear ANSI Z87.1 approved protective eyewear when there is a hazard from flying objects. ANSI Z87.1 approved UV protective eyewear is necessary when using a Ultra-violet light.

- **Foot Protection** – All persons must wear safety shoes or boots with impact protection when the work involves carrying or handling materials such as packages, objects, parts

or heavy tools which could be dropped, and for other activities where objects might fall onto the feet and cause injury.

- **Hand Protection** – Hand protection (gloves) are required whenever working with equipment or materials likely to be hazardous to the hands, such as:
    - Skin absorption of harmful substances
    - Severe cuts or scrapes
    - Punctures
    - Chemical or thermal burns
    - Harmful temperature extremes

- **Head Protection** – Head protection that resists penetration and absorbs the shock of a blow are required when working in an environment where there is a danger of head injuries from falling objects or other hazards.

- **Leg Protection** – When working where injury to legs is possible, special equipment is required to prevent injury. For example:
    - Working with chain saws – wear leg chaps
    - Working in areas where you may encounter venomous snakes – wear leg guards

- **Other Special Types of Protection** – includes protective aprons, waders, U.S. Coast Guard approved life vests, Mustang jackets.

COMMON HAZARDS

- Employees may work around vehicle traffic.
- Employees may work in the rain.
- Employees may work in wet conditions.
- Employees may work on ice or snow.
- Employees may work while kneeling.
- Employees may work over or near water (risk of drowning)
- Employees may work at elevated heights (climbing gear required)

PPE TRAINING

Project Managers must train employees, who in turn must comply with all PPE requirements including:

- Wearing PPE as required
- Completing PPE training
- Cleaning and maintenance to keep PPE in serviceable condition
- Notifying supervisors when PPE needs to be repaired or replaced

Training should include:

- When PPE is necessary.
- What PPE is necessary for which job task(s).
- How to properly put on, remove, adjust and wear PPE.
- The limitation of the PPE, and its proper care/maintenance/disposal.

Project Managers will provide retaining when either the type of PPE or workplace changes making earlier training obsolete or an employee illustrates a lack of knowledge concerning how to use the PPE or is observed using it incorrectly.

RECORD KEEPING

Project Managers should keep written records of PPE training for all employees. At a minimum, training records should include:

- Name of the person trained.
- Date of the training.
- Type of training provided.

PPE for STANDARDIZED BRI ACTIVITIES

Boating

- Required PPE
    - Employees are expected to wear a U.S. Coast Guard approved life vest when in a boat for work-related activities.
        - BRI will provide lightweight, self-inflatable personal flotation devices for this purpose.
    - When boating in cold weather or on the ocean, when the water temperature could cause hypothermia, BRI will provide USGC approved survival suits.
        - These suits are required to be in the boat.
        - The onsite Project Manager will determine if conditions require that they be worn.
- Other recommended PPE
    - Water-activated personal strobe light
    - Whistle

APPENDIX 7

SPOT TRACKER

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WHEN TO USE A SPOT

BRI has purchased three (3) SPOT Trackers for staff to use in the field. It is just one device that helps keeps field staff and BRI Maine in contact with each other and is viewed as an additional safety measure. It comes equipped with a SOS feature that, when triggered, notifies a 24/7 monitoring operation (GEOS) who will arranges emergency response(s) regardless of where you are at. The SPOT works globally, and BRI expects the following teams to carry (and use) a SPOT who are:

1. Working in remote locations were cell phone coverage is very sparse or nonexistent
2. Working in a marine environment in a boat that is not equipped with alternative tracking equipment
3. Conducting field work outside of the U.S.

While exceptions may apply, if your field work falls into one of the above categories, verify with your Director on the need to carry a SPOT.

If you are asked to carry a SPOT, information from the TRAVEL ITINERARY will be used to update the information GEOS will need in case of an emergency.

SPOT OPERATING DIRECTIONS

POWER

To turn SPOT on simply press and hold the ON/OFF button until the button blinks green.

- SPOT performs a self-diagnostic test.
- When power is ON, the button will blink green every 3 seconds.
    - This is helpful for making SPOT more visible in the dark.
- To turn SPOT off, press and hold the ON/OFF button until the light stops blinking.

AUTOMATIC SELF TEST

SPOT performs a self-test when you initially turn on your SPOT. If all visible lights flash red, the SPOT self-test has found a failure, and SPOT will not send a message. If the On/Off light, GPS light and Message Sending light all blink red, SPOT has a GPS failure, but SPOT may still be able to transmit an SOS or Help/SPOT Assist message without your GPS location

INITIAL TEST BEFORE GOING INTO THE FIELD:

Perform an initial system test to evaluate your entire messaging system, from the operational condition of the SPOT to the readiness of those you've chosen to receive your messages.

1) Go outside to where SPOT has a **clear view of the sky** in all directions.
2) Press and hold the **ON/OFF** button until the function light blinks green.
3) Press and hold the **Check-In/OK** button until the function light blinks green.
4) Leave SPOT outdoors. The GPS indicator light blinks green as SPOT acquires a GPS fix.
    a. Once SPOT acquires your GPS location, the Message Sending light and GPS light will blink green in unison for ~15 seconds to notify you that your message is being transmitted with GPS location.
    b. The Message Sending light will continue to blink green over the remainder of the 20 minute message cycle and for one (1) hour after the end of the message cycle (this is to provide you with additional time to check if your most recent message was transmitted).
    c. The Check-In/OK function light will turn off once the message cycle is complete.
5) Verify that the message was received in the email or SMS account(s) that you set up during activation in your Check-In/OK contact list.
6) You can also view your messages in your account at findmeSPOT.com

7) If the GPS light blinks red, SPOT does not have a clear view of the GPS satellites and you must move to an area with a clearer view of the sky for proper operation. Then repeat steps 2 through 5.
8) You can update the names and contact information anytime via your account on the SPOT website.

SPOT BUTTONS

SOS: Use this function in the event of a life threatening or other critical emergency to notify emergency services of your GPS location and that you need assistance.

- The GEOS International Emergency Response Center alerts the appropriate agencies worldwide – for example contacting 9-1-1 responders in North America and 1-1-2 responders in Europe.
- SPOT will again look for a GPS signal prior to sending the next scheduled message to GEOS Rescue Coordination Center (~4-5 minutes after the first message)
- SOS will repeat the entire message cycle until cancelled (or batteries are depleted) with updated location.
- SOS messages will be sent even if GPS location cannot be determined.
- SOS overrides Check-In/Ok, Custom Message, and Track Progress.

Help: In the event of a non-life threatening emergency, you can use this function to notify your personal contacts that you need assistance.

- Messages scheduled every 5 minutes for one hour with updated location to your friends or coworkers.
- SPOT sends Help/SPOT Assist messages even without a GPS location.
- SPOT will again look for a GPS signal prior to sending the next scheduled message (~4-5 minutes), and repeat the entire message cycle.
- Overrides Check-In/OK, Custom Message, and Track Progress.

Check-in/OK: This feature allows you to let your friends and family know that all is OK with a pre-programmed message along with your GPS location.

- **BRI biologists** – use this feature at the **BEGINNING** of your field day to notify BRI Gorham that your activities are underway.
- With a push of a button a message is sent via email or SMS to up to 10 pre-determined contacts and your waypoint is stored in your SPOT account for later reference.
- Messages scheduled 3 times over 20 minutes to contacts on your contact list.
- SPOT must get a GPS signal before sending your Check-In/OK or Custom Message.
- If no GPS signal is found, the GPS light blinks red and SPOT deactivates the function without sending any messages.
- Suspends Track Progress until message is sent, then Track Progress resumes automatically.

Custom Message: This feature allows you to let your friends and family now receive a custom message along with your GPS location with a push of a button.

- **BRI Biologists** – use this feature at the **END** of your field day to notify BRI Gorham that all is ok and your field day is done.
- SPOT must get a GPS signal before sending your Check-In/OK or Custom Message.
- If no GPS signal is found, the GPS light blinks red and SPOT deactivates the function without sending any messages.

Track Progress: Start/stop tracking at any time using your SPOT device.

- You can also mark a Reference Point or send Check-in/OK messages from specific locations while in Track Progress mode.
- SPOT will schedule an update to a transmission to your account every 10 minutes for 24 hours.
- Message not sent if GPS location cannot be determined.
- SPOT must get a GPS signal before sending your waypoint.
- SPOT will stay in the Track Progress function, and again look for a GPS signal at the next scheduled message interval.

Light indicators

SPOT uses lights to tell you what it's doing. Take a moment to become familiar with these lights. Function lights Each button has a backlight that blinks when that button is active. To activate (or if applicable, cancel) any function, you must press and hold the button until the function light starts blinking (approximately 3 seconds).

GPS Light

The GPS light notifies you whether SPOT is able to see the GPS satellites and obtain your GPS location.

• Green – The GPS light blinks green while SPOT sees the GPS satellites and is looking for a GPS location. Once the GPS location is obtained, the GPS light and Message Sending light blink green approximately 15 seconds to notify you that your message was sent with your GPS location.
• Red – The GPS light blinks red if SPOT doesn't see the GPS satellites and /or can't find your GPS location. You should move to a location with a clearer view of the sky.

Message Sending Light

The Message Sending light notifies you whether or not your most recent message was transmitted.

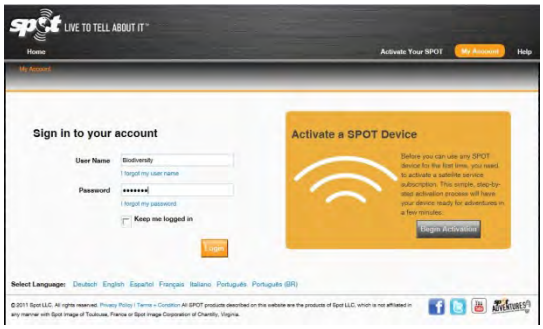
• Green – The Message Sending light blinks green after SPOT transmits the most recent message.
• Red – The Message Sending light blinks red if SPOT didn't send the most recent message.
The Message Sending Light will continue to blink as appropriate for each function – until the next scheduled message (Track Progress, Help/SPOT Assist, SOS) and/or until one (1) hour after themessage cycle is complete (Check-In/OK, Custom Message, Track Progress, Help/SPOT Assist).

VIEWING TRACK PROGRESS ONLINE

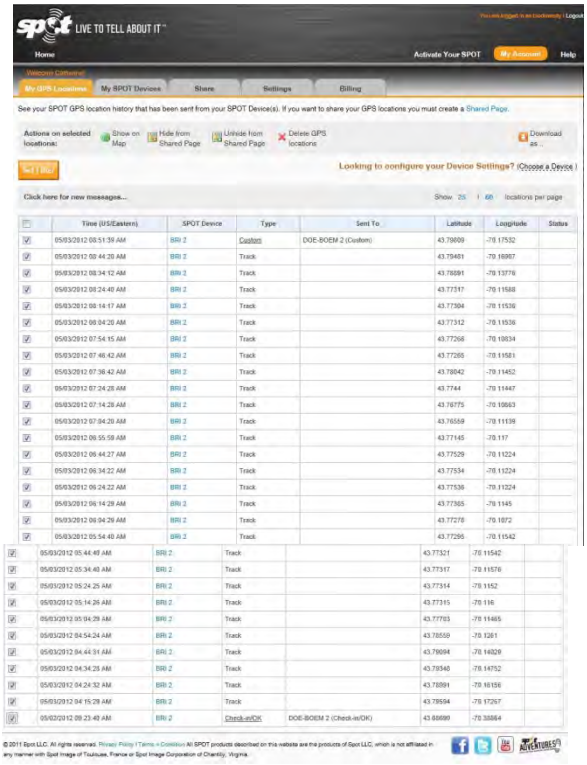
When the TRACK PROGRESS option button is pressed, the SPOT will locate your position every 10 minutes. To view your progress (or a history of it):

- Log onto http://www.findmespot.com
- Select **My Account** in the upper right-hand menu bar

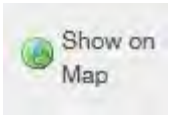
- User Name = **Biodiversity**
- Password = **gavia19**



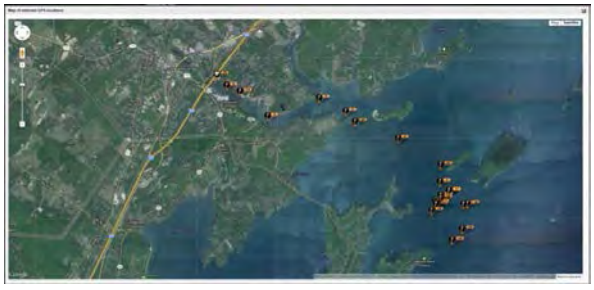
- Under the **My GPS Locations** tab
- Use **Set Filter** to your SPOT number (see back of carrying case), **Apply**
- Click each message – your page should look like this:



- Select **Show on Map** icon
- Map view appears



- Click the **Satellite** button in the upper right-hand corner of the map to see the map in satellite view



APPENDIX 8

ACCIDENT and NEAR MISS INVESTIGATIONS

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ACCIDENTS and NEAR MISSES

Accident and near miss incident investigation is a critical part of every Safety Program. The purpose of these investigations is to determine why the incident occurred and then prevent similar incidents in the future.

DEFINITIONS

Accident	An unintended injury, illness, death or property damage.
Near Miss Incident	An event which could have resulted in an accident but didn't (e.g. "that was a close one…."

ACCIDENT CAUSATION

It's important to report and investigate every accident and incident especially minor accidents and near misses incidents. Often, many minor incidents occur before a major accident; investigating and preventing minor incidents can also be prevent major accidents. For example, many people may slip on an oil puddle before someone falls and is injured. By finding and fixing the oil lead after someone slips (the "near miss incident") we also prevent someone from falling (the "accident").

Most accidents have more than one cause; the accident occurs because of a combination of factors which by themselves might not have caused the accident. Usually, the most underlying causes of an accident are in fact symptoms of underlying problems.

When conducting an accident or near miss investigation it is important to understand all of the causal factors in order to identify the most effective corrective actions.

STEP-BY-STEP INVESTIGATION

The following steps should be used as a guideline when investigating and evaluating an accident or near miss incident.

- Make the area safe
- Care for the injured
- Cordon off the accident area
- Assemble others to help assess (if necessary)
- Gather necessary investigative tools
    - Pen and paper for documentation
    - Digital camera
    - Tape measure

    - Marking tools (flagging)
- Investigate
    - Examine and describe the area
    - Take photographs
    - Review personal protective equipment
    - Interview others
    - Document finding in writing
- Analyze and identify the underlying problems
- Devise corrective actions
    - Present suggestions to the Executive Team
- Follow-up
    - Executive Team implements solution
    - Original accident investigator should also follow up on corrective actions

REPORTING

Project Managers should appoint an employee responsible for reporting and conducting an investigation on their project before an incident occurs. The Science Operations Director will review the investigation/reporting process with the identified employee prior to them embarking on their field season. The Science Operations Director is responsible for reporting and investigating incidents that occur at BRI's main offices in Gorham, ME. A form is provided in Appendix 1 to assist with this process.

Near miss and accidents must be reported in a timely manner.

- For incidents that involve an injury, notify the Executive Director, Deputy Director or Science Operations Manager within 8 hours. Upon notification, BRI will contract Chartis Insurance, BRI's Workers Compensation carrier, to establish a case file. Depending on the severity of the injury, other regulatory agencies (i.e., OSHA) will be notified. If working on a funded project, BRI is also obligated to inform the funding agency of the incident within 24 hours.
- For near miss incidents, the incident needs to be reported to the above BRI employees within 24 hours.

SUBCONTRACTORS

Each subcontractor working on BRI projects is obligated to comply with all Federal, State and Local safety requirements as well as project-specific requirements of the funding client. These combined safety requirements constitute a minimum level of performance expected from each subcontractor and his/her employees, or their agents, throughout the project's period of performance.

As part of the contracting agreement, subcontractors will supply BRI with a copy of their safety plan, and agree to be solely responsible for implementing their safety plan. They will also have their insurance carrier provide BRI with a copy of their Experience Modification Rate (EMR) for the past three years. The EMR is a metric that gauges both the past cost of injuries and the future chances of risk.

Before work begins, the subcontractor will be required to attend BRI's project orientation meeting where safety is discussed. Their attendance will be documented by the Project Manager, and this documentation will reside in the Finance Department's contract folder. Attendance is also required at subsequent job meetings where safety, hazard assessments, and inspections are discussed. It's highly advisable to include the subcontractor in the development of the job hazard assessment, however the level of their involvement may vary by project.

If an accident or near miss incident occurs, subcontractors must inform the BRI Project Manager within eight hours, who will then inform the appropriate agencies and/or clients within 24 hours.

Subcontractors should also be part of post-job performance reviews and include a safety review.

SAFETY AND ACCIDENT PREVENTION

APPENDIX 9

CONTACTS

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LOCAL MEDICAL FACILITIES

Mercy Hospital 144 State Street Portland, ME 04101 Telephone: 207.879.3000 Toll Free: 800.293.6583 24/7 hours Major medical emergencies	**Animal Emergency Clinic** 739 Warren Avenue Portland, Maine 04103 Telephone: 207.878.3121 24/7 hours Emergency animal care
Maine Medical Center - Brighton First Care 335 Brighton Avenue Portland, ME Telephone: 207.662.0111 Hours: 9:00 am – 8:00 pm, daily Minor medical emergencies and walk-in medical care	**Maine Veterinary Referral Center** 1500 Technology Way, Enterprise Park Scarborough, ME 04074 Telephone: 207.885.1290 27/7 hours Emergency and specialty animal hospital
Concentra Urgent Care 1600 Congress Street Portland, ME 04102 Telephone: 207.774.7751 Fax: 207.828.5410 Hours: M-F, 7:30 am – 5:00 pm Minor medical emergencies and walk-in medical care	

LOCAL LAW ENFORCEMENT and FIRE

For ALL Emergencies Dial 911	
Gorham Police Department 270 Main Street Gorham, ME 04038 Telephone: 207.839.5581 Fax: 207.839.7717	**Gorham Fire & Rescue** 270 Main Street Gorham, ME 04038 Telephone: 207.839.6762

BRI STAFF OFFICE and CELLULAR CONTACT INFORMATION

BRI – East 207-887-7160, Fax 207-887-7194 **BRI – West 207-839-5818, Fax 207-839-7655**

Name	Extension	Location	Cell
Apartment Office	122	West	
Amy Sauer	-	Offsite	1-315-200-0534
Andrew Gilbert	205	East	1-207-329-7525
Bruce Rinker	217	East	1-207-894-4399
Carl Anderson	126	West	1-802-324-5219
Carry Gray	247	East	1-207-272-8370
Cathy Flegel	212	East	1-727-267-1854
Chris DeSorbo	115	East	1-207-212-0794
Chris Perisco	122	West	1-207-478-1619
Conference Room	111	West	
Conference Room	216	East	
Dave Buck	245	East	1-603-953-7320
Dave Evers	221	East	1-207-518-9022
Dave Yates	114	East	1-207-491-4707
Deborah McKew	222	East	1-603-724-3609
Dustin Meattey	112	East	1-603-491-3940
Emily Connelly	203	East	1-518-424-7005
Evan Adams	204	East	1-207-217-4717
Jonathan Fiely	124	East	1-406-640-3212
Kevin Regan	107	West	1-860-917-2045
Iain Stenhouse	210	East	1-207-312-9401
Jennifer Goyette	208	East	1-414-526-0808
Jim Paruk	249	East	1-608-280-1758
Joan Plevich	-	Offsite	1-717-350-1295
Kate Taylor	218	East	1-207-450-4701
Kate Williams	108	East	1-207-318-2658
Kristin Hanegan	214	East	1-207-807-5752
Lee Attix	103	West	1-207-838-0359
Lynn Marchilli	201	East	1-207-450-6287
Lucas Savoy	104	East	1-207-232-3441
Madeline Turnquist	248	East	1-763-238-3867
Mark DiGirolamo	-	Offsite	1-207-542-3631
Matt O'Neal	-	Offsite	1-207-462-4467
Melissa Duron	251	East	1-207-409-0940
Mike Chickering	123	West	1-207-894-4378
Nina Schoch	-	Offsite	1-518-891-6965
Patrick Keenan	242	East	1-508-397-6476
Oksana Lane	106	East	1-207-939-3076
Rick Gray	125	East	1-207-322-1744
Robby Lambert	252	East	1-207-249-8310
Shay Hatch	209	East	1-908-358-8976
Tim Divoll	244	East	1-508-662-2274
Wing Goodale	219	East	1-207-807-8750

Rangeley House 207-864-5970
BRI East Landlord – Ken Lefebvre 207-210-1111

APPENDIX 10

BATS AND RABIES

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OVERVIEW

Rabies is a fatal viral zoonotic disease of public health significance (CDC 2011). It is a viral disease caused by RNA viruses in the family *Rhabdoviridae*, genus *Lyssavirus* (Lyles and Rupprecht 2007) that affect the brain and spinal cord. In humans, it generally takes many weeks and in rare cases even a few years before symptoms appear. Most often people show signs of the disease within one to three months after exposure to the virus. Unfortunately, once people show signs of the disease it is nearly always fatal. Even though tens of thousands of people are successfully vaccinated each year after being bitten by a mammal that may have rabies, a few die each year because they do not recognize the risk of rabies from the bite of a wild mammal or they do not seek medical advice once bitten (CDC, 2001). Rabid animals (wild and un-vaccinated pets and farm animals) have been recorded in every county in Maine (ME CDC, 2010).

Early signs of rabies in humans may include:

- Fever
- Headache
- Unclear thinking
- Sleepiness
- Excessive worry
- Numbness or tingling around the wound

Mammals with rabies may (or may not) show the following:

- Act strangely once the virus reaches their brains
- Seem shy or fearful
- Seem overly friendly or aggressive
- May stumble as drunk
- May appear lame

Rabies in Bats

Bats, like all mammals, are susceptible to contracting rabies. The literature cites that some bat species seem more susceptible to contracting rabies and the disease in bat populations is not thought to be increasing (Brass 1993). The occurrence of the disease in bats in North America has been estimated to be less than ½ of 1 percent (Constantine 1988), and the traditional view that bats are asymptomatic carriers of rabies, immune to its progression, has been debunked (Brass 1994).

The U.S. Department of Health and Human Services' Center for Disease Control and Prevention (CDC), and most State CDC offices maintain rabies is more common among certain mammals, including:

- Bats
- Raccoons
- Skunks
- Foxes, coyotes

They also report that rabies is very rare among small rodents, mice and chipmunks. While all of this is encouraging, given the lethalness of the virus and the inability to confirm diagnosis except through testing saliva or neural tissue, rabies remains a threat that must be approached with much caution.

The need for caution is further justified because the recent human rabies cases in the United States have been caused by the rabies virus from bats (CDC 2001), and the most common rabies virus variants responsible for human rabies in the United States are bat-related (CDC 2008). During 1990-2007, 34 naturally acquired bat-associated human cases of rabies were reported in the United States. Actual bites were reported in 18% of the case while contact with a probable bite represented 6%. The majority (44%) reported contact with a bat but no suspected bite, while 32% reported no bat interaction at all (CDC 2008). Laboratory data supports the hypothesis that the bat rabies virus variant associated with the silver-haired bat (*Lasionycteris noctivagans*) and the eastern tricolored bat (*Perimyotis subflavus*) have biological characteristics that might allow for a higher likelihood of infection (Morimoto et al. 1996).

The CDC (2008) recommends bats should never be handled by untrained and unvaccinated individuals (CDC 2008). If an exposure does occur, the mammal should either be tested or the bitten individual should seek medical counsel and possible vaccination regardless of their previous vaccination history. No studies exist on the effectiveness of rabies pre-exposure prophylaxis in preventing rabies deaths in humans (CDC 2008). While some studies on animals receiving pre-exposure vaccinations report complete protection from the street rabies virus isolates (Brookes, et al. 2005), when challenged with five (5) other lyssavirus variants survival rates ranged from 44% to 89% (Halon et al. 2005). These study results support the usefulness of the pre-exposure vaccinations, but also emphasize the variation in effectiveness between the vaccine and its phylogentic relatedness with the particular lyssavirus isolate. Approximately 94% of bats submitted for testing are not rabid (CDC 2011). The Advisory Committee on Immunization Practices (ACIP) (CDC 1999) and the World Health Organization (WHO) (WHO 1992) also recommend that prophylaxis for the prevention of rabies in humans exposed to the rabies virus should include thorough wound cleansing followed by vaccination

BRI recognizes that CDC data may be biased toward the infrequent interactions between the general public and bats. However, given the inability to look at an animal and definitively diagnose if it is infected with the rabies virus or not, the probability of a lethal outcome if exposures go untreated, the knowledge that 6% of all tested bats are rabid, and the high likelihood of exposure due to the nature of our work, BRI has adopted a cautious and conservative approach for BRI biologists who work with bats as part of their job. While BRI recognizes that some bat species are more likely to carry the virus, BRI maintains that all species of bats are a suspect rabid animal - an animal that is susceptible to rabies but in which the disease cannot be ruled out – and rabies is ruled out by testing which is performed via necropsy of a euthanized or dead animal. To that end, BRI has adopted the Standard Operating Procedures (SOPs) outlined throughout this document that staff must follow when handling bats.

EXPOSURE ROUTES

Exposure

The rabies virus is present in the saliva and neural tissue of infected mammals and the most widely known route of exposure occurs from the bite of a rabid animal. However, exposure to rabies might also occur when the virus, from the saliva or other potentially infectious material (neural tissue) is introduced into the handler. Direct exposure routes consist of (CDC 2011):

- Bites – even those that do not cause bleeding
- Existing open cuts in the handler's skin
- Mucus membranes of the handler – i.e., rubbing one's eyes, mouth or nose after handling

Bite Exposures

Any bite, regardless of body site or severity, constitutes an exposure to the rabies virus (CDC 2008). Although the risk for transmission varies with the anatomical location of the bite and the severity of the wound (98), rabies transmission can occur from bites that inflict minor injury (e.g., bats) resulting in lesions that are difficult to detect under certain circumstances (CDC 2005, Messenger et al. 2002).

Nonbite Exposures

While nonbite exposures from mammals rarely cause rabies, there is evidence that suggests such exposures require assessment to determine if there are sufficient reasons to consider post-exposure prophylaxis (Afshar 1979). The contamination of open cuts/abrasions or mucous membranes of the handler with the saliva or other infectious material (e.g., neural tissue) of a rabid animal is the nonbite exposure route BRI staff are most likely to encounter.

Indirect Contact

Indirect contact and activities do not constitute exposure. The rabies virus is inactivated by desiccation, ultraviolet irradiation and other factors and it does not persist in the environment (CDC 2008). However BRI strongly recommends using precautions with these indirect routes, which include (CDC 2011):

- Petting or handling an animal (without getting bitten)
- Contact with blood
- Contact with urine
- Contact with feces
- Contact of wet saliva with intact skin
- Touching dried saliva

There is a possibility that another animal may have saliva and/or neural tissue from rabies infected prey item present on its teeth, beak or talons. Given the lack of published research on this topic, BRI biologists need to be aware of this potential risk and take precautions when handling other animals. BRI supports consultation with medical experts and recommended rabies treatment for any staff who suspects they were exposed to the rabies virus.

VACCINATIONS

Pre-Exposure Management

The CDC recommends all individuals in high risk occupations, such as veterinarians, veterinary assistants, and wildlife handlers receive a series of pre-exposure vaccinations to boost the antibody level in the event of an exposure (CDC 2011). The pre-exposure vaccinations do not provide immunity to contracting

rabies; they are designed only to boost antibody titer and to improve the response to treatment that is still required following all possible exposures (CDC 2011).

BRI employees who handle bats must complete the pre-exposure prophylaxis vaccinations BEFORE they can handle bats. Pre-exposure management includes (CDC 2008):

1) Pre-exposure vaccines followed by serology and vaccine boosters
2) Promptly reporting and treating ALL potential exposures to the virus
3) Wearing protective gloves when handling mammals

Pre-exposure Vaccinations

BRI will arrange with a local medical care provider for the pre-exposure vaccinations. Pre-exposure vaccinations from human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV) are administered in a series of three (3) intra-muscular (IM) injections. The series starts at day 0, and continue with boosters at day 7 and day 21. The timing of the injections cannot be deviated from, so BRI biologist seeking pre-exposure should adjust their availability to accommodate the vaccination schedule.

- Only BRI biologists who have pre-exposure vaccinations and a current antibody check (titer level) shall handle bats.
  - A record of your vaccination schedule and subsequent titer test(s) must be in your medical file at BRI in Gorham, ME.
- Annual titer level tests are mandatory.
  - How long the antibodies remain active varies by individual.
  - The titer level test assesses the level of antibodies in your system.
  - Depending on test results, a booster shot may be required.
  - If you continue to be in a high risk category for exposure to rabies, you should plan on having your levels tested annually.
- No BRI biologist will be allowed on a bat project without proof of an annual titer test.
  - Test results can take weeks to obtain.
- As the field season approaches, plan ahead.
  - BRI covers the cost for any employee needing the pre-exposure vaccinations and titer test due to their work at BRI.
  - Contact the Science Operations Director with your request

EXPOSURE MANAGEMENT

Exposure management begins before BRI biologists are deployed into the field. It's important to think through the steps, research and obtain important local contact information, and review protocols with others – all before handling the first bat.

Handling Bats

As a conservation-research organization, BRI fully appreciates current threats faced by populations' wild species and to that end none of us wish to contribute to the loss of a wild animal. However, BRI has a responsibility to their employees to provide them with the safest environment within which to work,

and endorse policies that have the health and welfare of the staff as a priority. To help insure no bat must be euthanized for rabies testing, please exercise the following handling guidelines.

- Wear gloves at all times (see Appendix A)
  - High Risk Biters (generally the larger species with bigger teeth) require leather gloves on both hands at all time.
  - Low Risk Biters require latex gloves at all times, and it is recommended that handlers were one leather glove and one latex glove.
- Do not allow ungloved or unvaccinated staff to "help" you remove the animal from the mist/harp net
  - Assign them tasks that keep them out of contact with the bats.
  - Volunteers must sign a pre-waiver form and this form must be in the possession of BRI ME before the volunteer may join BRI staff in the field.
  - Not handling a possibly infected bat will reduce the risk of contracting rabies to nearly zero.

Isolate the Animal

The unfortunate happens – you get bitten by a bat. But you are mentally prepared because you know that rabies prevention should be forefront in all handlers' minds, even before they begin handling a bat.

- Come prepared with a clearly marked container to humanely house an animal that bites.
  - If bit, put the bat in the container immediately, do not continue handling it.
  - Make sure others at the site are aware of the container and its contents.
- Try to identify the species of bat before you handling it.
  - Flinging off a biting animal is often an automatic response.
  - Identifying an animal to species level before handling it will help in determining the final treatment if this automatic response results in the bat escaping.
- If it's a listed species…
  - Contact the nearest USFWS Game Warden.
  - Allow him/her to take over the fate of the live animal.

Wound Treatment

Regardless of the risk of rabies, when bitten by a mammal, the optimal medical treatment includes recognition of the wound and prompt treatment. For most types of bites, immediate irrigation with water or a dilute water povidone-iodine solution markedly reduces the risk for bacterial infection (Callaham 1978). When treating a wound, take care to not add further damage to the skin or tissues (CDC 2008). Studies with animals (not human studies) have shown that wound cleansing is especially important in rabies prevention because through wound cleansing alone, without other post-exposure prophylaxis, there is a marked reduction in the likelihood of rabies (Dean et al. 1963, Kaplan et al. 1962).

- Keep the first aid kit stocked with fresh water, soap and povidone iodine
- Always have the first aid kit onsite
- Supervisors need to remind staff daily of its presence and importance of wound care

Testing

In the event of a possible rabies exposure, BRI biologists are encouraged to have the animal tested for rabies even though testing is fatal to the animal.

- DO NOT euthanize a listed species.
  - Call the nearest USFWS Game Warden.
  - Allow him/her to take possession of the live bat.
- Euthanize non-listed species via cervical dislocation
  - Only staff skilled in this procedure should perform it.
  - Contact your supervisor if you need help.
- Keep carcass cool – do not freeze it.
  - Freezing will interfere with subsequent testing.
  - Never place biological samples in the same refrigerator with food consumed by humans.
- Contact the local health department and arrange for shipping.
  - Follow shipping instructions listed in the Rabies Specimen Submission section (below).

Reporting Exposures

BRI biologists must report a bat exposure to their supervisor(s) and BRI in Gorham, ME within 24 hours of the event. There are strict state laws regarding timelines in which BRI and its insurance carrier must report injuries to the state workers' compensation board. Any delay subject BRI to potential fines by the state.

- REPORT ALL EXPOSURES IMMEDATELY
  - Failure to report a bat bite or other exposure puts both the affected individual and BRI at great risk
  - Peer-pressure to NOT report an exposure will not be tolerated
- Employee (and/or their supervisor) is responsible for:
  - Completing BRI's Report of Injury Form
  - Answering basic questions for Workers' Compensation insurance/OSHA reporting
- Cost of the follow-up and testing will be covered by Worker's Compensation insurance.
  - Hospitals, Public Health Departments, and local pharmacies will need Worker's Compensation policy numbers.
  - Policy Number
    - You will be supplied with this number in advance.
    - Keep it with you at all times.
    - If you lose this number, you may still seek treatment – it can be provided later.
  - Claim Number
    - Available about 24 hours after the incident is reported to the insurance carrier.

Post-Exposure Treatment

BRI biologists should mentally prepare themselves for the steps involved with treatment following exposure to the rabies virus. Given the nature of BRI's bat work, there always remains a high probability that staff will encounter an exposure to the rabies virus. Bats tend to defend themselves (attempt to bite) during removal after being ensnared in mist and harp nets. Since the epidemiology and pathogenesis of rabies is complex, recommendations regarding post-exposure prophylaxis are dependent on associated risks which must be assessed by the attending medical professional (CDC 2008). These risks include:

1) Type of exposure
2) Epidemiology of animal rabies in the area where the contact occurred
3) Species of animal involved
4) Circumstances of the exposure incident

Clinicians should seek assistance from local or state public health officials for evaluating post-exposure management in situations that are not routine. State and local officials have access to CDC rabies experts for difficult decisions (CDV 2008). As the affected individual, this dialogue may seem confusing and unsettling. Remain calm and keep in mind that when and unvaccinated person is exposed the administration of the rabies post-exposure prophylaxis is a medical urgency, not a medical emergency (CDC 2011).

BRI has adopted the following protocols if a staff member experiences an exposure to the rabies virus. Please keep in mind that the actual decision to administer the post-exposure prophylaxis may differ between cases and is dependent on the affected individual's vaccination status (Table 1).

- Supervisors should provide staff, in advance of going into the field, with the contact information for:
  - Local hospital(s)
  - Local and State Public Health Facilities
- Consult with the local medical health care provider and the local/state public health officials
  - Keep notes on their recommendations
  - Ask questions
  - Use Table 1 as a guide to post-exposure treatment
  - Rabies vaccines are not always readily available, so the Emergency Room is the typical place to seek treatment.
    - In Portland, ME, Concentra may be a treatment option
- If the animal is available for testing
  - You most likely will be instructed to wait for the results before receiving the post-exposure prophylaxis
  - Employees are encouraged to seek medical treatment/advice if they feel they are at risk in waiting
- Keep BRI Gorham ME apprised of your progress.

Unfortunately, not many health care providers are accustomed to dealing with rabies exposures in individuals who have the pre-exposure vaccination. We recommend you bring the following table with you if you need to seek treatment.

Table 1. Rabies post-exposure prophylaxis schedule – United States, 2008 (CDC 2008, 2010)

Vaccination Status	Treatment	Regime*
Not previously vaccinated	Wound cleansing	All post-exposure prophylaxis should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as povidine-iodine solution should be used to irrigate the wounds.
	Rabies immune globulin (RIG)	Administer 20 IU/kg body weight. If anatomically feasible, the full dose should be infiltrated around the wound(s) and any remaining volume should be administered intramuscularly (IM) at an anatomical site distant from the vaccine administration. Also, RIG should not be administered in the same syringe as the vaccine. Because RIG might partially suppress active production of antibody, no more than the recommended does should be given.
	Vaccine	Human diploid cell vaccine (HDCV) or purified chick embryo cell vaccine (PCECV) 1.0 mL, IM (deltoid area[§]), on each day of days 0[¶], 3, 7, 14, and 29.
Previously vaccinated **	Wound cleansing	All post-exposure prophylaxis should begin with immediate thorough cleansing of all wounds with soap and water. If available, a virucidal agent such as providine-iodine solution should be used to irrigate the wounds.
	RIG	RIG should not be administered.
	Vaccine	HDCV or PCECV 1.0 mL, IM (deltoid area[§]), one each on days 0[¶]and 3.

* These regimes are applicable for all age groups, including children.
** Any person with a history of a complete pre-exposure or post-exposure vaccination regime w/HDCV, PCECV, or rabies vaccine adsorbed, or previously vaccination with any other type of rabies vaccine and a documented history of antibody response to the prior vaccination.
§ The deltoid area is the only acceptable site of vaccination for adults and older children. For younger children, the outer aspect of the thigh can be used. Vaccine should never be administered in the gluteal area.
¶ Day 0 is the day the first dose of the vaccine is administered.

RABIES SPECIMEN SUBMISSION

General Information

The purpose of this appendix is to provide BRI field staff with a guideline of how to prepare and ship a suspected rabies specimen to a local laboratory for testing. Each laboratory and/or state is likely to have specific protocols, which can be addressed by asking the following questions.

- Normal business hours
- Telephone number
- Do they use a specific courier

It is extremely unlikely that a live animal will be accepted by the laboratory.

Necropsy

- The animal should be humanely euthanized without damage to the head.
    - Exception: if the suspected animal is a listed species.
        - Call the nearest U.S. Fish and Wildlife Service office.
        - Turn the LIVE animal over to them for handling.
    - Only BRI employees experienced with this procedure should perform euthanasia.
        - Contact your supervisor if you need help.
- The head must be removed from the body and submitted intact for necropsy.
    - Exception: entire body of small mammals, such as bats, mice, and squirrels may be submitted as whole carcasses for testing.

Packaging and Shipping

- A laboratory submission form may be required – ask.
    - Fill it out completely.
    - Make a copy or scan the form for BRI's records.
- All materials collected for rabies diagnosis are considered to be infectious.
    - Appropriate handling and shipping precautions should be taken in order to ensure the safety of the collector/submitter, transportation carriers, laboratory staff and the public at large in accordance with 49 CFR Department of Transportation Regulations.
- Submit specimens to the laboratory promptly and cold to reduce decomposition of the animal.
    - Use frozen cold packs only.
    - Do not use "wet" ice as it may leak through the container; leaking containers are often rejected.
    - DO NOT FREEZE the specimen as this will delay the testing and possibly alter the results.
- All specimens should be sprayed or dusted for fleas and ticks with a pesticide before packaging.
- Wear disposable gloves while packaging a rabies sample.
- Clearly label the sample with:
    - Health Department or Animal Control internal tracking number (if provided)
    - Animal Species
- Triple package the specimen:
    - Primary Container
        - Ziploc bag or heavy-duty garbage bag appropriately sized for the specimen with an absorbent material (absorbent pads, paper towels, etc.) placed in the bag to prevent blood and body fluid from leaking.

        - If sharp objects protrude from the specimen, such as a shattered bone, wrap the specimen in several layers of newspaper.
        - Always tightly seal or fasten the primary container to contain the specimen.
        - Label this container.
    - Secondary Container
        - Use a metal can, heavy plastic pail with a lid or a heavy-duty plastic garbage bag as the secondary container.
        - Seal secondary container to help prevent leakage of blood or body fluid.
        - Label this container.
    - Rigid Outer Shipping Container
        - Use a cooler or thick-walled Styrofoam container with or without an exterior fiber board liner.
        - "Rabies" should be clearly labeled with permanent marker.
        - Place the secondary container inside the shipping container with sufficient frozen cool packs and cushion materials to prevent damage to the specimen during transport.
        - Clean the outside of the Outer Shipping Container with a disinfectant
        - 10% bleach (9 parts water, 2 parts household bleach)
        - Secure the lid of the container (tape) for transport
        - Place the address on the container

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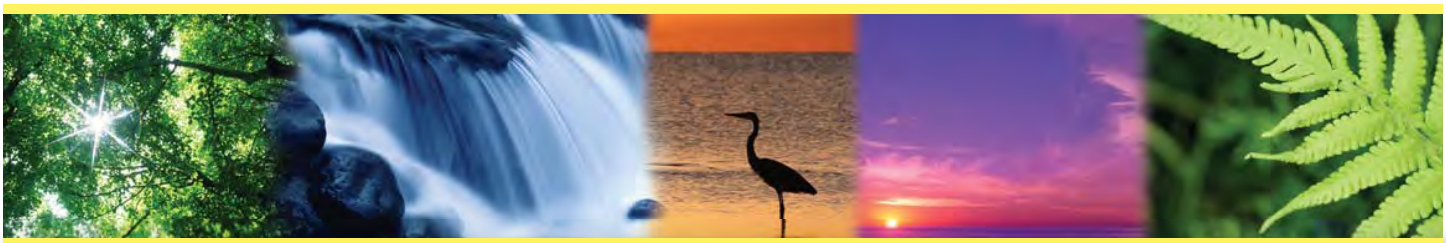
Enclosure 23 Conservation Law Enforcement Needs Assessment

NAVFAC Atlantic Biological Resource Services

Contract: N62470-13-D-8016; Task Order: WE13

FINAL - August 2016



Conservation Law Enforcement Program Needs Assessment

Naval Air Station Oceana,
Naval Air Station Oceana - Dam Neck Annex,
Naval Auxiliary Landing Field Fentress, and
Naval Support Activity Hampton Roads - Northwest Annex

Prepared for:
NAVFAC Mid-Atlantic
Hampton Roads IPT 9742
Maryland Ave., Norfolk, VA 23511

Prepared by:
Tetra Tech, Inc.
2200 Wilson Blvd., Suite 400
Arlington, VA 22201

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NAVFAC Atlantic Biological Resource Services

Contract: N62470-13-D-8016; Task Order: WE13

Conservation Law Enforcement Program Needs Assessment

Naval Air Station Oceana,
Naval Air Station Oceana- Dam Neck Annex,
Naval Auxiliary Landing Field Fentress,
Naval Support Activity Hampton Roads- Northwest Annex
Virginia Beach, Virginia,
Chesapeake, Virginia, and
Currituck County, North Carolina

FINAL – August 2016

Prepared for:

NAVFAC Atlantic
6506 Hampton Blvd.
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ACRONYMS AND ABBREVIATIONS

ARPA	Archaeological Resources Protection Act
ACHP	Advisory Council on Historic Preservation
BCC	USFWS Birds of Conservation Concern
BLM	U.S. Bureau of Land Management
BO	Biological Opinion
BST	Biological Science Technician
CFI	Certified Firearm Instructor
CFR	Code of Federal Regulations
CLE	Conservation Law Enforcement
CLEO	Conservation Law Enforcement Officer
CLEP	Conservation Law Enforcement Program
CNRMA	Commander, Navy Region Mid-Atlantic
CRP	Cultural Resources Program
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
DOD	Department of Defense
DODI	Department of Defense Instruction
DODD	Department of Defense Direction
EFH	Essential Fish Habitat
EO	Executive Order
ESA	Endangered Species Act
FLETC LMTP	Federal Law Enforcement Training Center Land Management Training Program
GIS	Geographical Information Systems
ICO	Installation Commanding Officer
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
MBTA	Migratory Bird Treaty Act
MOA	Memorandum of Agreement
MWR	Morale, Welfare, and Recreation
NALFF	Naval Auxiliary Landing Field Fentress
NASO	Naval Air Station Oceana
NASO-DNA	Naval Air Station Oceana Dam Neck Annex
NAVFAC	Naval Facilities Engineering Command
NAVMC DIR	Department of the Navy Marine Corps Directive
NCIS	Navy Criminal Investigative Services
NCWRC	North Carolina Wildlife Resources Commission
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NMFWA	National Military Fish and Wildlife Association
NRS	Natural Resources Specialist
NRP	Natural Resources Program
NSAHR-NWA	Naval Support Activity Hampton Roads Northwest Annex

NOAA-NMFS	National Oceanic and Atmospheric Administration National Marine Fisheries Service
OC	oleoresin capsicum
OPNAVINST	Chief of Naval Operations Instruction
RHPO	Regional Historic Preservation Office
RT&E	Rare Threatened and Endangered Species
SAIA	Sikes Act Improvement Act
SHPO	State Historic Preservation Office
SOP	Standard Operating Procedure
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USMC	U.S. Marine Corps
V.A.C.	Virginia Administrative Code
VDCR-DNH	Virginia Department of Conservation and Recreation Department of Natural Heritage
VDGIF	Virginia Department of Game and Inland Fisheries
VMRC	Virginia Marine Resources Commission

1.0 INTRODUCTION

This document identifies policies and provides direction for the Regional Navy Conservation Law Enforcement Program (CLEP) in accordance with Department of Defense Instruction (DODI) 5525.17. This CLEP Needs Assessment applies to the following four facilities: Naval Air Station Oceana (NASO), Naval Air Station Oceana-Dam Neck Annex (NASO-DNA), Naval Auxiliary Landing Field Fentress (NALFF), and Naval Support Activity Hampton Roads- Northwest Annex (NSAHR-NWA).

The Sikes Act Improvement Act (SAIA) requires that Conservation Law Enforcement (CLE) be provided on military lands, and that each military department ensure that professionally trained natural resources and CLE personnel are assigned responsibility to protect and manage natural resources found on Department of Defense (DOD) installations, including implementation of Integrated Natural Resource Management Plans (INRMP) and Integrated Cultural Resources Management Plans (ICRMP, DOD Legacy Program 2009). DOD installations must coordinate with the appropriate agencies to support CLE and enforce federal and applicable state laws and regulations that pertain to the management and use of the natural resources under their jurisdiction. This has included a variety of law enforcement options including employment of Conservation Law Enforcement Officers (CLEOs), game wardens, military police, or combinations of civilian CLEOs and military police. The DOD utilizes a combination of support options including cooperative agreements with State, other DOD Departments, and other federal partners to provide such oversight. DODI 5525.17 establishes overall policy and provides guidance for the DOD CLEP, in accordance with National Resources Conservation Program Policy (DODI 4715.03).

The Navy currently has one regional Biological Science Technician (BST), whose position also includes CLEO duties. The BST/CLEO has the authority to enforce federal laws and state laws at the four facilities where there is no corresponding federal law. The BST/CLEO currently does not maintain state credentials, so all other state laws must be enforced by a state commissioned officer, unless a Memorandum of Agreement (MOA) is put in place to authorize enforcement of both federal and state regulations (CEMML 2015). CLE responsibility at NASO, NASO-DNA, NSAHR-NWA and NALFF is jointly held by state commissioned officers and the Navy.

Currently the installations predominantly fall under either concurrent or proprietary jurisdiction. However, jurisdictional boundaries are being revised, which will likely change many installation parcels to concurrent and/or exclusive law-enforcement oversight (Personal communication, M. Wright, March 2016). Navy enforcement personnel cooperate with state and federal CLEOs, as needed, to enforce state and federal wildlife laws. The BST/CLEO is required to be trained in law enforcement and federal and state wildlife regulations, and must attend annual wildlife law enforcement refresher training in order to stay current on changes in regulations and enforcement policies.

1.1 PURPOSE

The purpose of the CLEP is to ensure the enforcement of federal conservation statutes set forth in DODI 5525.17 and applicable state and installation laws (described in Section 2.0 of this document), and to protect sensitive natural and cultural resources in order to sustain use of military lands for readiness activities. The CLEOs conduct a range of complex law enforcement activities to enforce natural and cultural resources laws, including but not limited to the following:

conducting field checks of individuals; investigating fish and wildlife crimes; patrolling; surveillance; interviewing witnesses; interrogating suspects; searching for physical evidence and clues; seizing wildlife or archaeological contraband, equipment, and vehicles; searching and serving warrants; making arrests; and testifying in federal and when authorized, state courts, for violations of any of the federal conservation laws provided in DODI 5525.17, state and installation laws described in section 2.0 of this instruction, and other applicable laws not listed in this instruction.

1.2 POLICY

The Navy does not have a formal guidance document dedicated to the implementation of CLEPs on Navy installations. However, the U.S. Marine Corps (USMC) Guide to Conservation Law Enforcement Program (NAVMC DIR 5090.4A) outlines the procedural guidance, directions, and details to establish and implement a CLEP, and to implement the provisions of a current MOA between the USMC and the U.S. Fish and Wildlife Service (USFWS). This directive outlines duties, position descriptions, procedures, training, equipment, etc., and was useful towards the development of this document. Other notable and successful DOD CLEPs that may be useful guides towards the development of a Navy or regional CLEP include: Joint Base Elmendorf-Richardson CLEP, Vandenberg Air Force Base CLEP, and Fort Carson CLEP. Additional information regarding these programs is available in the 2015 CLE Vulnerability Assessment for Front Range Air Force Bases (CEMML 2015).

In accordance with DODI 5525.17, it is Navy policy that the protection of property and natural and cultural resources under Navy control is accomplished through the enforcement of all applicable federal, state, and local/installation laws and regulations. The CLEP is used to support decisions and management actions by the Navy's natural and cultural resources managers regulating the users of these resources to achieve specific goals and objectives. Navy Component law enforcement officials exercise functional oversight over the CLEP and the CLEO(s) carrying out the program. A CLEO assigned to Navy Component law enforcement elements may be co-located with the conservation program manager at the installation.

The Navy Component's law enforcement and conservation functions will establish, and mutually support, an implementation method which defines roles, internal and external support agreements, funding responsibilities, accountability, command and control, and expectations which will provide for an effective and efficient CLEP. CLEP roles and responsibilities will be integrated into an installation's INRMP and ICRMP. The implementation method(s) for each installation CLEP should be proportionate to the CLE needed at the installation. Although the specific implementation methods at installations can vary, those details should be clearly defined at the appropriate command level and address at a minimum, consistent with DODI 5525.17, roles and responsibilities, internal and external support agreements, funding responsibilities, accountability, and command and control. Mutual assistance agreements with other agencies and organizations may be used to maximize enforcement capabilities, when authorized by law. To the extent practicable using available resources, the Navy shall ensure that sufficient numbers of professionally trained natural resource management personnel and natural resources law enforcement personnel are available and assigned the responsibility to perform tasks necessary to execute the requirements of Title 16 U.S.C. (Conservation) and DODI 5525.17. Enforcement of laws primarily aimed at protecting cultural/natural resources is an integral part of a cultural/natural

resource program and shall be coordinated with or be under the direction of the cultural/natural resources manager for the affected area.

2.0 STATUTORY AND REGULATORY AUTHORITY

Per DODI 5525.17, the protection of property and natural and cultural resources under Navy control is accomplished through the enforcement of all applicable federal and state laws and regulations. Federal natural and cultural resources laws that may be applicable to the CLEP are listed and briefly described below. A list of relevant state and installation laws/regulations is also provided.

Federal Cultural Resource Statutes, Executive Orders, and Laws

- Abandoned Shipwreck Act; *Title 43 U.S.C. §2101-§2106*. Establishes government ownership over the majority of abandoned shipwrecks located in waters of the United States of America and creates a framework within which shipwrecks are managed. State governments have authority to claim and manage abandoned shipwrecks on State submerged lands. There are no shipwrecks at any of the installations, so this is unlikely to apply to the regional CLEP.
- American Indian Religious Freedom Act; *Title 42 U.S.C. §1996.* Restored religious rights to Indian religions which include, but are not limited to, access to sacred sites, freedom to worship through ceremonial and traditional rights, and use and possession of objects considered sacred.
- Antiquities Act; *Subchapter LXI of chapter 1 of Title 16 U.S.C., beginning with §431.* The Act requires that a permit be obtained for examination of ruins, excavation of archaeological sites and the gathering of objects of antiquity on lands under the jurisdiction of the Secretaries of Interior, Agriculture, and Army, and provided penalties for violations.
- Archaeological Resources Protection Act; *Chapter 1B of Title 16 U.S.C., beginning with §470aa.* This Act established detailed requirements for issuance of permits for any excavation for or removal of archaeological resources from federal or Indian lands. It also established civil and criminal penalties for the unauthorized excavation, removal, or damage of any such resources; for any trafficking in such resources removed from federal or Indian land in violation of any provision of federal law; and for interstate and foreign commerce in such resources acquired, transported or received in violation of any State or local law.
- Archaeological and Historic Preservation Act; *Subchapter I of chapter 1A of Title 16 U.S.C., beginning with §461.* Declares it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration and protection of such sites.
- Curation of Federally Owned and Administered Archeological Collections; *(36 CFR 79).* Provides minimum standards for the long-term management and care of archeological collections, including the associated records and reports. The regulation considers actions that need to be taken for both new and existing collections. This act is unlikely to apply directly to the CLEP, as there is no Law Enforcement aspect of the law.
- Executive Order (EO) 13287; Preserve America. Provides leadership in preserving America's heritage by actively advancing the protection, enhancement, and contemporary use of the historic properties owned by the federal government, and promotes

intergovernmental cooperation and partnerships for the preservation and use of historic properties.

- Executive Order 11593; Protection and Enhancement of the Cultural Environment. Mandates that all Executive Branch agencies, bureaus, and offices compile an inventory of the cultural resources (archaeological, architectural and historical properties, sites and districts) for which they are trustee; nominate all eligible government properties to the National Register of Historic Places; preserve and protect their cultural resources; and insure that agency activities contribute to the preservation and protection of non-federally owned cultural resources.
- Executive Order 13007; Indian Sacred Sites. Intended to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites on federal lands.
- National Historic Preservation Act (NHPA); *Subchapter II of chapter 1A of Title 16 U.S.C., beginning with §470.* This act created the National Register of Historic Places, the list of National Historic Landmarks, and the State Historic Preservation Offices, in order to continue the preservation of historic resources. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register. This law provides guidance to federal land managers, but does not have any role for law enforcement; instead, it is enforced primarily through recourse to the Advisory Council on Historic Preservation (ACHP).
- Native American Graves Protection and Repatriation Act; *Title 25 U.S.C. §3001.* Requires any agency, which receives federal funding, to return Native American cultural items to lineal descendants and culturally affiliated Indian tribes and Native Hawaiian organizations. This law provides guidance to federal land managers, but does not have any role for law enforcement; instead, it is enforced primarily through recourse to the ACHP.
- Paleontological Resources Preservation Act; *P.L. 111-011 §6301-§6312 (components are applicable to both NR and CR programs, as such Navy requires coordination between both program managers when such resources are found).* Directs the Secretaries of the Interior and Agriculture to implement a comprehensive paleontological resource management program on federal lands.

State, Installation, and DOD Cultural Resource Laws and Regulations

- The Cave Protection Act *(§ 10.1-1000 through 10.1-1008 Code of Virginia).* Secures, protects, and preserves significant caves on federal lands for the perpetual use, enjoyment, and benefit of all people.
- The Virginia Antiquities Act *(§ 10.1-2302 through 10.1-2306).* Prohibits damage to or removal of objects of antiquity from archaeological sites on all state-controlled land.
- Permit Required for the Archaeological Excavation of Human Remains *(§ 10.1-2305)*
- Trespass at night upon any cemetery *(§ 18.2-125)*
- Violation of sepulture; defilement of dead human body *(§ 18.2-126)*
- Injuries to churches, church property, cemeteries, burial grounds, etc. *(§ 18.2-127)*
- DODD 4165.06; Real Property. Provides DOD policy on the acquisition, management, and disposal of real property, and delegates statutory and regulatory authorities and responsibilities relating to the acquisition, management, and disposal of real property.

- DODI 4165.70; Real Property Management. Implements policy and assigns responsibility, for managing real property and re-delegates various statutory and regulatory authorities and responsibilities relating to real property management.
- DODI 4715.03; Natural Resources Conservation Program. Implements policy for the integrated management of natural resources (including biological and earth resources) on property and lands managed and/or controlled by the DOD.
- DODI 4715.16; Cultural Resources Management. Establishes DOD policy and assigns responsibilities to comply with applicable federal statutory and regulatory requirements, EO's, and Presidential memorandums for the integrated management of cultural resources on DOD-managed lands.
- DODI 4715.9; Environmental Planning and Analysis. Implements policy and assigns responsibilities for integration of environmental considerations into DOD activity and operational planning.
- OPNAV Instruction 5090.1D; Environmental Readiness Program Manual. Discusses requirements, delineates responsibilities, and issues implementing policy guidance for the management of the environmental, natural, and cultural resources for all Navy ships and shore activities.
- SECNAV Instruction 4000.35A; Department of the Navy Cultural Resources Program.

CLEOs support the Cultural Resources Program (CRP) by overseeing and enforcing applicable federal, state, and local laws and regulations pertaining to the protection of archaeological sites and other cultural resources. Cultural resources, including archaeological sites, historic structures, buildings, landscapes, objects, and districts are nonrenewable resources that illustrate the historical development of the U.S. federal facilities. As stewards of cultural resources; this responsibility is recognized in the National Historic Preservation Act (NHPA) of 1966 as amended; EO 11593 Protection and Enhancement of the Cultural Environment, and EO 13287 Preserve America; in other federal laws and regulations (listed above), and other DOD and Navy policies (OPNAVINST 5090.1B, Environmental and Natural Resources Program Manual, Chapter 23, Historic and Archeological Resources Protection; SECNAVINST 4000.35, Department of the Navy Cultural Resources Program).

Under the NHPA each federal agency is tasked with the responsibility of establishing a preservation program to identify and evaluate cultural resources that may be eligible for listing on the National Register of Historic Places (NRHP). Properties under a federal agency's jurisdiction that are listed or eligible for listing on the National Register of Historic Places shall be managed and maintained in a way that considers the preservation of their historic, archaeological, architectural, and cultural values.

Archaeological sites on all four installations are protected under the Archaeological Resources Protection Act (ARPA). ARPA built on the Antiquities Act of 1906, which required permitting before ruins could be examined, archaeological sites could be excavated, or "objects of antiquity" could be gathered on lands administered by the DOD or by other federal agencies. However, "objects of antiquity" was not clearly defined, which lead to the passage of ARPA. ARPA "prohibits the unauthorized excavation, removal, or damage of archaeological resources on federal and Indian lands" (King 2013), and defines "archaeological resource" as "any material remains of past human life or activities which are of archaeological interest" (National Center for Cultural Resources 2006). These include, but are not limited to "pottery, basketry, bottles, weapons,

weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal materials, or any portion or piece of any of the foregoing items … that are at least 100 years old" (King 2013). ARPA is the law most directly relevant to law enforcement, and it protects all archaeological resources that are over a century old, regardless of their significance or NRHP eligibility. The NHPA and other federal laws largely provide guidance to federal mangers, and are enforced primarily through recourse to the ACHP.

In Virginia, further protection of archaeological and cultural resources is provided by various state laws that apply to all lands within the Commonwealth, including federal and federally-managed lands. The Cave Protection Act (§ 10.1-1000 through 10.1-1008 Code of Virginia) requires permitting before the excavation or removal of archaeological, paleontological, prehistoric, or historic features in any "naturally occurring void, cavity, recess, or system of interconnecting passages beneath the surface of the earth or within a cliff or ledge including natural subsurface water and drainage systems, but not including any mine, tunnel, aqueduct, or other man-made excavation, which is large enough to permit a person to enter," while various cemetery laws prohibit the excavation of human remains, damage to cemeteries or burial grounds, and trespass at night upon cemeteries. In North Carolina, no state laws applicable on federal lands were found that add additional protection to cultural resources.

Federal Natural Resources Statutes, Executive Orders, and Laws

- Airborne Hunting; *Title 16 U.S.C. §742j-l*. Prohibits shooting or attempting to shoot or harassing any bird, fish, or other animal from aircraft except for certain specified reasons, including protection of wildlife, livestock, and human life as authorized by a federal or state issued license or permit.
- Animal Damage and Control Act; *Title 7 U.S.C., beginning with § 426*. Provided broad authority for investigation, demonstrations and control of mammalian predators, rodents and birds.
- Bald and Golden Eagle Act; *Subchapter II of Chapter 5A of Title 16 U.S.C., beginning with §668.* Prohibits the take, sell, and other derivative actions in regards to Bald and Gold Eagles unless provided exemption (science, exhibition, and religion) by the Secretary of the Interior. Enforceable with maximum fine and/or imprisonment.
- Cave Resources Protection Act; *16 U.S.C. §4301*. Secures, protects, and preserves significant caves on federal lands for the perpetual use, enjoyment, and benefit of all people.
- Coastal Barrier Resources Act; Chapter 55 of *Title 16 U.S.C., beginning with §3501*. Designated various undeveloped coastal barrier islands for inclusion in the Coastal Barrier Resources System (System). Areas so designated were made ineligible for direct or indirect federal financial assistance that might support development.
- Coastal Zone Management Act (CZMA); *Chapter 33 of Title 16 U.S.C., beginning with §1451.* Provides for the management of the nation's coastal resources through development of regulating entities.
- Clean Water Act of 1977; *33 U.S.C. §1251 - §1376, P.L.* 95-217. Extensive series of regulations that guide federal agencies in the regulating of water, water quality, and commerce based water courses. This includes testing for water contamination and preservation of wetlands.

- Data Quality Act; *44 U.S.C. §3504.* Provides policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies.
- Endangered Species Act; *Chapter 35 of Title 16 U.S.C., beginning with § 1531.* Provides a program in which endangered and threatened species can be designated and defines prohibited acts. It is unlawful to import or export; deliver, receive, carry, transport, or ship in interstate or foreign commerce in the course of a commercial activity; sell or offer for sale in interstate or foreign commerce; take (includes harm, harass, pursue, hunt, shoot, wound, kill, trap, capture, or collect any wildlife within the United States); take on the high seas; possess, ship, deliver, carry, transport, sell, or receive unlawfully taken wildlife; remove and reduce to possession any plant from areas under federal jurisdiction; maliciously damage or destroy an endangered plant on areas under federal jurisdiction; and remove, cut, dig up, or damage or destroy any endangered plant in knowing violation of any State law or regulation or in the course of a violation of a State criminal trespass law. These prohibitions apply to live or dead animals or plants, their progeny (seeds in the case of plants), and parts or products derived from them. Certain actions (scientific research, incidental take are exempt with a permit through the USFWS. Criminal violations can be met with maximum fines and/or imprisonment.
- Estuary Protection Act; *Chapter 26 of Title 16 U.S.C., beginning with §1221.* Authorizes the Secretary of the Interior, in cooperation with other federal agencies and the states, to study and inventory estuaries of the United States, including land and water of the Great Lakes, and to determine whether such areas should be acquired by the Federal Government for protection.
- EO 12962; Recreational Fisheries. Mandates that federal agencies, to the extent permitted by law and where practicable, improve the quality, function, and sustainable productivity and distribution of U.S. aquatic resources for increased recreational fishing opportunities. It also established the National Recreational Fisheries Coordination Council.
- EO 13186; Migratory Birds. Directs federal agencies that take actions that either directly or indirectly effect on migratory birds to develop a Memorandum of Understanding (MOU), and to work with the U.S. Fish & Wildlife Service, and other federal agencies to promote the conservation of migratory bird populations.
- Federal Insecticide, Fungicide, and Rodenticide Act; *Chapter 6 of Title 7 U.S.C., beginning with §136.* Regulates the sale and distribution of pesticides, described specifically within this act.
- Federal Land Policy and Management Act; *Chapter 35 of Title 43 U.S.C., beginning with §1701.* Allows for the use of federally owned lands for public access while simultaneously preserving natural resources tied to said lands.
- Fish and Wildlife Conservation Act; *Chapter 49 of Title 16 U.S.C., beginning with §2901.* Promotes the continued protection of non-game species by agencies, to the extent of their jurisdiction. Deals largely with development of conservation plans.
- Forest and Rangeland Renewable Resources Planning Act; *Chapter 36 of Title 16 U.S.C., beginning with §1601.* Authorizes planning and development of management plans that ensure the future supply of forest resources while maintaining a quality environment.
- Forest Management Act*; 10 U.S.C. §2665.* Allows for the regulation of sale of lumber or forest products from lands leased to the Federal Government or military.

- Forest Resource Conservation and Shortage Relief Act of 1990/Domestic Allotment Act; *16 U.S.C. §620.* Promotes the conservation of forest resources in conjunction with State and federal resources management plans, and other actions or decisions, affecting the use of forest resources while also promoting the use and acquisition of timber vital to the United States, particularly in the West.
- Game, Fur-Bearing Animals, and Fish Act; *Subchapter I of chapter 5A of Title 16 U.S.C., beginning with §661.* Directs federal agencies that have programs and activities that have a measurable effect on public land management, outdoor recreation, and wildlife management to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.
- Hunting, Fishing, and Trapping on Military Installations; *Title 10 U.S.C. § 2671.* Establishes that the DOD require all hunting, fishing, and trapping at an installation or facility be in accordance with the fish and game laws of the State in which it is located, require that an appropriate license for hunting, fishing, or trapping on that installation or facility be obtained, and develop, subject to safety requirements and military security, and in cooperation with the Governor (or his designee) of the State in which the installation or facility is located, procedures under which designated fish and game or conservation officials of that State may, at such time and under such conditions as may be agreed upon, have full access to that installation or facility to effect measures for the management, conservation, and harvesting of fish and game resources.
- Lacey Act; Chapter 53 of *Title 16 U.S.C., beginning with §3371.* Prohibits the trade, sell, or reception of illegally acquired wild life and acts in congruence with already established protection acts. Enforceable powers are consistent with suspected felony offenses.
- Magnuson-Stevens Fishery Conservation and Management Act; *16 U.S.C. §1801.* Substantial Act that allows for the conservation of marine fisheries through prevention of overfishing, via development of regional councils over bodies of water.
- Marine Mammal Protection Act; Chapter 31 of *Title 16 U.S.C., §1361 – §1384 and §1401-§1407.* Establishes an increased need for protection and understanding in regards to Marine Mammals. Establishes regulations and enforcement protocol for the taking of marine mammals.
- Migratory Bird Treaty Act (MBTA); *Subchapter II of chapter 7 of Title 16 U.S.C., beginning with §703.* Makes the taking, killing, or possession of migratory birds an unlawful act, barring exceptions provided in this act. Enforceable with maximum fine and/or imprisonment.
- Migratory Bird Conservation Act; *Subchapter III of chapter 7 of Title 16 U.S.C., beginning with §715.* Establishes a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds.
- Migratory Bird Hunting and Conservation Stamps Act; *Subchapter IV of chapter 7 of Title 16 U.S.C., beginning with §718.* Clarifies the distribution, validation, requirements, and enforcement of hunting stamps used in conjunction with taking of migratory waterfowl.
- Military reservations and facilities: hunting, fishing, and trapping*; 10 U.S.C. §2671.* Establishes general requirements for hunting, fishing, and trapping on military installations.

- Multiple Use Sustained Yield of Forests Act; Title 16 U.S.C. §§ 528-531. Development of natural resources for the presence and establishment of resources such as range, timber, outdoor recreation, watershed protection, and wildlife and fish purposes.
- National Environmental Policy Act; *Chapter 55 of Title 42 U.S.C., beginning with § 43421.* Requires that all federal agencies prepare detailed environmental impact statements for "every recommendation or report on proposals for legislation" and other major federal actions significantly affecting the quality of the human environment.
- National Forest Management Act; *Chapter 36 of Title 16 U.S.C., beginning with §1600.* Act requires that the Secretary of Agriculture shall develop, maintain, and, as appropriate, revise land and resource management plans for units of the National Forest System, coordinated with the land and resource management planning processes of State and local governments and other federal agencies.
- National Invasive Species Act; *16 U.S.C. §4701.* Identifies the problematic introduction on non-indigenous life forms through ship ballasts, particularly in reference to lake systems.
- National Marine Sanctuaries Act; *33 U.S.C. §1431.* Regulates the transport of materials for the purpose of ocean dumping and establishes a permitting system to override said prohibited acts.
- National Wildlife Refuge System Improvement Act; *16 U.S.C. §668dd - §668cc.* Amends the National Wildlife Refuge System Administration Act of 1966, ensuring that the Refuge System is managed as a national system of related lands, waters, and interests for the protection and conservation of the Nation's wildlife resources.
- National Trails System Act; *Chapter 26 of Title 16 U.S.C., beginning with §1241.* Provides for establishment of National Recreation and National Scenic trails.
- Noxious Weeds Act; *Chapter 61 of Title 7 U.S.C., beginning with §2809.* Provides authority to inspect, seize and destroy products, and to quarantine areas, if necessary to prevent the spread of noxious weeds. Established federal program to control spread of noxious weeds.
- Recreational Hunting Safety Act; *Chapter 72 of Title 16 U.S.C., beginning with §5201.* Makes it unlawful to physical hinder a lawful hunt, enforceable via maximum fine.
- Rivers and Harbors Act of 1899; *Title 33 U.S.C.* §401 and §403. Prohibits the construction of any bridge, dam, dike or causeway over or in navigable waterways of the U.S. without Congressional approval.
- Refuge Recreation Act; *Subchapter LXVIII of chapter 1 of Title 16 U.S.C., §§ 460-460k-4*. Authorizes the Secretary of the Interior to administer refuges, hatcheries and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes.
- Sikes Act; *Subchapter I of chapter 5C of Title 16 U.S.C., beginning with §670.* Provides for cooperation by the Departments of the Interior and Defense with State agencies in planning, development and maintenance of fish and wildlife resources on military reservations throughout the United States.
- Soil and Water Conservation Act; *Chapter 40 of Title 16 U.S.C., beginning with §2001.* Requires planning and development of plans in regards to conservation of water, soil, and relatable natural resources.
- Taylor Grazing Act; *Chapter 8A of Title 43 U.S.C., beginning with §315.* Regulates the overgrazing and deterioration of public lands, in order to improve rangeland conditions.

- Wild and Scenic Rivers Act; *Chapter 28 of Title 16 U.S.C., beginning with §1274.* Establishes a National Wild and Scenic Rivers System and prescribes the methods and standards through which additional rivers may be identified and added to the system.
- Wild Bird Conservation Act; *Chapter 69 of Title 16 U.S.C., beginning with §4901.* Law prohibits the removal of wild birds for trade, particularly when due harm is caused to wild bird populations, and endeavors to improve conservation of wild bird populations.
- Wild Horses and Burros Act; *Chapter 30 of Title 16 U.S.C., beginning with §1331.* Provides for protection of wild, free-roaming horses and burros.
- Wilderness Act; *Chapter 23 of Title 16 U.S.C., beginning with §1131*. Provides for the designation, protection, and administration of "wilderness areas."

State, Installation, and DOD Natural Resource Laws and Regulations

- Game, Inland Fisheries and Boating*; §29.1-100 through §29.1-829 Code of Virginia.* Establishes the VDGIF as the regulatory authority for fish and game in Virginia.
- Virginia Department of Game and Inland Fisheries (VDGIF) Regulations; *4 V.A.C. beginning with* §15. Establishes hunting and fishing regulations for Virginia, with the VDGIF as the regulatory authority.
- Virginia Marine Resources Commission (VMRC); *Code of Virginia beginning with §28.2-100.* Establishes the VMRC as the regulatory authority for marine fisheries in Virginia.
- Virginia Marine Resources Commission; *4 V.A.C. beginning with §20.* Establishes regulations for marine fisheries in Virginia.
- North Carolina Wildlife Resources Commission (NCWRC); *15A N.C.A.C. §10A-10K.* Establishes hunting and fishing regulations for North Carolina, with the NCWRC as the regulatory authority.
- CNRMA Instruction 11015.1; *Fishing.* Establishes policy and rules for regional installation fishing programs. Contents subject to change.
- CNRMA Instruction 11015.2A; *Hunting and Trapping Program.* Establishes regulations for hunting and trapping on regional installations. Contents subject to change.
- CNRMA Instruction 11015.3; *Natural Resources Management for Fish and Wildlife, Feral Animals, Invasive Species, and Certain Pests.* Establishes policy and assigns responsibility for management of fish and wildlife, feral animals, invasive species, and pest response for regional installations.
- NASO Instruction 5090.2E; Establishes procedures for cutting firewood and use of tree products on NASO.
- NASO SOP for Sea Turtles; (*Appendix F, 2015 NASO INRMP*). Establishes SOP for sea turtle stranding response and nest monitoring.
- Northwest Annex Instruction 11015.1; Establishes procedures for cutting firewood and use of tree products on NSAHR-NWA.

The regional CLEO(s) supports the Natural Resources Program (NRP) by overseeing and enforcing federal, state, and local laws and regulations pertaining to installation hunting & fishing programs, the protection of rare, threatened and endangered species (RT&E) and significant ecological communities, and in some cases assistance with the management of nuisance wildlife. Many of the federal, state, and installation laws/regulations provided in the above lists may be applicable to the duties and responsibilities of the regional CLEO(s). In accordance with DODI

5525.17, one objective of the CLEP is to clearly define areas to prevent hunting, fishing, and other outdoor recreational activities in unauthorized areas.

The SAIA requires that military installations provide for the sustainable multipurpose use of resources, to include hunting, fishing, trapping, and recreational access, as consistent with the military mission, the INRMP, and installation security and safety requirements. The Natural Resources Manager is responsible for direction and oversight of hunting and fishing programs, and multiple other natural resources programs. Current permits sold by the installations requiring enforcement include: Hunting, Trapping, Archery, Fishing, and Firewood Collection. Installations may institute General Wildlife Recreation Permits (trail use, wildlife observation, etc.) in the future, similar to other installations, which would warrant additional enforcement permit checks.

Installation hunting and fishing programs are subject to all state and installation laws and regulations as contained in the Code of Virginia, the VDGIF as referenced in the Virginia Administrative Code (V.A.C.), NCWRC regulations (for NC portions of NSAHR-NWA), CNRMA Instruction 11015.2B (subject to change), Installation INRMPs, OPNAVINST M-5090.1B, and the annual installation hunting rules and regulations (Navy 2015a, subject to change). It is important to note that all hunting, fishing, and trapping on an installation are to be in accordance with the laws of the State in which it is located, and according to Title 10 U.S.C. §2671, "Offenders who are guilty of a like offense are subject to a like punishment for an act or omission on the installation that would be punishable if committed within the jurisdiction of the state." Game management on installations is also subject to the Game and Fish Act, the Lacey Act, the Migratory Bird Act, and the Migratory Bird Hunting and Conservation Stamps Act. Policy and procedures for the registration, transportation, and storage of private firearms for hunting (or other purposes) on the installations is provided in COMNAVREGMIDLANTINST 5820.2.

Recreational fisheries management on the four installations is also governed by several authorities including EO 12962 Recreational Fisheries, CNRMA Instruction 11015.1 (subject to change), and the 1996 DOD Addendum to the National Recreational Fisheries Resources Management Plan. For installations with access to marine fisheries (NASO and NASO-DNA), the regulatory authority is the VMRC, and installations are subject to all VMRC rules and regulations as contained in the V.A.C. and Code of Virginia. In accordance with these authorities, Navy installations must improve the quantity, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunities by restoring degraded habitat, fostering conservation, and providing access to and awareness of opportunities for recreational fishing.

The primary regulatory protection for threatened and endangered species on military installations is the Federal Endangered Species Act (ESA). The Federal ESA requires all federal agencies to ensure that any action undertaken is not likely to jeopardize the continued existence of a federally listed threatened or endangered species. Section 9 of the ESA prohibits the taking of any endangered species without special exemption. The ESA is administered by the USFWS and the Commerce Department's National Marine Fisheries Service, part of the National Oceanic and Atmospheric Administration (NOAA-NMFS). The USFWS has primary responsibility for terrestrial and freshwater organisms, while the responsibilities of NMFS are mainly marine wildlife.

The Virginia ESA grants the VDGIF regulatory authority over federally or state-listed fish or wildlife species in Virginia, and the North Carolina ESA grants the NCWRC regulatory authority over federally or state-listed fish or wildlife species in North Carolina. Therefore, coordination

with the USFWS, NOAA NMFS, VDGIF and/or NCWRC (in NSAHR-NWA) is required when actions have the potential to affect federal and state listed species. The CLEO may also serve to ensure that Navy units that are training comply with requirements of Biological Opinions (BOs) issued by the USFWS, in accordance with consultation requirements in Section 7 of the ESA. BOs are provided in installation INRMPs. Bald eagles, marine mammals, migratory birds, and other wildlife that are present or that may occur on installations are also protected through the enforcement of the Lacey Act, MBTA, Bald and Golden Eagle Act and the Marine Mammal Protection Act.

Migratory birds are a large, diverse group of birds that utilize breeding grounds in the U.S. and Canada, and overwinter in southern North America, Central and South America, the West Indies, and the Caribbean. The MBTA (16 USC §703–711) is the primary legislation in the U.S. established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds, their eggs, parts, and nests unless permitted by regulation. The Final Rule on Take of Migratory Birds by the Armed Forces (50 CFR Part 21) allows for the incidental take of migratory birds by DOD during military readiness activities, provided a permit authorizing such activities has been received. To address the unintentional take of migratory birds as a result of activities necessary to support the military mission, a MOU was adopted between the DOD and the USFWS, as required by EO 13186, Migratory Birds, on 31 July 2006. This MOU allows the military to obtain permits for the "unintentional take" of a migratory bird if it is in support of a military readiness operation.

Per CNRMA Instruction 11015.3, some of the regional CLEOs responsibilities are tied into nuisance wildlife and pest management, through the use of depredation trapping, pesticide application, and responding to complaints about nuisance wildlife. Applicable federal, state, and local regulations for pesticide application apply, as detailed in the installation Integrated Pest Management Plans. The current BST/CLEO is a Navy Certified Pesticide Applicator, and also has surveying and data recording responsibilities for various species. Appropriate permits must be acquired before trapping game and non-game wildlife.

Nuisance wildlife is defined in 4 V.A.C. §15-20-160, and lists those species that are considered by Virginia as nuisance species; however feral pets, Canada goose and other waterfowl are not considered nuisance wildlife by this code. The code further states that "It shall be unlawful to take, possess, transport, or sell all other wildlife species not classified as game, furbearer or nuisance, or otherwise specifically permitted by law or regulation." To ensure compliance with this law, any nuisance wildlife removal or control activities performed by the environmental staff will be coordinated with VDGIF or NCWRC as necessary, to make certain that methods employed do not violate Virginia or North Carolina law.

3.0 INSTALLATION DESCRIPTIONS

A brief description of each of the four installations and the natural and cultural resources they contain is provided in the sections below. Additional information is contained in each installation INRMP and ICRMP (Navy 2014 a-c, Sadler & Whitehead Architects 2012). A location map containing all four installations is included in Figure 1.

3.1 NASO

NASO is approximately 5,800 acres (ac) (2,347 hectares [ha]), and is located in the Tidewater region of southeastern Virginia, also referred to as the Hampton Roads area. NASO is located within the bounds of the City of Virginia Beach near what was formerly the Village of Oceana, Virginia. NASO is bounded by the Norfolk and Southern Railroad to the north, Oceana Boulevard to the east, Harper's Road to the south, and London Bridge Road to the west. Several additional parcels lie north of the railroad tracks, east of Oceana Boulevard, and west of London Bridge Road (Midway Manor Housing parcel).

Approximately one third of the installation consists of maintained airfield and urban areas. The rest of the installation consists of maintained open areas, agricultural areas, forested areas, open water and recreational areas. Many natural resources worthy of protection exist at NASO, including wetlands, coastal resources, and wildlife/plant species of concern and their habitat.

Outdoor recreational opportunities supported at NASO including hiking, nature trails, picnicking, horseback riding, golfing, tennis, swimming, athletic field sports, skeet and trap shooting, archery, hunting, fishing, and trapping. The NRP manages the hunting and fishing programs. Both MWR and the NRP provide management oversight of facilities/programs that provide wildlife viewing/watching opportunities. Because of mission constraints, there are limited opportunities for public access to outdoor recreational programs at NALFF. The hunting program is open to active duty and retired military personnel and their dependents, current civilian employees of NALFF and their dependents, and reservists.

NASO land ownership falls mostly under concurrent jurisdiction, whereby both state and federal officers have authority to enforce regulations on the site. The commissary and Owl's Creek parcels are under propriety jurisdiction, whereby state and local law enforcement officers handle calls for service as if the land were privately owned. Appropriate state or federal law enforcement authorities are contacted and consulted when an incident occurs, per federal and state regulations.

Cultural Resources

The CRP at NASO is the responsibility of NAVFAC Mid-Atlantic (Code EV2) under the Regional Historic Preservation Officer (RHPO). There are 54 archaeological sites on NASO, all of which are protected under ARPA. Of the 54 sites, 37 are not eligible for National Register of Historic Places (NRHP) listing and are not managed by the CR Program, but remain protected under ARPA. The additional 17 have not been assessed for eligibility but are managed by the CRP.

An architectural survey and assessment was conducted at NASO in 1996 (Navy 2014a). With the exception of the Bell House, there are no historic properties at NASO eligible for listing in the NRHP. The Bell House is considered to be an important historic resource; however, the property was transferred from the Navy to the Mid-Atlantic Military Family Communities, LLC as part of a family housing project. The property is included in a 2005 Programmatic Agreement between

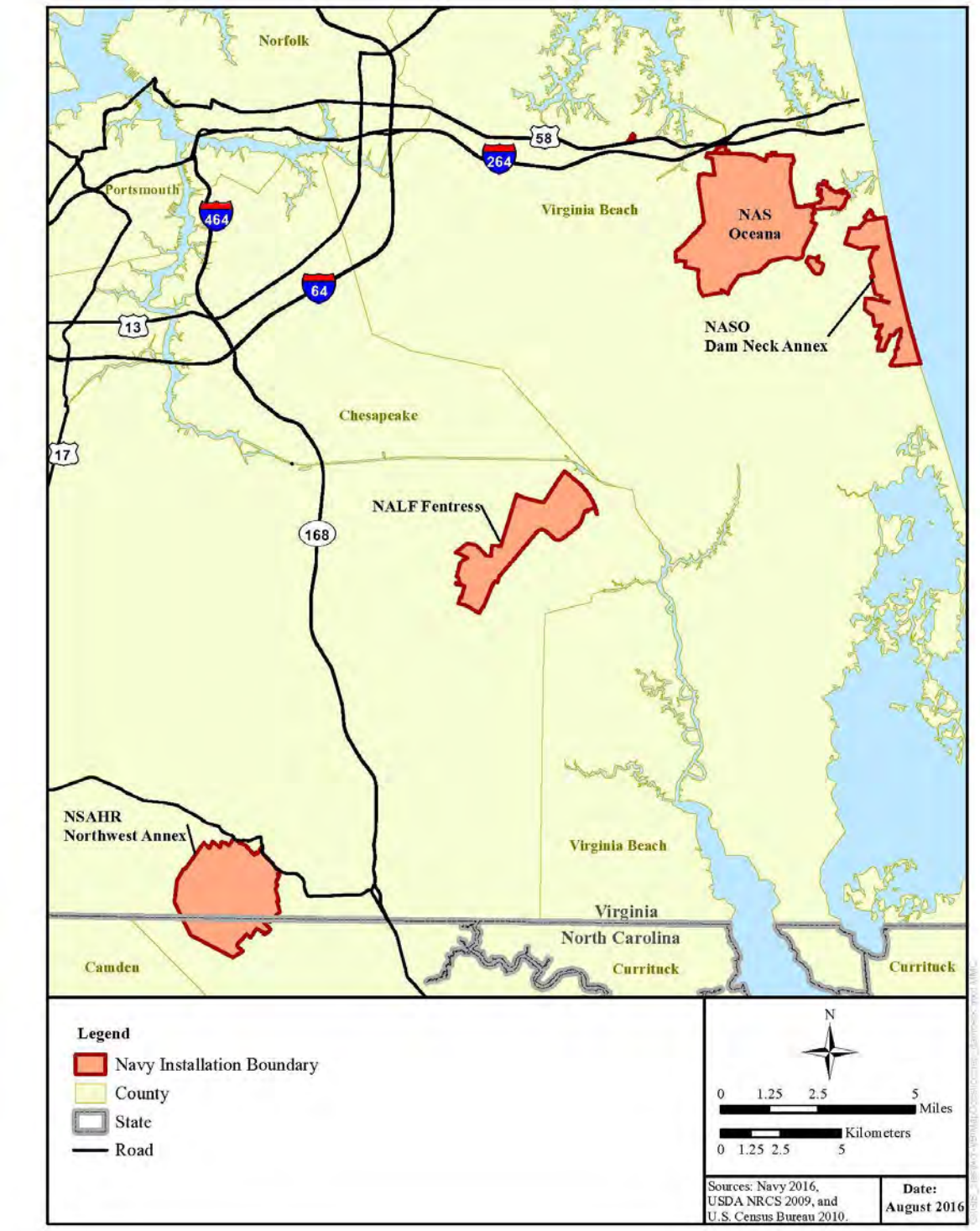

Figure 1. Location of NASO, NASO-DNA, NALFF, and NSAHR-NWA. NASO Midway Manor Parcel not included.

the Navy, SHPO, and Mid-Atlantic Military Family Communities, LLC, which establishes a process for considering effects on historic properties after conveyance.

The survey confirmed the presence of five previously identified architectural resources predating development of NASO, including the early 19th century Bell-Taylor house, an early 20th century agricultural complex, the circa 1929 Oceana High School and circa 1920s gymnasium, and the Old Bowmans Building. None of the additional pre-1940s resources are listed, or have been determined eligible for listing in the NRHP. The survey determined that World War II-era buildings located at NASO do not represent architectural, engineering, technological, or scientific examples significant for their period, style, or method of construction. Although the Cold War-era buildings evaluated during this survey were not yet 50 years old, the survey did not anticipate that any resources built from 1947–1959 would possess qualities of significance applying NRHP criteria when they reached 50 years of age (Sadler & Whitehead Architects, PLC 2012). No formal architectural survey has been conducted on the Owls Creek parcel at NASO; however all buildings on this parcel were constructed by the Navy after 1992, and are assumed to be ineligible for listing in the NRHP (Sadler & Whitehead Architects, PLC 2012).

While there is a small possibility of artifacts washing up along Owl's Creek, this would be a rare occurrence. Nevertheless, such artifacts are protected by ARPA and other regulations described in Section 2.0 of this document. Each installation should have as part of its ICRMP a monitoring program for cultural resources and should also provide coordination requirements if such artifacts are discovered. Beach combing or collection of such artifacts by the general public is prohibited.

The cultural resources information identified in Figure 2 is not reflective of all known cultural resources at NASO. To protect the integrity of archaeological sites in accordance with the guidance provided by the RHPO and as dictated by ARPA, specific cultural resources information is not shown. The figure shown does not include all of the archaeological sites on the installation and the sensitive areas are comprised of both identified cultural resources and unsurveyed areas. Because NRHP-ineligible sites are still protected under ARPA, if CLEOs encounter illicit digging in areas outside the sensitive areas on the maps there may still be an ARPA violation. The Cultural Resource Manager maintains a record of their locations in a Geographic Information Systems (GIS) format. CLEOs will coordinate directly with the installation Cultural Resources Manager to address conservation law enforcement and protection of archaeological and cultural sites. NASO was included in the 2012 regional ICRMP prepared for Naval Installations in Hampton Roads (Sadler & Whitehead Architects, 2012), and this document provides additional information and guidance on cultural resources management.

Natural Resources

Hunting and Fishing

Hunting opportunities are available at NASO through a regional deer and small game recreational hunting program shared by NASO, NASO-DNA, NALFF, and NSAHR-NWA, though the regional instruction is out of date and does not accurately reflect current SOPs. The most current information available to the public is the NAS Oceana/NASO Dam Neck Annex/NALF Fentress/NSAHR Northwest Annex Deer Hunting Rules and Regulations 2015-2016 season (Navy 2015). Various additional educational outreach brochures and materials are contained in the installation INRMP. All hunting areas/stands, parking locations, and access roads are subject to change, and hunters are required to obtain the most current maps before any hunt (available at the Natural Resources Center on Oceana Blvd., Bldg. 78). In accordance with Title 10 U.S.C. § 2671,

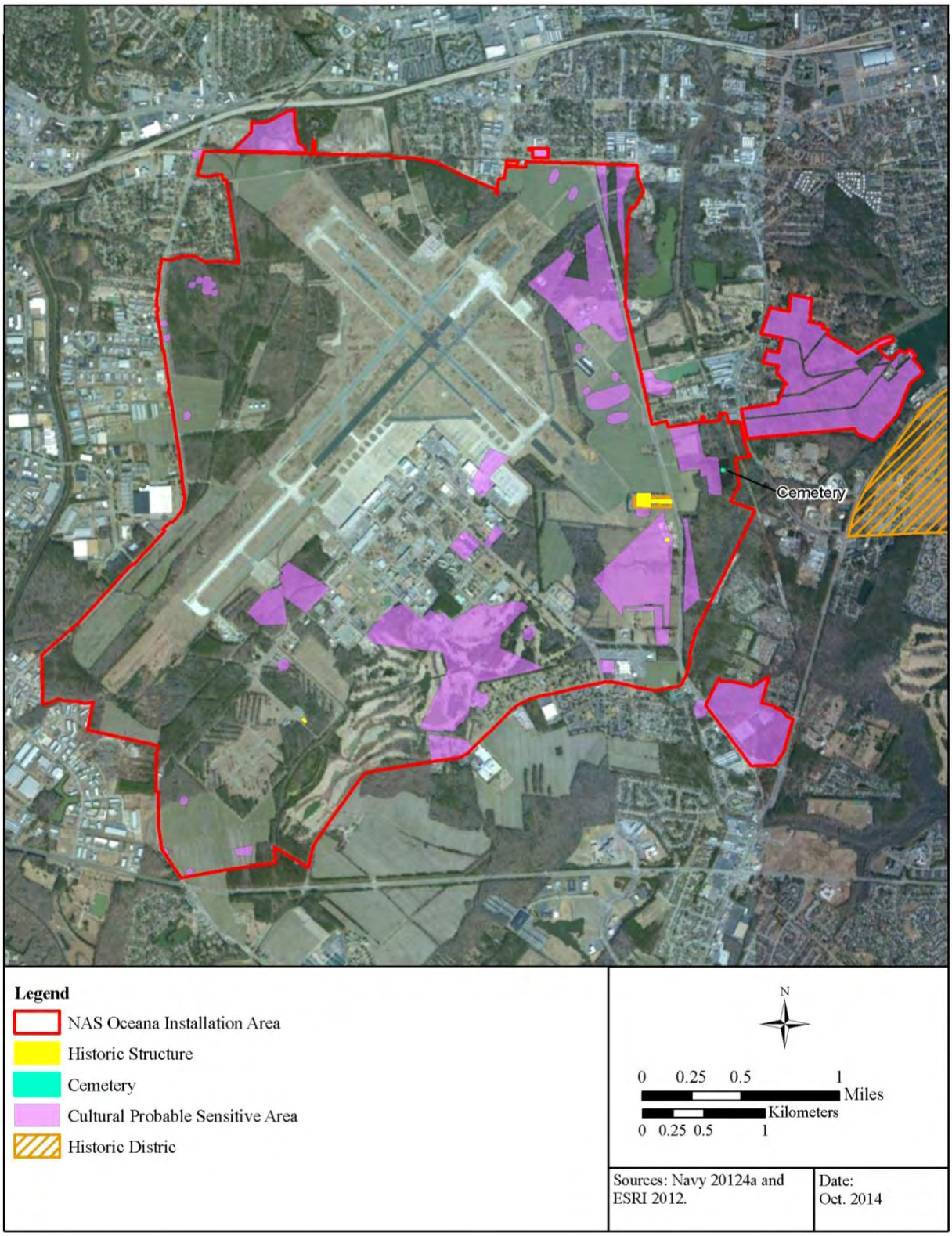

Figure 2. NASO Cultural Resources Sensitive Areas. From NASO INRMP. Not all cultural resource areas are depicted, map is subject to annual updates.

all hunting, fishing, and trapping on military installations are to comply with the federal and state laws and regulations (See Section 2.0 of this document).

At NASO, approximately 1,157 ac (469 ha) are available for muzzleloader and archery hunting, though this is subject to change (Figure 3). The provided map (Figure 3) may not reflect current hunting type designations, as changes are typically made during annual INRMP updates. Small game hunting areas, in which the use of shotguns is permitted, are also present, but not shown in Figure 2. Small game hunters may hunt during the appropriate season on most of the agricultural fields and woodlands. Game species at NASO include a variety of small mammals, furbearers, birds, and whitetail deer. Whitetail deer are the most popular game species. Other small game species that occur, but are not intensively hunted, are eastern cottontail, raccoon, Virginia opossum, red fox, gray fox, northern bobwhite, and mourning dove.

Shotguns may be used for small game hunting at NASO. Muzzleloading firearms and bow hunting are permitted. Handheld and hand drawn equipment must be used. Waterfowl hunting is prohibited due to shot size restrictions that are necessary to ensure aircraft and personnel safety, and to reduce the potential for user conflicts. Trapping is generally not pursued as a recreational activity, but is used to control populations of invasive and nuisance wildlife species. Typically one recreational trapper is authorized per installation annually. If more than one trapper request is received for a particular installation a random lottery selection is conducted to select the trapper who will trap that installation for the year.

At NASO, fishing is currently authorized at Oceana Pond only, although providing access to other ponds is under consideration. One boat ramp is currently available for non-motorized boating at Oceana Pond, and parking is permitted in the designated cul-de-sac area, and requires an additional parking permit that is issued along with the NASO fishing permit. Installation permits can be purchased at the NASO MWR ticket office. NASO fishing permits are valid at all of the regional Navy installations that participate in the fishing program. The outdoor recreational and hunting areas map for NASO is provided in Figure 3, and all areas are subject to change. The boy scout hunting area is located to the south of Archery Only area 43 on Figure 3.

The regional CLEO serves as a game warden and has the authority to apprehend and arrest all violators of federal, state, or installation fish and game laws and regulations on NASO. The presence of trained CLEOs is an important component of the hunting and fishing programs as it greatly reduces the potential for fish and game violations on the Installation. Routinely the CLEO patrols fishing and hunting areas of the installation to ensure people recreating are complying with natural resources regulations and policies. All firearm users must demonstrate weapons utilization competency by completing weapons qualifications administered by the NRP staff/CLEO, show proof of completion of a state-certified hunter safety course, attend a hunter indoctrination. In addition, all bowhunters must show proof of completion of an International Bowhunter Education Program and demonstrate competence through a qualification test with natural resources staff.

Rare, Threatened, and Endangered Species

Rare, threatened, and endangered species surveys of NASO have not identified any species that are listed under the federal ESA (Navy 2014a, Navy 2014d, Derge and Belden 2002, VDCR–DNH 1990a and VDCR–DNH 1990b). The installation supports populations of one state-listed threatened species, the upland sandpiper (*Bartramia longicauda*). Eight plants and two wildlife species that are considered rare in Virginia are known to occur at NASO.

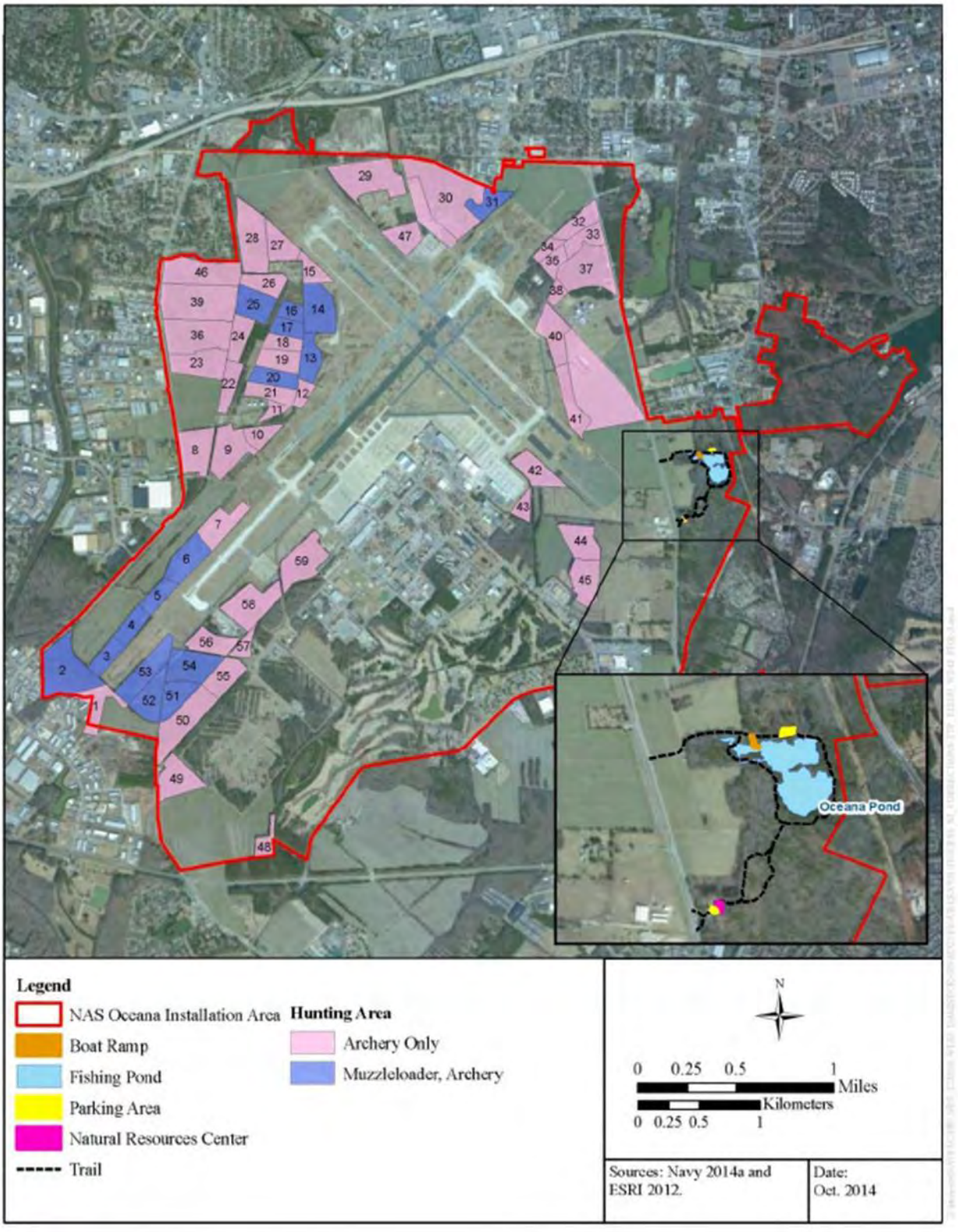

Figure 3. Outdoor Recreation Facilities and Hunting Areas of NASO. From NASO INRMP. Small game areas not depicted. Map is subject to annual updates

In addition, six bird species that are considered rare in Virginia, and four bird species that are listed as USFWS Birds of Conservation Concern (BCC) are known to occur at the installation.

There were no state or federally threatened or endangered fish species collected during stream and fish surveys in 2014. Federally endangered Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnose sturgeon (*Acipenser brevirostrum*) have the potential to occur in the nearshore environment off of NASO's Owls Creek parcel and within the Rudee Inlet area; however, this is not considered ideal habitat for these species.

Neither the federally threatened Northern long-eared bat (*Myotis septentrionalis*) nor the state endangered Rafinesque's big-eared bat (*Corynorhinus rafinesquii macroti*s) were captured in 2015 during mist net surveys; however, suitable habitat for both are located on the installation and both species have been documented west and east of the installation on other Naval installations (NALFF and NASO-DNA). Acoustic monitoring was competed in 2016 and results are pending.

Designated rare species and species of concern are granted no special legal protection. Tables listing all RT&E species that have been observed on the installation can be found in the NASO INRMP (Navy 2014a). NASO has one confirmed eagle nest recorded fall 2014, along the Owl's Creek waterway, and bald eagles have been observed flying over the airfield and golf course. Additionally, numerous birds regulated under the MBTA are present or known to occur on the installation (Avian Species List Study, Navy 2014e), and marine mammals and other protected marine species such as sea turtles may occasionally enter the nearshore environment of the installation.

Wetlands and Coastal Zone Management

NASO contains wetlands which are conserved and/or mitigated based on impact through installation activities. Results of the wetland delineations for which a preliminary jurisdictional determination has been received from USACE identified approximately 572 ac (231 ha) of wetlands at NASO. In addition to the 572 ac (231 ha) of jurisdictional wetlands identified at NASO, an additional 1,115 ac (451 ha) of National Wetlands Inventory wetlands have been mapped at NASO. Natural Resources Personnel on the Installation are trained in wetland delineation and permitting in regards to wetland conservation. Wetland maps are provided in the NASO INRMP (Navy 2014a).

As a federal installation, NASO is exempted from inclusion in the state-designated coastal zone; however management of coastal zone resources does occur across the installation. Although federal lands are excluded from state-designated coastal resources management areas, activities on federal lands that are reasonably likely to affect land or water use or natural resources of coastal zones must be consistent, to the maximum extent practicable, with the enforceable policies of the Virginia's Coastal Zone Management Program (CZMP). All installation activities are reviewed for their potential impact to coastal zone resources and their compliance with the state's enforceable policies of the CZMA. The Navy strives to avoid and minimize impacts to coastal zone resources to the extent practicable when conducting activities that have the potential to impact these resources. Management actions include monitoring non-point source pollution, marine fish and wildlife species and habitat, and wetlands. The installation has implemented numerous management practices that benefit the coastal zone and nearshore environment, including protection of stormwater quality, erosion and sediment controls, and measures to protect marine resources. These management techniques directly and indirectly benefit plant and wildlife species,

water resources, and habitat that exist in the watershed and nearshore environments of the installation.

Special Interest Areas

Special Interest Areas (SIA) that are present at NASO provide habitat for several of the RT&E species and species of special concern that occur at the Installation. As specified in the facility INRMP, with the exception of the select management actions, little active management of the SIAs at NASO is conducted, as these areas are allowed to persist naturally. However, on a case-by-case basis, active management of these may be implemented to address issues such as erosion or invasive species. The SIAs at NASO include Aeropines Mitigation SIA, Oceana Ponds SIA, Owl Creek SIA, VACAPES Restoration SIA, and Northwest Woods SIA. The SIA locations, boundaries, and descriptions are provided in the 2014 Natural Heritage Inventory Report for NASO and NALFF (Navy 2014d).

3.2 NASO-DNA

NASO-DNA is located in the southeastern portion of the City of Virginia Beach, Virginia, and encompasses approximately 1,900 ac. The installation is bounded by the community of Sandbridge to the south; the Atlantic Ocean to the east; Hampton Roads Sanitation Division, City of Virginia Beach Properties, and private properties to the west; and Virginia Army National Guard - Camp Pendleton to the north. A majority of the area immediately surrounding the installation includes industrial, commercial, residential, recreational, and agricultural land uses. However, most of the agricultural lands are rapidly being converted to residential and recreational developments.

The installation contains 1,115 ac of natural areas, 271 ac of beaches and dunes, and 444 ac of urban areas. The northern portion of NASO DNA remains largely undeveloped and is dominated by forested wetlands. The southern portion of NASO-DNA contains a large portion (approximately 386 ac) of developed and urban landscape that consists of impermeable surface, mowed lawn, shade trees, and ornamental trees and shrubs.

Recreational opportunities at NASO-DNA include camping, swimming, surfing, hunting, fishing, various sports fields and courts, wildlife viewing, and recreational trails. NR personnel are consulted on issues pertaining to natural resources management and environmental regulation. MWR provides instructions and maps for users of recreational facilities of the installation that describe accepted and prohibited uses, and identify approved recreational areas. Because of mission constraints, there are limited opportunities for public access to outdoor recreational programs at NASO-DNA. The hunting program is open to active duty and retired military personnel and their dependents, current civilian employees of NASO-DNA and their dependents, and reservists.

NASO-DNA land ownership is mostly under concurrent jurisdiction, whereby both state and federal officers have authority to enforce regulations on the site. One parcel located on the southwestern portion of the installation (Ethel Kesler property), is under propriety jurisdiction, whereby state and local law enforcement officers handle calls for service as if the land were privately owned. Appropriate state or federal law enforcement authorities are contacted and consulted when an incident occurs, per federal and state regulations.

Cultural Resources

The CRP at NASO-DNA is the responsibility of NAVFAC Mid-Atlantic (Code EV2) under the RHPO. There are 14 archaeological sites on NASO-DNA, all of which are protected under ARPA. One of those sites have been determined eligible for listing in the National Register of Historic Places, and this site is managed by the CRP. The remaining 13 sites are not eligible for NRHP listing and are not managed by the CR Program, but remain protected under ARPA.

Several cultural resources surveys were conducted at NASO-DNA during the 1980s (Navy 1983a, 1983b, 1983c, 1987a, 1987b, and 1987c). These surveys were conducted in the southern portion of NASO DNA and did not include the northern portion of the installation. In October 2008, the Navy performed an additional archaeological survey, prepared by Southeastern Archaeological Research Inc. The Virginia Department of Historic Resources, also known as the State Historic Preservation Office (SHPO), concurred with the findings of the report in a letter dated 11 December 2007. Additionally in January 2010, the southern area of the installation was surveyed and two archaeological sites were evaluated.

An archaeological survey of the northern portion of NASO-DNA found no archaeological sites and recommended no further investigation (Navy 1987d). However, formal concurrence on this finding has not been obtained from the Virginia SHPO. The most recent architectural survey, Phase I Architectural Survey of Potentially Significant Cold War Era Resources (1948–1962) at Navy Hampton Roads Bases, identified a potential historic district associated with the Surface Launched Guided Missile School. The potential historic district consists of three buildings: Buildings 586, 543 and 572. The findings of the Phase 1 Architectural Survey are currently under review by Virginia Department of Historic Resources (Sadler & Whitehead Architects, 2012). The northern-most portion of NASO-DNA, adjacent to Camp Pendleton, has not yet been surveyed for cultural resources (Personal communication, R. Hobgood, 28 April 2016).

While there is a small possibility of shipwrecks, artifacts, or archaeological resources washing ashore along the beaches at NASO-DNA (due to storm erosion or wave action), this would likely be a rare occurrence. Nevertheless, such artifacts are protected under ARPA and other regulations described in Section 2.0 of this document. Each installation should have as part of its ICRMP a monitoring program for cultural resources and should also provide coordination requirements if such artifacts are discovered. Beach combing or collection of such artifacts by the general public is prohibited.

The cultural resources information identified in Figure 4 is not reflective of all known cultural resources at NASO-DNA, and is subject to annual updates and modifications. To protect the integrity of archaeological sites in accordance with the guidance provided by the RHPO some cultural resources information is not shown. The figure shown does not include all of the archaeological sites on the installation and the sensitive areas are comprised of both identified cultural resources and unsurveyed areas. Because NRHP-ineligible sites are still protected under ARPA, if CLEOs encounter illicit digging in areas outside the sensitive areas on the maps there may still be an ARPA violation.

The Cultural Resource Manager maintains a record of culturally sensitive resource locations in a GIS format. Two cemeteries are located at NASO-DNA, and any proposed action located within or adjacent to the boundaries of a cemetery shall be coordinated with the installation facilities management division and the RHPO. CLEOs will coordinate directly with the installation Cultural Resources Manager to address conservation law enforcement and protection of archaeological and cultural sites. NASO-DNA was included in the 2012 regional ICRMP prepared for Naval

Figure 4. NASO-DNA Cultural Resources Sensitive Areas. From NASO-DNA INRMP. Not all cultural resource areas are depicted, map is subject to annual updates.

installations in Hampton Roads (Sadler & Whitehead Architects, 2012), and this document provides additional information and guidance on cultural resources management.

Natural Resources

Hunting and Fishing

Hunting opportunities are available at NASO-DNA through a regional deer and small game recreational hunting program shared by NASO, NASO-DNA, NALFF, and NSAHR-NWA, though the regional instruction is out of date and does not accurately reflect current SOPs. The most current information available to the public is the NAS Oceana/NASO Dam Neck Annex/NALF Fentress/NSAHR Northwest Annex Deer Hunting Rules and Regulations 2015-2016 season (Navy 2015). Various additional educational outreach brochures and materials are contained in the installation INRMP. All hunting areas/stands, parking locations, and access roads are subject to change, and hunters are required to obtain the most current maps before any hunt (available at the Natural Resources Center on Oceana Blvd., Bldg. 78). In accordance with Title 10 U.S.C § 2671, all hunting, fishing, and trapping on military installations are to comply with the federal and state laws and regulations (See Section 2.0 of this document).

Hunting opportunities at NASO-DNA include hunting for deer and waterfowl. Hunting is permitted in three separate areas of the Installation; the north end, which includes the wooded area north of the firing ranges; the central area of the installation, which includes South Marsh and the adjacent forested areas; and within the southern-most portion of the installation. The hunting areas map provided in Figure 5 may not reflect current hunting type designations, as changes are typically made during annual INRMP updates. Natural Resources Educational Trails are not shown. Approximately 535 ac (217 ha) are included in the hunting areas. The hunting areas are divided into approximately 60 compartments that can accommodate one to two hunters each depending on the type of hunting and size of the compartment, however, some areas have been closed. Most forested land on the installation is considered huntable land. Hunting Areas north of Dam Neck Blvd. are designated “Restricted Area Recreational Hunting.” These are hunted by recreational hunters, though additional access restrictions are required compared to the "Open" Recreation Hunting Areas. The area to the north of hunting area 35 (see Figure 5) is also currently hunted, but is an escorted managed hunt area. It is being considered for being opened to unescorted recreational hunting opportunities. Authorized hunting areas change annually and sometimes seasonally. Hunting area 25 was closed to hunting in 2014. It will be reopened to hunting once approval has been obtained indicating sufficient UXO clean-up has been completed.

Popular recreational activities include saltwater fishing along the shoreline and freshwater fishing at the freshwater lakes of NASO-DNA. Saltwater shore fishing is allowed between Labor Day weekend and Memorial Day weekend at designated locations, and a beach utilization map is provided by MWR that identifies areas approved for these activities. Freshwater fishing is permitted at Sadler Pond, and fishing also is allowed in the ditches that drain the installation. Appropriate state licenses and an installation permit for freshwater fishing are required for fishing at NASO-DNA. Installation permits can be purchased at the NASO MWR ticket office.

The Regional CLEO serves as a game warden and has the authority to apprehend and arrest all violators of federal, state, or Installation game laws and regulations on NASO-DNA. The presence of a trained CLEO is an important component of the hunting and fishing programs as it greatly reduces the potential for fish and game violations on the installation. Routinely the CLEO patrols fishing and hunting areas of the installation to ensure people recreating are complying with natural

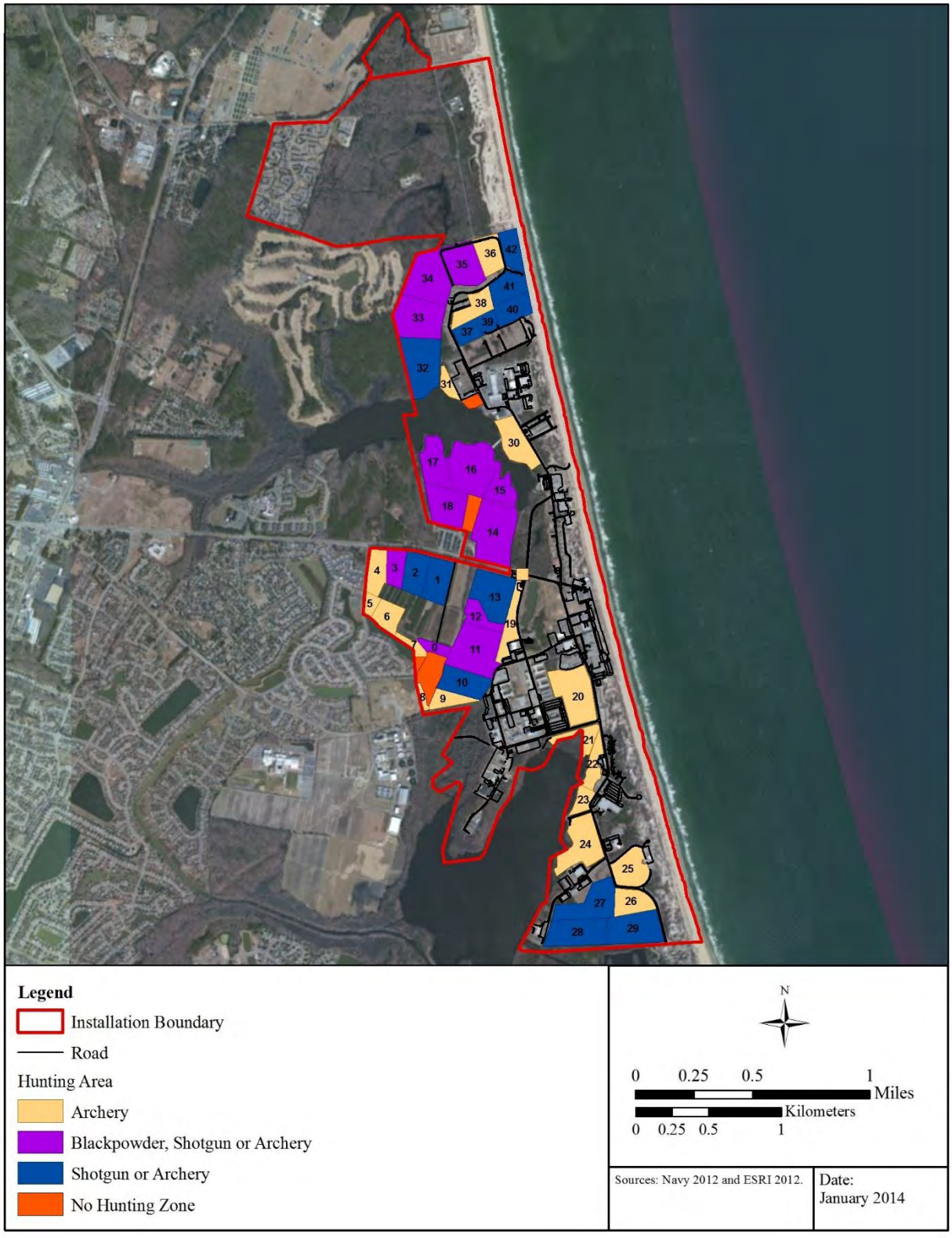

Figure 5. NASO-DNA Hunting Map. From NASO-DNA INRMP. Map is subject to annual updates, and all hunting areas subject to change.

resources regulations and policies. All firearm users must demonstrate weapons utilization competency by completing weapons qualifications administered by the NRP staff/CLEO, show proof of completion of a state-certified hunter safety course, attend a hunter indoctrination. In addition, all bowhunters must show proof of completion of an International Bowhunter Education Program and demonstrate competence through a qualification test with natural resources staff.

Rare, Threatened and Endangered Species

NASO-DNA supports 40 rare plant occurrences, and 10 rare animals, including the state-listed least bittern (*Ixobrychus exilis*), state-listed canebrake rattlesnake (*Crotalus horridus* ssp. *atricaudatus*), state-listed eastern glass lizard (*Ophisaurus ventralis*), federally listed piping plover (*Charadrius melodus*), federally-listed loggerhead sea turtle (*Caretta caretta*), and federally-listed Kemp's ridley sea turtle (*Lepidochelys kempii*). These species were identified during several inventories of rare, threatened, and endangered species conducted at NASO-DNA from 1968 through 2010 (Buhlmann et al. 1992, Corning 1968, Evans and Belden 2010, Galvez and Swihart 2000, Geo-Marine Inc. 2003, Swihart 1982, USFWS, Office of Fishery Assistance 1985 and 1988, Van Alstine et al. 2001, and VDCR-DNH 1990). RT&E species tables can be found in the NASO-DNA INRMP (Navy 2014b).

Through survey and research efforts conducted in 2015, a number of additional protected species were identified as occurring or historically occurring on the installation, including the federally threatened northern long-eared bat, state endangered Rafinesque's big-eared bat, state threatened peregrine falcon (*Falco peregrinus*), state threatened gull-billed tern (*Gelochelidon nilotica*), and species of concern Brimley's assassin bug, *Pnirontis brimlyii* (Navy 2015b, Navy 2016). Designated rare species and species of concern are granted no special legal protection. Federally listed Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) have been known to strand on the beaches of NASO-DNA (Personal communication with Michael Wright, March 2016). The installation also supports habitat that may be utilized by the federally threatened red knot (*Calidris canutus rufa*) as a winter stop-over.

Numerous birds regulated under the MBTA are present or known to occur on the installation (Navy 2015b), and marine mammals/other marine species that are protected may occasionally enter the nearshore environment of the installation. While no longer federally listed, bald eagles (*Haliaeetus leucocephalus*) have been observed on the installation, and are protected by the Bald and Golden Eagle Protection Act.

Significant and Rare Natural Communities

Several of the ecological communities that occur on NASO-DNA are considered significant, rare natural communities in Virginia. The maritime wet grasslands, maritime upland forests, maritime dune woodlands, and interdune swales that occur in the beach and dune area are rare natural communities that are severely threatened by coastal development throughout their natural range. VDCR-DNH descriptions of the ecological community groups identified at NASO DNA in surveys conducted in 1992, 2001, and 2010 (Buhlmann et al. 1992, Van Alstine et al. 2001, and Evans and Belden 2010) are provided in the NASO-DNA INRMP (Navy 2014b).

The primary dunes located at NASO-DNA are an important protected natural resource. Dune utilization activities within this unit should be consistent with the state's Coastal Zone Management Program. NR staff will review proposed projects for coastal consistency. Routinely the CLEO patrols the beaches to ensure people recreating are complying with natural resources

regulations and policies. Recreational beach users are limited to use of pedestrian walkways, which were constructed to minimize unauthorized access and erosion of the dunes. Installation residents and volunteers also are encouraged to participate in habitat conservation efforts in the beaches and dunes area. Education and outreach regarding the importance of dunes and what is or is not authorized in dune areas, coupled with increased security and CLE patrols of this area are needed to stop/minimize the unauthorized dune access contributing to the degradation and destabilization of the dunes.

Special Interest Areas (SIA) that are present at NASO-DNA provide habitat for several of the RT&E species and species of special concern that occur at the Installation. As specified in the installation INRMP, with the exception of the select management actions, little active management of the SIAs at NASO-DNA is conducted, as these areas are allowed to persist naturally. However, on a case-by-case basis, active management of these may be implemented to address issues such as erosion or invasive species. SIAs at NASO-DNA include: Lovetts Marsh SIA, Southeast Redwing Lake Wetlands SIA, Middle Beach Dunes Special Interest Area, Helicopter Pad Wetlands SIA, and Interdunal Swales, Dune, and Freshwater Marsh SIA. The SIA locations, boundaries, and descriptions are provided in the 2015 Listed Species Surveys at NASO-DNA (Navy 2015b).

Wetlands, Coastal Zone Management, and Marine Species Conservation

A large portion of the installation consists of undeveloped forested wetlands and marshes. Wetland delineations were recently completed at NASO DNA, for which preliminary jurisdictional determinations were received in 2011 and 2012. Wetland delineations identified approximately 922 ac (373 ha) of wetland habitats. Of the 922.0 ac (373.0 ha) of wetland habitat that have been mapped at NASO DNA, approximately 254.5 ac (102.9 ha) of wetlands are located at the northern portion of NASO DNA, and approximately 667.5 ac (270.1 ha) of wetlands are located at the southern portion of NASO DNA.

As a federal facility NASO-DNA is exempted from inclusion in the state-designated coastal zone; however management of coastal zone resources does occur across the installation. All Installation activities are reviewed for their potential impact to coastal zone resources and their compliance with the state's enforceable policies of the Coastal Zone Management Act (CZMA).

A large number of saltwater species also are known to occur in the coastal waters offshore of NASO-DNA. Because the area is in a transition zone between temperate and subtropical regions, fish fauna is extremely diverse, with approximately 685 species known to occur (Navy 2003). The NOAA-NMFS has designated essential fish habitat (EFH) for fish species of particular economic or ecological importance in the area. The Magnuson-Stevens Fishery Conservation and Management Act requires that EFH be identified for all fish which are federally managed.

It is not uncommon to observe marine mammals, reptiles, fishes, and birds along NASO-DNA beaches and within the Navy's defined nearshore environment. Marine mammals are protected under the Marine Mammal Protection Act, and any marine animal (e.g., mammal, bird, fish, herpetofauna) sighted on NASO-DNA beaches must be reported to NR staff, who will respond, as appropriate, to the site and report the sighting to the Virginia Aquarium and Marine Science Center and additional points of contact.

3.3 NALFF

NALFF is approximately 2,600 ac (1,052 ha), and is located in the Tidewater region of southeastern Virginia, also referred to as the Hampton Roads area. NALFF is located approximately 7 miles (mi) (11 kilometers [km]) southwest of NASO near the community of Fentress in what is now the City of Chesapeake. NALFF is generally bounded by Mount Pleasant Road to the north, Carter Road to the west, Long Ridge Road to the south, and Fentress Airfield Road to the southeast.

The installation consists of an airfield and small developed area on the North side of the installation, and the rest of NALFF is made up of large agricultural and forested areas. Vegetation in agricultural and urban areas primarily include mowed turf grasses and row crops, and support very limited natural communities. The remaining undeveloped areas, however, support a variety of vegetation communities including forests, early successional habitat, and emergent and scrub-shrub wetlands.

Recreational opportunities at NALFF primarily consist of hunting. Because of mission constraints, there are limited opportunities for public access to outdoor recreational programs at NALFF. The hunting program is open to active duty and retired military personnel and their dependents, current civilian employees of NALFF and their dependents, and reservists.

NALFF land ownership is entirely under concurrent jurisdiction, whereby both state and federal officers have authority to enforce regulations on the site. Appropriate state or federal law enforcement authorities are contacted and consulted when an incident occurs, per federal and state regulations.

Cultural Resources

The CRP at NASO is the responsibility of NAVFAC Mid-Atlantic (Code EV2) under the RHPO (Navy 2014a). There are 23 archaeological sites on NALFF, all of which are protected under ARPA. One of those sites have been determined eligible for listing in the National Register of Historic Places, while 21 have not been assessed for eligibility; these 22 sites are managed by the CRP. The remaining site is not eligible for NRHP listing and is not managed by the CR Program, but remains protected under ARPA.

An architectural survey and assessment was conducted at NALFF in 1996. The 1996 architectural survey concluded that the major buildings constructed at NALFF during the World War II- and Cold War-eras were not directly associated with nationally important identified themes, critical events, or persons with exceptional significance. The survey did not anticipate that any resources built from 1947–1959 would possess qualities of significance applying NRHP criteria when they reached 50 years of age (Sadler & Whitehead Architects, PLC 2012).

The cultural resources information identified in Figure 6 is not reflective of all known cultural resources at NASO DNA, and are subject to annual updates and modifications. Several archeological sites are located at NALFF; to protect the integrity of archaeological sites in accordance with the guidance provided by the RHPO and as dictated by ARPA, some cultural resources information is not shown. The figure shown does not include all of the archaeological sites on the installation and the sensitive areas are comprised of both identified cultural resources and unsurveyed areas. Because NRHP-ineligible sites are still protected under ARPA, if CLEOs encounter illicit digging in areas outside the sensitive areas on the maps there may still be an ARPA violation.

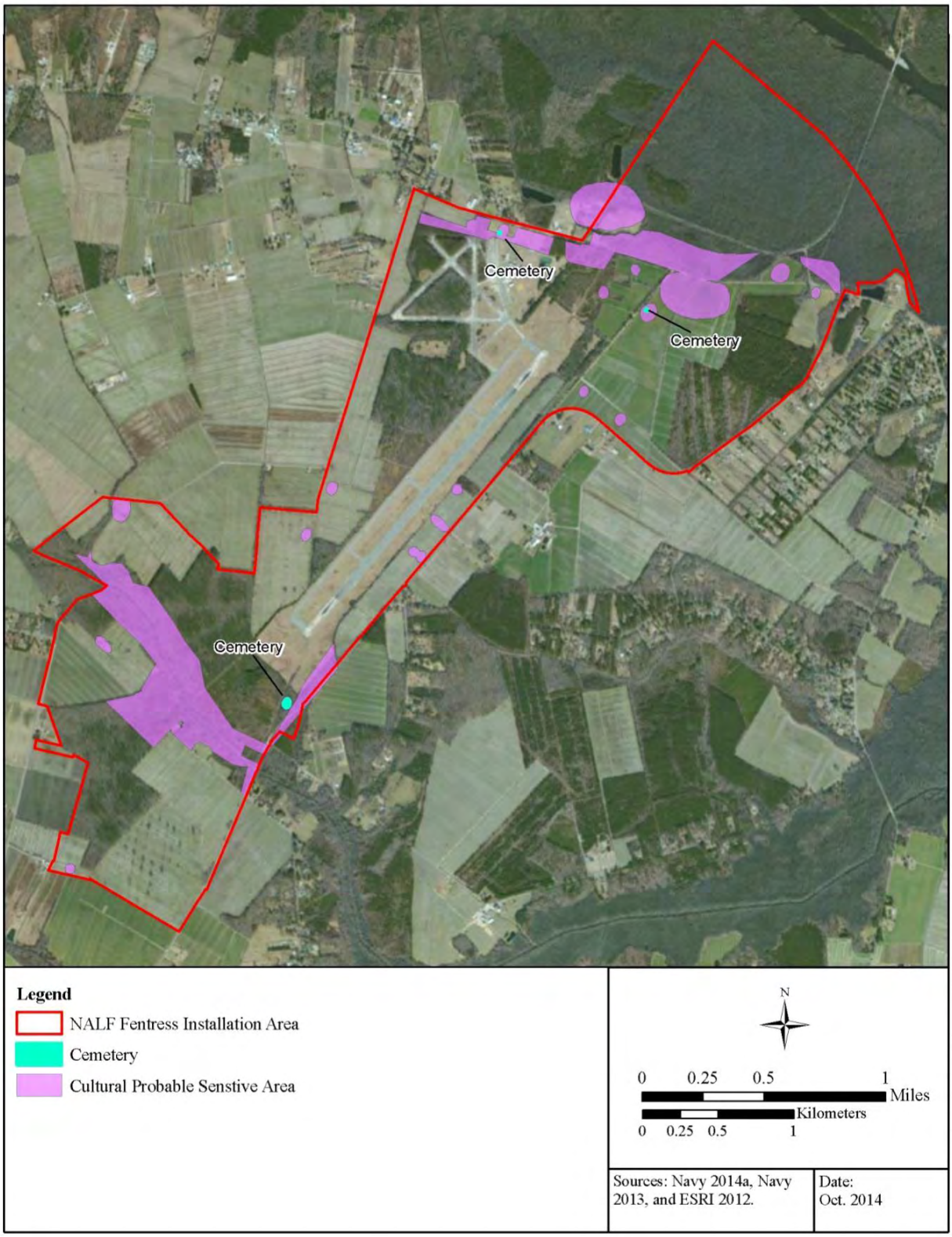

Figure 6. NALFF Cultural Resources Sensitive Areas. From NALFF INRMP. Not all cultural resource areas are depicted, map is subject to annual updates.

The Cultural Resource Manager maintains a record of cultural resource locations in a GIS format. CLEOs will coordinate directly with the installation Cultural Resources Manager to address conservation law enforcement and protection of archaeological and cultural sites.

Four cemeteries are located at NALFF, and any proposed action located within or adjacent to the boundaries of a cemetery shall be coordinated with the Installation facilities management division and the NAVFAC Mid-Atlantic RHPO. NALFF was included in the 2012 regional ICRMP prepared for Naval Installations in Hampton Roads (Sadler & Whitehead Architects, PLC 2012), and this document provides additional information and guidance on cultural resources management.

Natural Resources

Hunting opportunities are available at NASO through a regional deer and small game recreational hunting program shared by NASO, NASO-DNA, NALFF, and NSAHR-NWA, though the Regional Instruction is out of date and does not accurately reflect current SOPs. The most current information available to the public is the NAS Oceana/NASO Dam Neck Annex/NALF Fentress/NSAHR Northwest Annex Deer Hunting Rules and Regulations 2015-2016 season (Navy 2015). Various additional educational outreach brochures and materials are contained in the Installation INRMP. All hunting areas/stands, parking locations, and access roads are subject to change, and hunters are required to obtain the most current maps before any hunt (available at the Natural Resources Center on Oceana Blvd., Bldg. 78). In accordance with Title 10 U.S.C § 2671, all hunting, fishing, and trapping on military installations are to comply with the federal and state laws and regulations (See Section 2.0 of this document).

Approximately 2,481 ac (1,004 ha) are available for hunting at NALFF (Figure 7). The hunting areas map provided in Figure 7 may not reflect current hunting type designations, as changes are typically made during annual INRMP updates. The woods between B-6 and B-3 cannot currently be hunted at NALFF due to UXO status, but once cleared hunting will likely resume in this area. Natural Resources Educational Trails are not shown. Archery areas are closed on a rotational basis during small game season. Game species at NASO and NALFF include a variety of small mammals, furbearers, birds, and whitetail deer. Whitetail deer are the most popular game species. Other small game species that occur, but are not intensively hunted, are eastern cottontail, raccoon, Virginia opossum, red fox, gray fox, northern bobwhite, and mourning dove. In support of conserving and managing the timber (canebrake) rattlesnake population on the installation, the hunting program does not authorize the take of squirrels as this prey is one of the primary diet sources of these snakes on the Installation.

Shotguns may be used for small game hunting and for deer hunting in designated areas at NALFF. Muzzleloading firearms and bow hunting are permitted. Handheld and hand drawn equipment must be used. Waterfowl hunting is prohibited due to shot size restrictions that are necessary to ensure aircraft and personnel safety, and to reduce the potential for user conflicts. Trapping is generally not pursued as a recreational activity, but is used to control populations of invasive and nuisance wildlife species. Typically one recreational trapper is authorized per installation annually. If more than one trapper request is received for a particular installation a random lottery selection is conducted to select the trapper who will trap that installation for the year.

NALFF is primarily landlocked, and the installation does not support recreational fishing. Potential fisheries exist via the natural and channelized stream courses of Pocaty Creek, drainage ditches, and the flooded forest tracts associated with the North Landing River. Fishing is not currently

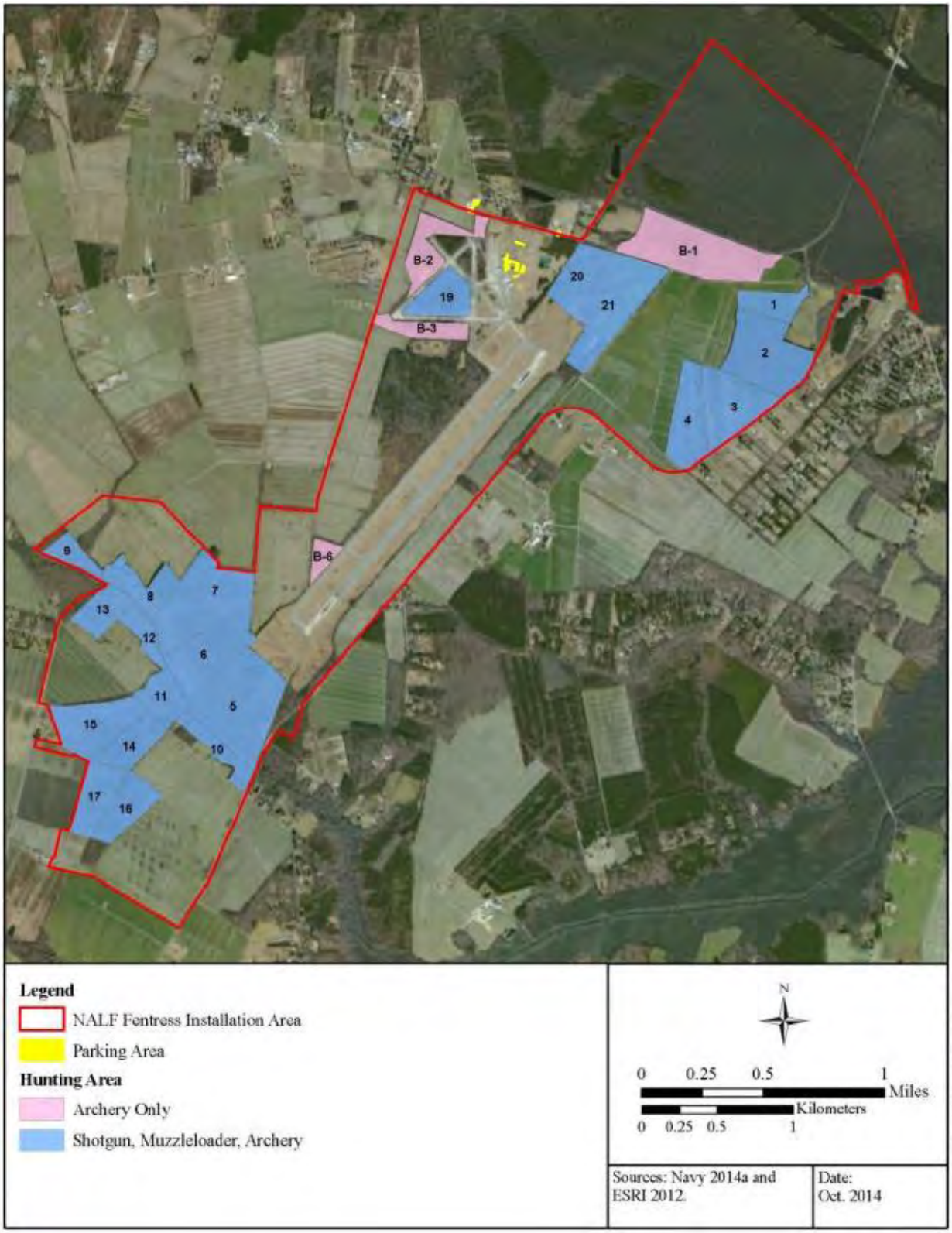

Figure 7. NALFF Hunting Map. From NALFF INRMP. Map is subject to annual updates, and all hunting areas are subject to change.

authorized in these areas, though poaching/unauthorized fishing occurs in these areas, and as such, require CLE oversight and response (Personal communication, Michael Wright, NRS, March 2016).

The Regional CLEO serves as a game warden and has the authority to apprehend and arrest all violators of federal, state, or installation game laws and regulations on NALFF. The presence of a trained CLEO is an important component of the hunting and fishing programs as it greatly reduces the potential for fish and game violations on the installation. Routinely the CLEO patrols fishing and hunting areas of the installation to ensure people recreating are complying with natural resources regulations and policies. All firearm users must demonstrate weapons utilization competency by completing weapons qualifications administered by the NRP staff/CLEO, show proof of completion of a state-certified hunter safety course, attend a hunter indoctrination. In addition, all bowhunters must show proof of completion of an International Bowhunter Education Program and demonstrate competence through a qualification test with natural resources staff.

Rare, Threatened, and Endangered Species

Past rare, threatened, and endangered species surveys of NALFF did not identify any species listed under the Federal ESA occurring on the installation (Navy 2014a, Derge and Belden 2002, VDCR–DNH 1990a and VDCR–DNH 1990b). However, the federally threatened northern long-eared bat was discovered on the installation as a result of mist- netting surveys conducted in summer 2015. One plant, silky camellia (*Stewartia malacodendron*), and two wildlife species, Tri-colored bat (*Perimyotis subflavus*) and Southeastern myotis (*Myotis austroriparus*), are considered rare in Virginia and are known to occur at NALFF. The installation supports populations of two state listed wildlife species, Rafinesque's big-eared bat, and canebrake rattlesnake (Navy 2015b). In addition, three bird species considered rare in Virginia, and three bird species that are listed as USFWS Birds of Conservation Concern (BCC) are known to occur at the installation. Designated rare species and species of special concern are granted no special legal protection. RT&E species tables can be found in the NALFF INRMP (Navy 2014a).

Wetlands and Coastal Zone Management

Results of the wetland delineations for which a preliminary jurisdictional determination has been received from USACE identified approximately 1,126 ac (456 ha) at NALFF. Of the 1,126.1 (456 ha) of jurisdictional wetlands delineated at NALFF, a majority (94.4%) are classified as palustrine forested, approximately 3.0% were not classified in the Navy GIS dataset (uncoded), and approximately 2.6% were classified as palustrine emergent. In addition to jurisdictional wetlands, approximately 738.0 ac (298.7 ha) of National Wetlands Inventory wetlands have been mapped at NALFF.

The installation has implemented numerous management practices that benefit the coastal zone and nearshore environment, including protection of stormwater quality, erosion and sediment controls, and measures to protect marine resources. These management techniques directly and indirectly benefit plant and wildlife species, water resources, and habitat that exist in the watershed and nearshore environments of NALFF.

Special Interest Areas and Ecological Reserve Area

The SIAs that are present at NALFF provide habitat for several of the rare, threatened, and endangered fauna that occur at the installation. With the exception of the management actions described in this section, little active management of the SIAs of NASO and NALFF is conducted,

as these areas are allowed to persist naturally. However, on a case-by-case basis, active management of these may be implemented to address issues such as erosion or invasive species.

The SIAs at NALFF include the Pocaty Creek SIA, Tip-of-Runway SIA, and North Landing Swamp SIA. The designations of conservation sites and/or SIA are not legal definitions tied to specific federal or state regulations but do provide valuable information to NRMs in regards to the extent and locations of significant ecological areas. The SIA locations, boundaries, and descriptions are provided in the 2014 Natural Heritage Inventory Report for NASO and NALFF (Navy 2014d).

3.4 NSAHR-NWA

NSAHR-NWA is approximately 3,600 ac (1,457 ha) and is located along the border of Southeastern VA and Northeastern North Carolina. Three-quarters of the installation is in Chesapeake, Virginia, and one-quarter is in Currituck County, North Carolina. The area immediately surrounding NSAHR-NWA is largely undeveloped and is comprised of agricultural land and forested wetlands. In the last several years, however, residential development has expanded along the Ballahack Road corridor to the northeast of the installation. NSAHR-NWA is located within the historic boundaries of the Great Dismal Swamp, which once extended from the James River to the Albemarle Sound.

The installation consists of a few developed and urban areas (271 ac), including ROTHR arrays and several training and operational facilities. The majority of NSAHR-NWA is made up of agricultural outlease parcels (750 ac), forested communities (2,345 ac; bottomland forest, loblolly pine forest, mesic mixed hardwood forests, pine-hardwood forest, and swamp forest), and early successional communities or maintained open areas (295 ac).

Recreational opportunities at NSAHR-NWA include hunting, picnicking, wildlife watching, hiking, jogging, and camping; and may include fishing in future years. The MWR Department administers picnicking and camping activities. The Installation also provides access to a 1-mile (2-km) long boardwalk through a portion of the Great Dismal Swamp that offers a self-guided educational wetlands tour. The NRP manages the hunting program. Both MWR and the NRP provide management oversight of facilities/programs that provide wildlife viewing/watching opportunities. The hunting program is available to active duty and retired military personnel and their dependents, civilian employees of the Installation and their dependents, reservist military personnel, and one sponsored guest for each of the aforementioned.

NSAHR-NWA land ownership is entirely under proprietary jurisdiction, whereby state and local law enforcement officers handle calls for service as if the land were privately owned. Appropriate state or federal law enforcement authorities are contacted and consulted when an incident occurs, per federal and state regulations.

Cultural Resources

The CRP at NSAHR-NWA is the responsibility NAVFAC Mid-Atlantic (Code EV2) under the RHPO (Navy 2014c). There are 54 archaeological sites on NSAHR-NWA, all of which are protected under ARPA. Eight of those sites have been determined eligible for listing in the National Register of Historic Places, while one has not been assessed for eligibility; these 9 sites are managed by the CRP. The remaining 45 sites are not eligible for NRHP listing and are not managed by the CR Program, but remain protected under ARPA.

A phased survey is being conducted of resources at the Installation constructed from 1948–1962 to determine if any resources are eligible for listing on the NRHP. Several areas have been identified as potential historic districts that warrant additional evaluation, although no potentially significant properties have been identified. Several resources were identified which were constructed after the study period but may be of interest for later studies, including the relocatable over-the horizon radar (ROTHR) antenna system and satellite reception, and transmission equipment related to important technological developments during the later years of the Cold War era. A report has been submitted to the Virginia SHPO for review and concurrence is pending (Sadler & Whitehead Architects 2012).

Archaeological surveys were conducted at NSAHR-NWA between the early 1980s and 2000. Several Phase I surveys were performed on proposed construction sites, and though some artifacts were found, no sites were determined to be eligible for the NRHP (Couch and Cottrell 1994, Fesler and Luccketti 1992, and Morehead et al. 1987). Subsequent surveys determined there are seven sites at NSAHR NWA that are eligible for the NRHP and two additional sites that require Phase II surveys (Lowthert et al. 2000, McDonald et al. 1999, and Sheehan et al. 1999). No additional archaeological testing is necessary unless land disturbance is proposed in (1) areas that require additional Phase II testing, (2) areas of eligible sites, or (3) along Mill Stream (Anderson 2004). Any proposed ground-disturbing activities in previously undisturbed areas should be coordinated with the RHPO to ensure there is no potential to affect archaeological resources. An architectural survey completed in 1996 concluded no architectural resources at NSAHR-NWA are eligible for listing on the NRHP, but recommended that Installation buildings and structures be re-evaluated when they reached the 50-year criteria (R. Christopher Goodwin & Associates 1997).

The cultural resources information identified in Figure 8 is not reflective of all known cultural resources at NSAHR-NWA, and is subject to annual updates and modifications. To protect the integrity of archaeological sites in accordance with the guidance provided by the RHPO and as dictated by ARPA, some cultural resources information is not shown. The figure shown does not include all of the archaeological sites on the installation and the sensitive areas are comprised of both identified cultural resources and unsurveyed areas. Because NRHP-ineligible sites are still protected under ARPA, if CLEOs encounter illicit digging in areas outside the sensitive areas on the maps there may still be an ARPA violation.

The Cultural Resource Manager maintains a record of cultural resource locations in a GIS format. CLEOs will coordinate directly with the installation Cultural Resources Manager to address conservation law enforcement and protection of archaeological and cultural sites. Five cemeteries are located at NSAHR-NWA, and any proposed action located within or adjacent to the boundaries of a cemetery shall be coordinated with the Installation facilities management division and the NAVFAC Mid-Atlantic RHPO. NSAHR-NWA was included in the 2012 regional ICRMP prepared for Naval Installations in Hampton Roads (Sadler & Whitehead Architects 2012), and this document provides additional information and guidance on cultural resources management.

Natural Resources

Hunting opportunities are available at NSAHR-NWA through a regional deer and small game recreational hunting program shared by NASO, NASO-DNA, NALFF, and NSAHR-NWA, though the Regional Instruction is out of date and does not accurately reflect current SOPs. The most current information available to the public is the NAS Oceana/NASO Dam Neck Annex/NALF Fentress/NSAHR Northwest Annex Deer Hunting Rules and Regulations 2015-

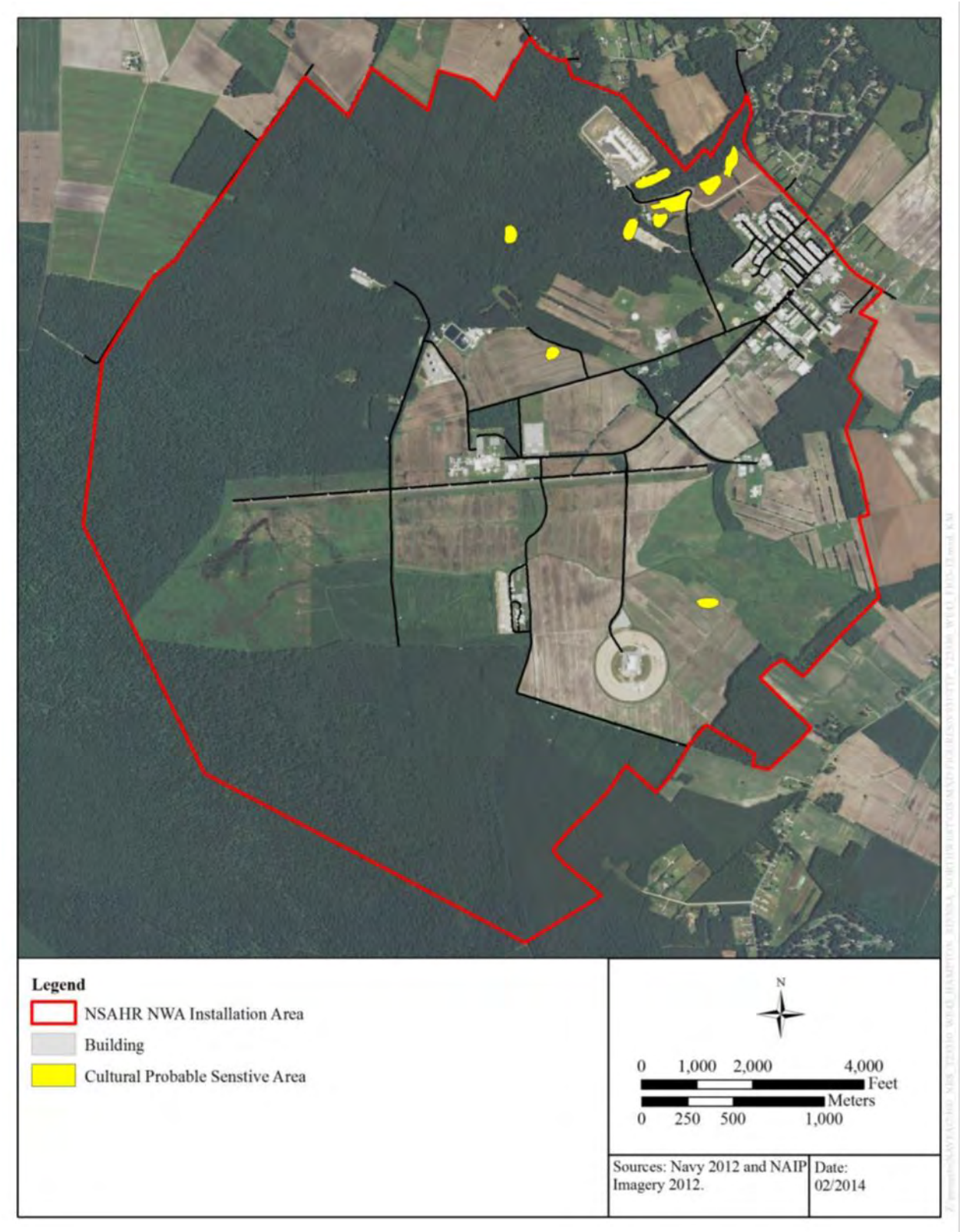

Figure 8. NSAHR-NWA Cultural Resources Sensitive Areas. From NSAHR-NWA INRMP. Not all cultural resource areas are depicted, map is subject to annual updates

2016 season (Navy 2015). Various additional educational outreach brochures and materials are contained in the Installation INRMP. All hunting areas/stands, parking locations, and access roads are subject to change, and hunters are required to obtain the most current maps before any hunt (available at the Natural Resources Center on Oceana Blvd., Bldg. 78). In accordance with Title 10 U.S.C § 2671, all hunting, fishing, and trapping on military installations are to comply with the federal and state laws and regulations (See Section 2.0 of this document).

Hunting is permitted throughout the undeveloped portions of the Installation. Deer hunting is the most popular sport, with between 350 and 500 permits sold annually for the region and daily use of NSAHR-NWA by 10–30 hunters. In support of conserving and managing the timber (canebrake) rattlesnake population on the Installation, the hunting program does not authorize the take of squirrels as this prey is one of the primary diet sources of these snakes on the installation.

The hunting areas map provided in Figure 9 may not reflect current hunting type designations, as changes are typically made during annual INRMP updates. Authorized hunting areas change annually and sometimes seasonally. Natural Resources Educational Trails are not shown. NR staff and volunteers maintain 113 permanent tree stands. Eighty-two (82) tree stands exist on the Virginia portion of the Installation and 31 are on the North Carolina portion of the Installation. In addition to these stands, bowhunters are permitted to use personal temporary tree stands. Barracks Woods and Supply Woods are designated only as bowhunting areas, whereas bowhunting, black powder, and shotgun are permitted in the remaining hunting areas. While the INRMP does not provide specific fishing details for the Installation, Lunker Lake is currently being investigated for inclusion as a recreation fishing area (Personal communication, Michael Wright, NRS, March 2016).

The Regional CLEO serves as a game warden and has the authority to apprehend and arrest all violators of federal, state, or installation game laws and regulations on NSAHR-NWA. The presence of a trained CLEO is an important component of the hunting and fishing programs as it greatly reduces the potential for fish and game violations on the Installation. Routinely the CLEO patrols fishing and hunting areas of the Installation to ensure people recreating are complying with natural resources regulations and policies. All firearm users must demonstrate weapons utilization competency by completing weapons qualifications administered by the NRP staff/CLEO, show proof of completion of a state-certified hunter safety course, attend a hunter indoctrination. In addition, all bowhunters must show proof of completion of an International Bowhunter Education Program and demonstrate competence through a qualification test with natural resources staff.

Rare, Threatened, and Endangered Species

Two rare plants and 41 wildlife species have been identified at the Installation that are considered rare, threatened, or endangered under federal or state ESAs, or global or state conservation rankings. The federally endangered northern long-eared bat is known to occur on the installation as a result of mist- netting surveys conducted in summer 2013, 2014, and 2015 (Navy 2015c). The Virginia state endangered Rafinesque's big-eared bat, the state endangered canebrake rattlesnake, and the state threatened Dismal Swamp southeastern shrew (*Sorex longirostris fisheri*) were also observed on the Installation during 2013 surveys. Two plants listed as rare (S1S2) in Virginia have been observed on the Installation (Wright 2013a and Belden 1993): highland dog-hobble (*Leucothoe fontanesiana*) and Spanish moss (*Tillandsia usneoides*). Designated rare species and species of special concern are granted no special legal protection, though their habitat is maintained and/or enhanced to the maximum extent practicable by the NRP.

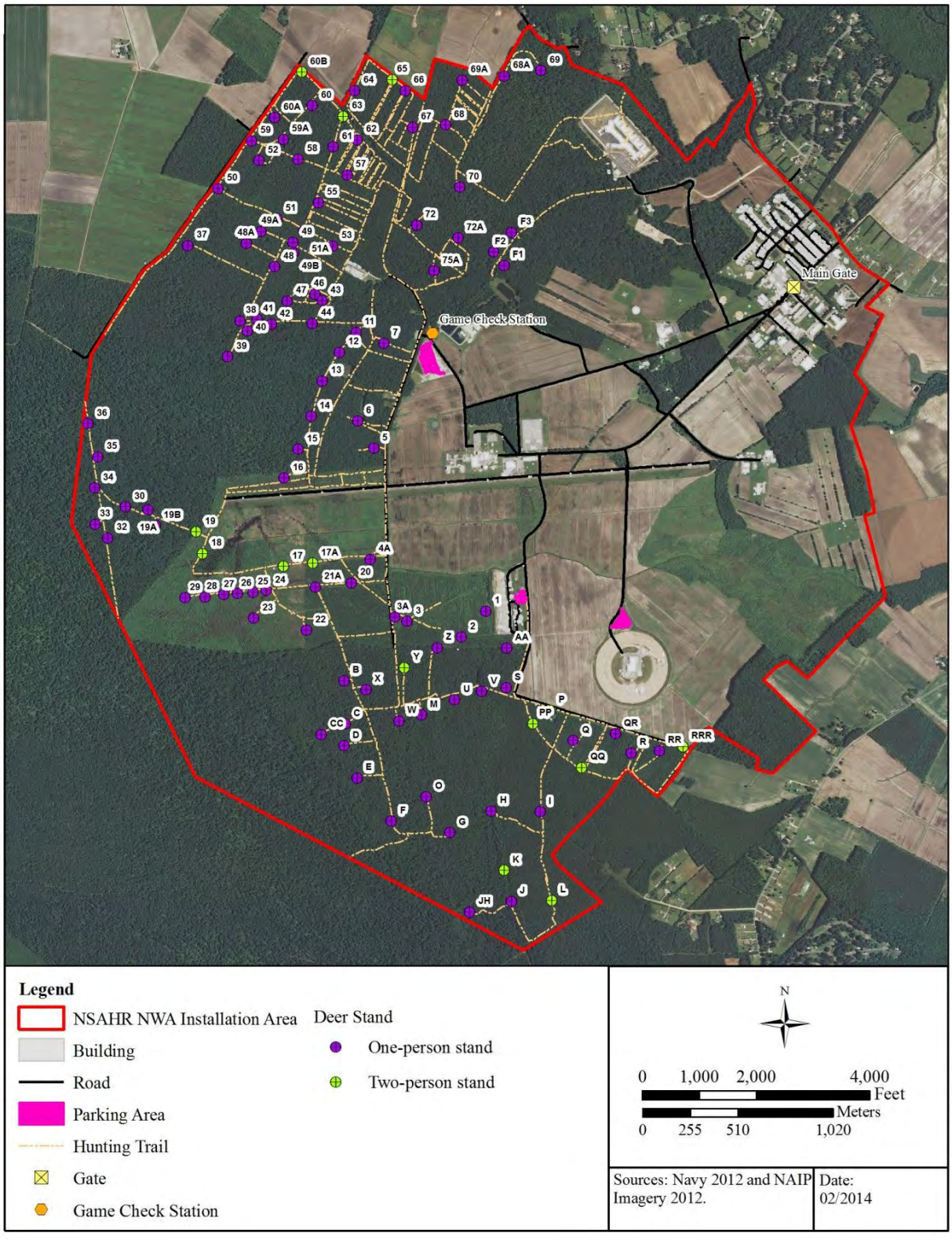

Figure 9. NSAHR-NWA Hunting Map. From NSAHR-NWA INRMP. Subject to annual updates, and all hunting areas subject to change. Lunker Lake not shown.

Observations and identification of rare species for the Installation is based on data collected during rare, threatened and endangered plant and animal surveys, and significant ecological communities surveys completed at the Installation (Rose et al. 1988, Belden 1993, Schwab 2003a, Schwab 2003b, Quillen 2013, and Watts 2013). RT&E species location maps can be found in the NSAHR-NWA INRMP (Navy 2014c). Numerous birds regulated under the MBTA are present or known to occur on the installation (Navy 2014e).

Wetlands and Coastal Zone Management

An Installation-wide wetland delineation was completed in May 2012 for NSAHR-NWA (Navy 2014c). A preliminary jurisdictional determination received from USACE in 2012 identified 2,203.98 ac (891.92 ha) of wetlands at NSAHR-NWA, of which 127.82 ac (51.73 ha) are located in North Carolina. Wetland delineations were completed pursuant to methods outlines in the 1987 Corps of Engineers Wetland Delineation Manual and The Regional Supplement to the Wetland Delineation Manual: Atlantic and Gulf Coastal Plan Region.

NSAHR-NWA must comply with the state Coastal Zone Management requirements of Virginia and/or North Carolina, where applicable. All Installation activities are reviewed for their potential impact to coastal zone resources and their compliance with the state's enforceable policies of the CZMA. The Navy strives to avoid and minimize impacts to coastal zone resources to the extent practicable when conducting activities. All development or other activities that are likely to impact land or water use or natural resources within state coastal management areas (coastal zones) require a coastal consistency determination. Federal lands, the use of which is by law subject solely to the discretion of or which is held in trust by the federal government, its officers or agents, are excluded from state coastal zone requirements. However, activities on federal lands with any reasonably foreseeable effects to state-designated coastal zone areas must be consistent to the maximum extent practicable with the state's coastal zone management program.

NR staff must review plans and proposed actions at the installation to ensure consistency with the Virginia and North Carolina coastal zone management programs and help obtain a consistency determination when required. Management actions include monitoring nonpoint source pollution, marine fish and wildlife species and habitat, and wetlands. The installation has implemented numerous management practices that benefit the coastal zone environment, including protection of stormwater quality, erosion and sediment controls, and riparian buffer restoration. These management techniques directly and indirectly benefit plant and wildlife species, water resources, and habitat that exist in the coastal zone at NSAHR-NWA.

Invasive/Feral Communities

Feral pigs that have existed in the region since early European settlement are a problem species for native habitats and wildlife. Feral pigs (or Eurasian feral hogs) were first identified on the installation in October 2012 (Navy 2014c). One pig was removed from the installation in 2012 and additional removal efforts were completed by VDGIF on their Cavalier Wildlife Management Area. In March of 2013 the NRS and VDGIF partnered to conduct a helicopter survey of the VDGIF Cavalier Property and NSAHR-NWA to identify any active sign of the pig. It appeared from the helicopter survey effort and the lack of sightings by Installation NR staff, volunteers, hunters, and military personnel in 2013 that the Rapid Response and Removal efforts by the Navy and VDGIF personnel removed the immediate threat from feral pigs at the installation. The Navy continues to coordinate with VDGIF to determine the presence of the species on the installation

and its rapid removal. The installation NRS actively participated in VDGIF's September 2013 Feral Hog Stakeholder's meeting.

Special Interest Areas

The SIAs that are present at NSAHR-NWA provide habitat for several of the rare, threatened, and endangered fauna that occur at the installation. With the exception of the management actions described in this section, little active management of the SIAs of NSAHR-NWA is conducted, as these areas are allowed to persist naturally. However, on a case-by-case basis, active management of these may be implemented to address issues such as erosion or invasive species.

The SIAs at NSAHR-NWA include the Great Dismal Swamp Natural Heritage Resource Area and the Potential Dismal Swamp Southeastern Shrew Habitat. The designations of conservation sites and/or SIA are not legal definitions tied to specific federal or state regulations but do provide valuable information to NRMs in regards to the extent and locations of significant ecological areas. The SIA locations, boundaries, and descriptions are provided in the 2015 Natural Heritage Inventory Report for NSAHR-NWA (Navy 2015c).

4.0 PROCEDURES

4.1 OBJECTIVE AND PLANS

The objectives of the CLEP in accordance with DODI 5525.17 are to:

- Conserve and direct the use of natural and cultural resources in accordance with the INRMP and ICRMP.
- Ensure installations and military and public users remain in compliance with appropriate environmental, natural, and cultural resource laws and regulations.
- Provide specialized law enforcement expertise regarding natural and cultural resource matters and protection of government property.
- Improve inter-jurisdictional conservation law enforcement among the military departments, federal, state, tribal, and local law enforcement and land management agencies, and
- Collect and track data on violations.

Each installation that is required to prepare an INRMP or ICRMP in accordance with DODI 4715.03 will incorporate within the INRMP or ICRMP the methods, techniques, and strategies that will be utilized to provide law enforcement services to the federal lands, complementing the resource management objectives of the installation.

The CLEP section will provide specific goals and objectives to ensure compliance with laws and regulations; to support the overarching goals of the INRMP and ICRMP; and to integrate with other installation security and emergency services plans. These objectives will include:

- Providing education and training to the installation populace, workforce, and general public to prevent inadvertent violation of natural resource and cultural resource laws;
- Defining areas clearly to prevent hunting, fishing, and other outdoor recreational activities in unauthorized areas.
- Reporting non-compliance with laws and regulations in accordance with military service criminal data reporting procedures.
- Encouraging coordination with the USFWS and NMFS.
- Reporting and tracking natural and cultural resources crimes and their disposition (both military and civil).

CLEPs and personnel may be co-located with the installation Conservation Program Manager. This best serves the installation commanders in implementing the INRMP and ICRMP and promoting the maximum availability of land, waters, and airspace to accomplish mission and training requirements.

Frequency of reporting criminal activity to the installation Security/Law Enforcement Office will be determined at the installation level and identified in the respective installation order or standard operating procedure (SOP). Normally, incidents will be reported to Security within 24 hours. Communication between conservation officers and the military police is paramount. The installation Law Enforcement Office shall provide continuous access to the Security first responder communication to the conservation officers. The rapport between conservation officers and military police must be fostered to ensure proper support and safety for all agencies (Base Police, Chesapeake Police, Virginia Beach Police, animal control, and the NCWRC). CLEOs will be responsible for investigating and arresting anyone suspected of violating the Federal Statues listed in DODI 5525.17.

4.2 CLEO AUTHORITY AND POWER

Title 10 U.S.C. §2671 requires that all hunting, fishing, and trapping on an installation be in accordance with the laws of the state in which it is located. It also states that offenders are guilty of a like offense and subject to a like punishment for an act or omission on the installation that would be punishable if committed within the jurisdiction of the state. On installations under either proprietary or concurrent legislative jurisdiction, state laws may be directly enforceable under state authority. Per the Assimilative Crimes Act, 18 U.S.C §13, in areas of exclusive or concurrent federal jurisdiction, state law may be used where no federal law governs the particular conduct on involved federal lands, and where there is an applicable state law. Under the act, the state law is adopted and used to prosecute the defendant in federal court as a federal offense. Currently all four of these installations fall within proprietary or concurrent jurisdictions, though jurisdictional boundaries may be subject to change.

The Secretary of Defense may enforce all natural resources management laws, pursuant to the authority of Title 16 U.S.C. §670e-l and cultural resources management laws, pursuant to the authority of §470ff on military installations within the United States. Although Title 16 U.S.C. provides authority to enforce natural and cultural resources laws, it does not expressly grant powers to search, seize, or arrest with regard to each statute. Military and civil service law enforcement personnel may temporarily detain civilian offenders until civilian law enforcement authorities arrive. The natural and cultural resource management laws are numerous and are listed in Section 2.0 for informational purposes.

The United States District Court Violation Notice is used as the charging document to notify the magistrate court of misdemeanor offenses that occur within its jurisdiction; however, felonies committed on Navy lands are referred to the local United States Attorney's Office. Felony violations on the installation are within the investigative purview of the Navy Criminal Investigation Services (NCIS). Coordination will be conducted with both the NCIS and the USFWS before proceeding beyond the preliminary stages of a felony investigation so that appropriate coordination can be made with the responsible assigned Assistant United States Attorney. For paleological resources violations, coordination with U.S. Bureau of Land Management (BLM) is required. For marine resources violations, coordination with the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA-NMFS) is required. For cultural resources violations, coordination with the SHPO is required. Each installation should have as part of its ICRMP a monitoring program for cultural resources and also provides coordination requirements.

Title 16 U.S.C. §3375 allows the Secretaries of Interior and Commerce to use (via agreement) Navy personnel, services, and facilities to the extent necessary for enforcement of any laws relating to fish and wildlife. The agreements are accomplished at the local level under the guidance of the responsible Navy Component. Navy Component heads may enter into standard agreements with the USFWS for CLEOs to exercise authority under USFWS commission for those laws for which the USFWS is the regulating authority.

In accordance with CNRMA Instruction 11015.3, management and control of fish and wildlife, feral animals, invasive species, and certain pests within Commander, Navy Region, Mid-Atlantic Area of Responsibility is assigned to the Regional Environmental Program Manager, and may be sub-delegated to a properly trained Regional Natural Resources Program Manager, under the supervision of the Regional Environmental Group Head. Under the direction of the Regional

Natural Resource Program Manager, the installation Natural Resource Specialist (NRS) uses integrated management practices and procedures to manage fish and wildlife and control certain feral, nuisance, and invasive species. CLEOs enforce fish and wildlife and other natural and cultural resource laws and regulations under the direction of the installation NRS, in addition to conducting field inspections and approved species control methods, wildlife forensic investigations, and responding to wildlife damage complaints.

The CLEOs draw their powers, when delegated, from the installation commander's authority to protect or secure an installation in accordance with the authority in Title 50 U.S.C. §797. A CLEO may use necessary and appropriate force to apprehend suspects in accordance with DODD 5210.56 and OPNAVINST 5530.14E (Navy Physical Security and Law Enforcement Program). The primary consideration in the use of force is the timely and effective application of an objectively reasonable level of force required to establish and maintain lawful control. A paramount consideration is the preservation of life and prevention of bodily injury.

Conservation law enforcement positions are generally posted under the following job series: GS-0025 – Park Ranger Series, GS-0083 – Police Series, GS-1801 – General Inspection, Investigation, Enforcement, and Compliance Series, and GS-1811 – Criminal Investigation Series (CEMML 2015). In certain cases, CLEO duties may be included in the position description of a GS-0404 – Biological Science Technician position. As such, the billet/position description is not classified as a 100% law-enforcement position (Personal communication, M. Wright, March 2016).

The Navy has not yet officially decided whether the CLEP should reside under Environmental or Security Forces. Currently it is implied that the program should be housed under Security/Law-enforcement and officers should be co-located with the installation Conservation Managers (Personal communication, M. Wright, March 2016). According to a recent CEMML study, implementing a CLEP under Security Forces has the advantage of equipping the position more easily, though a disadvantage is that natural and cultural resources rank lower in security priority and programs might suffer a loss of focus on natural and cultural resource protection (CEMML 2015). Regardless of where the CLEP resides, ongoing and consistent collaboration between Security Forces and Environmental are necessary for an effective program.

4.3 LAW ENFORCEMENT AGREEMENTS

Per DODI 5525.17, installations may enter into appropriate agreements, when authorized by law, with local law enforcement agencies, state fish and game agencies, sheriff's offices, or other federal agencies, on a reimbursable basis for the purpose of CLEP support. Appropriate agreements are available for use on installations and ranges that require Navy CLEOs and contain complex natural and cultural resource issues such as endangered species, coastal resources, or cultural resources, such that the installation(s) require an INRMP and ICRMP. Installation-specific agreements may be developed to address complex or multi-jurisdictional issues such as border patrol, coastal zone management, and shared land use.

Three types of agreements may be used by the DOD to implement and/or support CLE. MOA are commonly used to issue a special commission to confer authority to an appropriate agency, such as the USFWS, with the purpose being to clarify and avoid confusion regarding jurisdiction and authority over many federal wildlife statutes. Because the language of the Sikes Act does not adequately define which statutes are considered "related to the management of natural resources," some interpret the phrase as referring only to statutes that address land management, while others

believe it refers to statutes addressing wildlife management (CEMML 2015). MOAs are also used to define enforcement responsibilities among agencies. For instance, a MOA may be used to confer state and federal authority from other agencies to NAVY CLEOs, or to confer DOD/Navy authority to commissioned CLEOs from other federal agencies such as the USFWS, or commissioned CLEOs from state agencies such as the VDGIF and NCWRC.

Memorandum of Understanding (MOU) typically establish a cooperative relationship (authorized by the CO) between a DOD component and an agency such as the USFWS, VDGIF, or NCWRC for a specific purpose, such as personnel providing CLEP support on DOD installations. An Interagency Agreement (IA) is used in conjunction with an appropriate MOU to facilitate the transfer of funds between agencies (for example, a DOD component and the VDGIF) in order for CLE support position(s) to be funded.

These agreements should identify the roles and responsibilities of the installation and the cooperating agency or agencies where the cooperating agency is the lead in all CLE activities. An example of an installation agreement template is provided in Appendix A (DODI 5525.17) and a copy of the 2003 Memorandum of Agreement (MOA) between the USMC and the USFWS can be found in NAVMC DIR 5090.4A (Appendix B).

5.0 TRAINING, CREDENTIALS, EQUIPMENT, AND USE OF FORCE

5.1 TRAINING AND CREDENTIALS

The SAIA (16 U.S.C. §670e-2) requires sufficient numbers of professionally trained natural resources personnel and CLE personnel to be available and assigned responsibility to perform tasks necessary to carry out Title I of the SAIA, including the preparation and implementation of INRMPs.

The Federal Law Enforcement Training Center (FLETC) provides training for CLEOs. Basic training requirements for a federally certified CLEO are identified in DODI 5525.17 and are provided through the FLETC Land Management Police Training Program (LMPT). The DOD also developed a CLEO Pilot Training Course in 2007, which tailors the BLM law enforcement managers course to meet DOD CLEP policy and guidance. Additional training opportunities include, but are not limited to, the following:

- NEC 9545 Navy Law Enforcement Specialist Phase I (Base Police Law-enforcement training);
- NEC 9545 Navy Law Enforcement Specialist Phase II (Command Specific Law-enforcement training;
- NEC 9575 Correctional Custody Specialist Ashore;
- FLETC Criminal Investigation Training Program (CITP);
- State Police Academies
- National Military Fish and Wildlife Association (NMFWA) Conservation Officer Refresher Training; and
- Weapons qualifications biannually with the Navy Security Department.

Per DODI 5525.17, the CLEO should complete at least 40 hours of annual refresher training specialized to CLE, in addition to having first completed the FLETC LMPT. Annual refresher training is also available through FLETC for CLEOs. Annual firearm familiarization training, live-fire training, and use-of-force training are required yearly per DODD 5210.56.

Seasonal hires assigned to the CLEP are not required to have completed the FLETC LMPT training, but they must be supervised by and receive on the job training specific to CLE by a full-time, fully certified, and FLETC LMPT trained CLEO. Non-law-enforcement seasonal/temporary CLEP personnel may assist conservation officers with case-specific investigations and education and awareness activities, but they may not carry out direct law enforcement duties (unless their core personnel document or position description includes law enforcement duties and they have completed LMPT at FLETC or equivalent), or carry weapons in performance of this duty (unless so authorized and provided by the ICO after individuals have received appropriate training and are qualified with the authorized weapon).

In accordance with DODI 5525.17, all full-time conservation officers must complete LMPT at the FLETC or equivalent training as required by the DOD Peace Officers Standards and Training (POST) Commission within 1 year of being hired. The DOD POST Commission, in accordance with the authority in DODI 5525.17, are responsible for certifying CLEP equivalent training standards. The USMC CLEP detailed in NAVMC DIR 5090.4A also provides a "grandfather clause," for CLEOs who were trained, qualified, and authorized to carry firearms at their installation as of 6 Oct 2003 (before the NAVMC DIR 5090.4 or DODI 5525.17 requirements took

effect). In accordance with the NAVMC 5090.4A, these individuals should be considered fully qualified and issued credentials, however, those who have not yet completed the FLETC LMPT are highly encouraged to do so. Grandfathered CLEO must complete FLETC LMPT in order to meet position requirements to receive a promotion in the conservation officer field. While USMC requirements are not necessarily consistent with Navy CLEP requirements, the NAVMC DIR 5090.4 is a useful resource since the Navy has not yet issued formal CLEP direction.

DOD CLEO officers have highly specialized duties, and as such, require specialized training to develop the required knowledge and expertise in environmental laws and natural and cultural resource protection and use, troop training and outreach for compliance with environmental laws and regulations, and specialized investigative responsibilities beyond basic law enforcement patrol.

5.1.1 Natural and Cultural Resources Training

CLEOs must be trained to enforce natural resource laws including the Marine Mammal Protection Act, ESA, MBTA, and any other laws identified in section 2.0 as applicable to resources found on the installations described in Section 3.0. As a result of specialized knowledge and training, CLEOs should serve to ensure that Navy units that are training comply with requirements of BOs issued by USFWS, in accordance with the ESA (and as described in Section 2.0). NOAA-NMFS, U.S. BLM, and other State Agencies may also provide recommended training courses. Officers may need training for additional skills associated with equipment utilization for wildlife capture and/or removal, which may warrant training from the U.S. Department of Agriculture (USDA) or other agency/educational institution.

Installations that have cultural resources that warrant resource protection and enforcement under the ARPA (Title 16 U.S.C. § 470aa-mm) shall ensure CLEOs receive applicable training to enforce these laws. The CLEO should be familiar with provisions of the Native American Graves and Repatriation Act of 1990 and the American Antiquities Act of 1906, as amended, and other applicable State and local cultural resource protection laws (described in Section 2.0) for the identification of illegal trafficking of Native American human remains or unauthorized excavation activities, to be reported to the Installation Cultural Resource Manager for administrative action. The CLEO should be familiar with the NHPA of 1966, as amended, to identify vandalism to protected historic resources on the base, for reporting to the Cultural Resources Manager for administrative action. Installations shall determine the frequency and type of training courses for the CLEO to meet historic and archaeological resource protection requirements.

Additional suggested agency offered training courses include, but are not limited to:

- CECOS – Civil Engineer Corps Officer School (CECOS), Natural Resources Compliance, Environmental Law, Environmental Negotiation, CZMA, Cultural Resources, and other courses as applicable to the installation(s).
- Department of Interior – National Conservation Training Center, fish, wildlife and archaeological resources courses.
- USFWS National Conservation Training Center Courses.
- FLETC Courses: ARPA, NHPA Council, Introduction to Federal Projects, and Historic Preservation Law.

5.1.2 Use of Firearms and Training

Use of firearms by law enforcement personnel on DOD Installations is governed by 10 U.S.C. §1585 (Carrying of firearms), which is implemented by DODD 5210.56 (Carrying of Firearms and the Use of Force by DoD Personnel Engaged in Security, Law and Order, or Counterintelligence Activities). DODD 5210.56 states that qualified personnel shall be armed when required for assigned duties and there is reasonable expectation that DOD installations, property, or personnel lives or DOD assets will be jeopardized if personnel are not armed. DOD Components must also comply with provisions in DOD 5200.2-R (Personnel Security Program) and 18 U.S.C. §922, to ensure appropriate background investigation and screening procedures.

In accordance with DODD 5210.56, CLEOs and other law enforcement personnel who routinely engage in duties or activities where firearms proficiency is required shall satisfactorily complete DOD Component-approved training at least every 12 months, including firearms familiarization (classroom academic), live-fire qualification, and use-of-force training. In addition, DOD Components will consider periodic sustainment training for personnel to maintain firearms familiarization and proficiency. Regional CLEOs must maintain weapons qualifications biannually with the Navy Security department. Navy small arms training and qualification requirements can be found in OPNAVINST 3591.1F. Navy small arms and weapons management policy and guidance may be found in NAVSEA Instruction 8370.2D.

CLEOs and NR staff also require a letter of authorization from the Installation Commanding Officer (ICO) to carry firearms on installations in performance of official duties. In accordance with DODD 5210.56, all arming authorizations shall be in writing and signed (e.g., ink or digitally) by the appropriate authorizing official(s) before a firearm is issued to an individual. Written authorization is not required to be maintained by the individual carrying a firearm, unless determined necessary or appropriate by the issuing authority. Current individual qualification results, including authorized extensions, are to be documented and retained by the issuing authority for as long as the individual has authorization to be armed.

In accordance with DODD 5210.56, DOD personnel shall carry only Government-issued firearms and ammunition when performing official duties. The carrying of personal firearms and ammunition while on duty are prohibited from use by a CLEO. Individuals who are authorized to be armed must comply with DOD Component implementing safeguards to prevent loss, theft, and unauthorized use of firearms and ammunition. Personnel must return firearms to a designated armory or secure storage area for accountability and safekeeping upon completion of their official duties or training, in accordance with DOD Component procedures, or as specified in written authorization letters.

Per DODD 5210.56, the Heads of the DOD Components, or their designees, may authorize DOD personnel to carry and retain a Government-issued firearm off DOD property for official purposes, and shall prescribe specific guidance governing DOD jurisdiction, authority, and lawful use of force. The Heads of the DOD Components, or their designees, may authorize personnel to retain, transport, and store Government-issued firearms at Government or non-government locations for situations that warrant immediate action to protect DOD assets or person's lives.

In accordance with DODD 5210.56, personnel authorized to retain, transport, and store Government-issued firearms at Government or non-government locations must be provided a safety-lock device and instructions for its proper use. DOD Components are responsible for providing guidance and procedures to prevent loss, theft, and unauthorized carrying or use of

firearms. A CLEO must safely and securely store all firearms assigned. Government firearms that are not routinely carried should be stored at base facilities in a vault, gun locker, or other location that is secured in such a manner as to substantially reduce the possibility of theft or unauthorized removal and that meets physical security requirements.

Firearms must be returned or retrieved for DOD Component accountability and safekeeping when, at any time, the security of the firearm could be compromised. Firearms and ammunition accountability and losses must be reported in accordance with DOD 5100.76-M (Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives). Immediately upon the loss or theft of any government firearm, the CLEO must verbally inform his or her immediate supervisor, the Installation Security, the Naval Criminal Investigation Service, and the pertinent local police jurisdictions. The firearm make, model number, serial number, and caliber will be provided and a memo for the record will be prepared within 48 hours.

5.1.3 Credentials

The Navy will issue an official CLEO identification card and a Federal badge of commission to new hire conservation officers who have completed FLETC LMPT. Supervisors of the qualified CLEO shall submit a request letter for badges and identification card to be issued to each qualifying CLEO at the installation. The full name, GS series, grade, date of birth, color of eyes, hair, weight, two standard passport photos 1 inch by 1 inch in size, and a copy of the FLETC LMPT certificate shall be included with the letter. The Navy shall send the badges and identification card to the installation, or present them to the CLEO during the FLETC graduation ceremony. The Navy will keep records of all personnel, badges, and identification cards issued and returned for 5 years following employment termination of the CLEO. The Navy will issue three badges to each qualified conservation officer.

The installation will also issue an identification card to the CLEO using a template provided to the installations by the Navy which is not shown in this document for security purposes. The purpose of the installation identification card is to permit conservation officers to enter restricted areas on installations that require such authorization. Although the installation identification card is written to grant authority to enforce installation regulations and applicable federal and state laws under the Uniform Code of Military Justice, 10 U.S.C. 807.(b), U.S.C. Title 16, Chapter 5C, Subchapter 1, §670e-1, and the Assimilative Crimes Act, 18 U.S.C. §13 and those pertaining to the federal laws set forth in DODI 5525.17, the CLEO shall carry the installation identification card at all times when on official duty and whenever armed. Additional credentials may be required by CLEO personnel, dependent on terms and requirements negotiated in applicable MOA or MOU. For instance, under the terms of a MOA between the USMC and the USFWS (NAVMC DIR 5090.4A), USMC CLEO are also issued a USFWS Law Enforcement Officer identification card.

Both federal and state credentials may be required by Navy CLEOs, as many state laws may only be enforced by a state commissioned officer unless a Memorandum of Agreement (MOA) is put in place to authorize enforcement of both federal and state regulations (CEMML 2015). If a CLEO is commissioned from a state agency (VDGIF, NCWRC), an MOA may need to be put in place to confer DOD/Navy/Federal authority.

Upon termination from a CLEO position, that individual will surrender all badges and identification cards to his or her supervisor who shall return the badges to the Navy within 30 days by certified mail and return receipt.

5.2 EQUIPMENT

Title 10 U.S.C. §1585 and DODD 5210.56 authorize a CLEO to carry firearms. In accordance with DODI 5525.17, no CLEO will be issued a firearm until he or she has completed FLETC LMPT (unless so authorized and provided by the commander after individuals have received appropriate training and are qualified with the authorized weapon). The NAVMC DIR 5090.4A provides additional direction regarding equipment, which has been adapted below to be relevant to the regional CLEP:

> A CLEO who has completed FLETC LMPT [or other equivalent training] shall be issued vehicles, a radio; a cellular telephone; firearms; ammunition; and support equipment 24 hours a day, seven days per week, to meet routine surveillance, duty, and emergency response requirements. CLEOs are authorized to have access to and use standard Government issued equipment, firearms, and ammunition to perform duty requirements and for their safety.
>
> For required weapons that are not standard issue with the Navy Safety Center, a letter of authorization by the ICO is required. When the installation utilizes equipment such as watercraft, all-terrain vehicles (ATV), chainsaws, radios, batons, oleoresin capsicum (OC) spray, etc., the chief CLEO or Installation Component Law Enforcement Official shall ensure applicable training, instruction, certification and recertification requirements are met for such equipment. Each installation will have a directive reflecting SOP in the proper and safe use of such equipment, to include vehicle pursuit, boat pursuit, ATV use, etc. These SOPs are coordinated and/or developed through or in coordination with the Installation Safety Office.

Table 1 provides details on equipment requirements for the CLEP (adapted from NAVMC DIR 5090.4A). Ammunition that the installation CLEP is currently using is presented in Appendix C.

5.2.1 Firearms

The Navy is authorized to procure firearms, ammunition, and equipment through the Navy Munitions Command in Crane, Indiana. The Navy complies with standards set by the Navy Safety Center, in accordance with OPNAVINST 5530.14E. The Navy Safety Center has not made all of the weapons and ammunition required for CLEP/INRMP implementation available for acquisition, as it typically focuses on non-conservation law enforcement firearm requirements. For this reason, the CLEP currently utilizes all donated weapons that have cleared background checks and have been authorized by the ICO for use on installation, and purchasing required ammunition is problematic (Personal communication, M. Wright, August 2016). The Chief CLEO or the designated Certified Firearm Instructor (CFI) for each installation is responsible for reporting expended rounds and qualification sheets to the designated office. Expenditures of ammunition shall be reported within three working days after shooting, so that accurate records of ammunition balances can be maintained.

The standard issue firearm for the CLEP shall be assigned based on regional department need and accessibility. There are currently no existing Navy guidelines for designating CLEP firearm specifications. According to a FY04/05 DOD Legacy Project to standardize the DOD Conservation Law Enforcement Program (Rogers 2004), the most common service sidearm is a 9mm. The USMC lists the preferred standard issue firearms for their CLEP in NAVMC DIR 5090.4A, which are detailed below:

Table 1. Authorized CLEP Equipment

Firearm	Model	Caliber
Safe action system. Polymer frame. Magazine capacity 15 rounds with 1 in chamber	Glock 22 Corrosive resistant/tenifer finish	0.40 cal
Shotgun - 12 guage	Semi-automatic 18 to 21 inch barrel length	00 buck or rifled slugs
Rifle - Colt M-4 carbine or M16-A2	Semi-automatic 18 to 21 inch barrel length	0.223 (5.56mm)
Safe action system, polymer frame. Small capacity secondary handgun, magazine capacity 6 rounds, with 1 in chamber	Glock 27 Corrosive resistant/tenifer finish	0.40 cal
Rifle- short action, hunting		0.308
Ammunition		
Metal jacketed or semi-jacketed expanding bullets (0.40 cal hollow points)	12 Gauge Shot, #1, #2, #6	0.177 caliber pellets
12 Gauge Bangers (shell crackers, birdfrite scare cartridges, etc.)	0.22 caliber pellets 0.22 caliber shot shell	7mm rifle cartridges 0.308 rifle cartridges
Vehicles		
4-wheel drive truck	All-terrain vehicle (ATV)	Canoe, John-boat with motor
Equipment		
Handcuffs, flex-cuffs, leg cuffs and body chains to control, restrain, and transport persons	Black nylon tactical gear with level 2 or 3 security holster and magazine pouches	Batons, belts, holsters which are required to carry and transport firearms and ammo
Storage safe unit/container with locking mechanisms	Brackets or safety rack for securing firearms inside government vehicles	Night sight, rifle sight, or optical/electronic sight
Vehicle emergency code lights	Radios, cell phones	Chemical agent Oleoresin Capsicum (OC)
field cameras; remote access lap-top computers	*various sized noose poles; various snake hooks; various sized capture nets	*various sized animal transport crates/cases/bags; various sized animal traps
bean bags, noise makers/bangers/flash-bangs, pellets, starter caps, screamers etc.		
**animal trapping and capture equipment may be owned by the NR program and checked out by the CLE program, if such supplies do not exist within the CLE program.*		

> "The standard issue sidearm (primary weapon) for a CLEO shall be a Glock model 22, which is of a composite constructed (steel alloy and or polymer frames) safe action, or semi-automatic pistol of 0.40 caliber. The semi-automatic sidearm has a magazine capacity of 15 rounds with one in the chamber; a magazine release mounted on the side of the frame; no external safety, which would require manipulation prior; and no magazine disconnect that would prevent the weapon from being fired with the magazine removed. Due to environmental conditions, the firearm is made of a high corrosive resistant tenifer finish and of a composite lower receiver. Black accessory gear required to carry and transport sidearms and ammunition, such as magazine pouch, holster and belt, are considered equipment items that will be purchased by the CLEO using funds provided by the installation.
>
> A CLEO will have a secondary handgun available, to be issued by the Conservation Law Enforcement Office. The firearm will be a Glock 27, safe action system, polymer frame, magazine capacity six rounds with one in the chamber, 0.40 caliber.
>
> The standard issue shotgun shall be a 12-gauge semi-automatic police type weapon with a barrel length of 18 to 21 inches, and fitted with rifle sights or optical/electronic sights. After market replacement barrels are authorized. The standard issue rifle for law enforcement purposes shall be an M-16A2 or M-4 colt type semi-automatic in 0.223 caliber (5.56 mm). For non-law enforcement application, such as depredation and predator control, use of other weapons, and other caliber ammunition is advised and authorized through the local purchase procedure and/or through the installation contract office."

Contracts awarded for nuisance animal control or bird-aircraft strike reduction on the installation may authorize contract staff to utilize firearms. Only those weapons that are needed to meet contract objectives are to be authorized, and any weapon brought onto the installation shall meet federal, state, and installation orders/SOP requirements, as applicable. Contract personnel must meet credentials and training requirements of their employer and the Navy.

Additional weapons policies can be found in OPNAVINST 5530.14E (Navy Physical Security and Law Enforcement Program).

5.2.2 Ammunition

Only government issued ammunition is authorized by DODD 5210.56. There are currently no existing Navy guidelines for designating CLEP firearm/ammunition specifications. The USMC lists the ammunition specifications for their CLEP in NAVMC DIR 5090.4A, which are detailed below:

> Only new, commercial factory, or military arsenal manufactured, center-fire rifle ammunition of full metal jacket or jacketed mushrooming or expanding design will be carried or used for law enforcement purposes. Ammunition shall be loaded with metal jacketed or semi-jacketed mushrooming or expanding bullets (hollow-points), 0.40 caliber. Ball ammunition may be used for practice, but not when firing a qualification or requalification score for record, nor may it be carried for duty purposes.
>
> A CLEO will qualify and requalify with the same or ballistically equivalent ammunition, which they normally carry on duty. Shotgun ammunition utilized for CLEO duty purposes shall be factory manufactured 12 gauge, number 00 buck, rifled slugs, or other suitable rounds, as recommended by the training officer, and ultimately chosen by the CLEO. Less

lethal or specialty rounds needed for non-law enforcement purposes, such as wildlife damage control, are authorized to be purchased by the installation chief CLEO, or his/her designee, and stored in the same conditions as other ammunition.

To ensure that a CLEO remains proficient with his/her weapons, each officer should be provided with an appropriate number of rounds to meet all requalification requirements and to practice with each weapon carried. This ammunition should be in addition to any ammunition provided to the officer for the annual 4-hour firearms training, bi-annual requalification, and once every 3 years for the CFI, for each weapon used. It shall be the responsibility of the training officer to ensure that this ammunition is provided and fired on an annual basis.

5.2.3 Standard Issue Equipment and Uniform

In accordance with DODD 5210.56, DOD personnel will have available and use appropriate personal protective equipment commensurate with the duty or task assigned for individual safety and mission assurance. There are currently no existing Navy guidelines for designating CLEP standard issue equipment or uniform specifications. Equipment requirements will vary by installation, based on existing natural and cultural resources, available programs, and frequency of infractions. The USMC lists standard issue equipment for their CLEP in NAVMC DIR 5090.4A, provided below:

> A CLEO shall be authorized to obtain at government expense, carry, and store the following equipment: handcuffs, flex-cuffs, leg cuffs, and body chains to control, restrain, and transport persons; chemical agent OC, cuff case, magazine pouch, keepers, badge wallet, pancake holster, batons, belts, and holsters required to carry and transport firearms and ammo; storage-safe unit/container with locking mechanisms; brackets or safety rack for securing firearms inside Government vehicles; night sight, rifle sight, or optical/electronic sight; and emergency code lights for vehicles. Associated firearms black gear required, such as holsters, belts, magazine cases, and cuff cases, shall be considered authorized equipment to be purchased using installation operations and maintenance program funds. When standard motor vehicles are not adequate to safely support monitoring, patrolling, and enforcement duties in remote locations, a CLEO is authorized to obtain all-terrain vehicles or watercraft through the local purchase procedure and/or through the installation contract office.

The USMC lists standard issue uniform requirements for their CLEP in NAVMC DIR 5090.4A, provided below:

> The badge of commission shall be worn on the exterior of the left side of the uniform shirt. If a uniform jacket is worn, the second badge shall be worn on the exterior left side. The third badge will be concealed in a wallet or similar type leather holder for identification purposes. A patch signifying CLEO status of the local installation(s) shall be worn on the left shoulder of the shirt. The patch may be an existing one currently in use by all base CLEOs, or may be a new one prepared for the natural resource enforcement program. Patches will be designed to represent the local or regional natural resource or outdoor programs at the installation and may be different for each installation.
>
> Shirts will be a stone color, with a collar, of a standard style for law enforcement. Shirts may be short or long sleeved and with or without pockets, depending on preference and

climate needs. Installations may select a polo shirt or tee shirt to be worn while conducting fieldwork. The field shirt will depict a badge, embroidered or ink-printed, of the installation patch on the upper left hand side. Pants will be a hunter green or dark brown color. Style of pants as to number of pockets, cuffs or no cuffs will depend on CLEO staff preference.

A separate set of field pants may be worn which are designed for field conditions and not suitable for professional work environments. Shorts may be worn if desired in warmer climates. Shorts will be dark, hunter green, or dark brown in color. A CLEO hat will be worn that has the conservation logo patch on the front. The installation personnel will choose hat style or design preference. Any other accessories will be chosen by preference of the CLEO at the installation.

The type of dress shirt, pants, field clothes, and overall uniform will be chosen by the chief CLEO with concurrence from his or her supervisor and based on preference, climate needs, and field conditions at the installation. Once the uniform style and color are selected, all CLEOs at the installation will wear it. An initial uniform issue cost allowance and an annual uniform maintenance cost allowance shall be given to each CLEO and funded by the installation.

5.3 USE OF FORCE POLICY

Use of force policy on DOD Installations is governed by DODD 5210.56 (Carrying of Firearms and the Use of Force by DoD Personnel Engaged in Security, Law and Order, or Counterintelligence Activities), and 10 U.S.C. 1585 (Carrying of Firearms). CLEOs should only use the amount of force reasonably necessary to carry out their duties, and must complete use-of-force training every 12 months.

In accordance with DODD 5210.56, employment of 'less-lethal force" may be used with a reasonable amount of force necessary to overcome resistance in a lawful arrest or apprehension, or to accomplish the lawful performance of duties. Less-lethal force and use of non-lethal weapons can cause severe injury or death. Individual(s) subject to less-lethal force must receive immediate medical attention. DODD 3000.3 establishes DOD policy for the development and employment of non-lethal weapons.

In accordance with DODD 5210.56, a CLEO may use deadly force only under conditions of necessity and may only be used when lesser means cannot reasonably be employed or have failed. An oral warning shall be given prior to the use of deadly force if the situation permits and does not increase the danger to the CLEO or others. There is no requirement to delay force or sequentially increase force to resolve a situation or threat. CLEOs will attempt to de-escalate applied force if the situation and circumstances permit. CLEOs will warn persons and give the opportunity to withdraw or cease threatening actions when the situation or circumstances permit.

Deadly force is justified when the officer reasonably believes that the officer or another individual is in imminent danger of death or serious bodily injury. A CLEO must use only that degree of force that is legally permissible; reasonably necessary to perform their duties; and is required to protect themselves and others. The level of force used by an officer must not be excessive or unjustified. A CLEO may not use deadly force to stop a fleeting suspect who is unarmed and who presents no immediate threat of harm to the CLEO or to another person.

Deadly force may also be directed against vicious animals, when necessary in self-defense or in defense of others.

6.0 NEEDS ASSESSMENT

This section provides information relative to a needs assessment for the CLEP on NASO, NASO-DNA, NALFF, and NSAHR-NWA. This document performs a comparative assessment of the existing installation resources and CLEO duties and responsibilities to identify the needs of the CLEP and generate recommendations for development of a fully functioning CLEP.

6.1 EXISTING CONDITIONS

6.1.1 Methodology

The purpose for this needs assessment is to identify the levels of CLE needed for each of the installations. Because there is currently no formal Navy guidance for the determination of CLEP manpower, training, equipment, and policy requirements, the installation NRS and the Regional BST/CLEO were consulted to help determine CLE needs based on current program conditions. A similar assessment was recently conducted for six Front Range Air Force installations (CEMML 2015), the results of which were used to generate staffing recommendations.

Natural/cultural resources information from installation INRMPs/ICRMPs (Section 3.0) and applicable CLE relevant laws and regulations (Section 2.0) were reviewed and summarized, with an emphasis on resources that may routinely impact CLE (archaeological sites, artifacts, historic buildings, installation hunting/fishing programs, species of special concern, special interest areas, nuisance wildlife, wetlands, coastal zone requirements, etc.)

This document assesses current CLEP conditions, identifies needs, and considers multiple factors in order to provide recommendations for development of a more fully functioning CLEP. Factors assessed include: manpower and safety; training and equipment; installation CLE demands; and installation size/location/response time. These factors, once considered, are the basis for staffing, training, and equipment recommendations.

6.1.2 Manpower and Safety

One Biological Science Technician (BST), whose position description also includes CLEO duties, is currently responsible for providing CLE for the NAVFAC Hampton Roads IPT. The BST/CLEO services a total of 11 installations in Southeast Virginia and Northeast North Carolina. The regional BST/CLEO has arrest authority at these installations associated with the enforcement of federal, state, and installation natural and cultural resources laws and regulations, as defined in Section 2.0. The BST/CLEO is currently the only CLEP employee at these facilities, and as such, is on-call 24 hours a day, 7 days a week, and accumulates a great deal of overtime (Personal communication, M. Wright, 3 March 2016). The current CLEP has a total of 2,503 work-hours per year dedicated to law enforcement, according to installation INRMP annual metrics.

Per CNRMA Instruction 11015.4, under the direction of the NRS the BST/CLEO enforces fish and wildlife and other natural resources laws and regulations (as described in Section 2.0). The BST/CLEO may conduct field inspections and employ approved control methods for certain species. Control measures include, but are not limited to, live trapping, relocation, and lethal methods. CLEOs also perform wildlife forensic investigations and respond to wildlife damage complaints. NR personnel (including the current BST/CLEO) manage fish and wildlife and control certain feral, nuisance, and invasive species. Per NASOCEANAINST 3750.2 (series), NR personnel (including the current BST/CLEO) develop and execute depredation and dispersal

procedures for Bird Animal/Aircraft Strike Hazard (BASH) purposes, and personally supervise these actions when lethal methods are required.

Although the regional BST/CLEO enforces natural and cultural resources laws, the bulk of his duties are tied into traditional game warden tasks and feral/nuisance/invasive species control. He also conducts emergency wildlife response, nuisance wildlife response, and assists with surveys, maintenance, and implementation of various NRPs. Because there is only one BST/CLEO available for all four installations, except in the case of emergency, response to calls and reported violations is on a "first-come, first served" basis (Personal communication, M. Wright, 3 March 2016).

While on duty, for health and safety reasons the BST/CLEO is required to be accompanied by another NR employee or Security Officer for any anticipated weapons discharge (Personal communication, M. Wright, 3 March 2016). The BST/CLEO may request support if needed from Base Security, though this support is not necessarily timely (due to remote access and availability of personnel and equipment), nor have the Security Officers received specialized training, on-the-job training, or equipment for CLE (described in Section 2.0) to meet the requirements of DODI 5525.17. Installation Security Officers sometimes are the first reponders to emergency wildlife complaints and service requests during "after-hours" until support arrives from the NRS, the BST/CLEO, and/or pest management personnel as appropriate.

The use of state and federal conservation officers or an interagency MOU (as recommended by DODI 5525.17) for CLEP support may be pursued in the future, but dedicated support would be needed to provide sufficient assistance on military installations. There are three state/federal conservation officers that work in Southeast Virginia and are available for CLEP assistance on military installations. However, the personnel may be too widely distributed to be effective in timely responses (Personal communication, M. Wright, March 3 2016).

6.1.3 Training and Equipment

A regional CLEO is required to be trained in CLE and state and federal wildlife regulations, and attend annual CLE NASO and NALFF Integrated Natural Resources refresher training to remain current on changes in regulations and enforcement policies (see Section 5.0). The current BST/CLEO has completed specialized training, including: EC 9545 Navy Law Enforcement Specialist Phase I (Base Police Law-enforcement training), NEC 9545 Navy Law Enforcement Specialist Phase II (Command Specific Law Enforcement Training), NEC 9575 Correctional Custody Specialist Ashore, MBTA training for DOD, a variety of CECOS and ECATTS environmental courses, and the NMFWA Conservation Officer Refresher Training (when offered and travel approved), and qualifies on his weapons biannually with the Navy Security department. Annual use-of-force training is also required per DODD 5210.56.

Per DODI 5525.17, all conservation officers (regardless of previous law enforcement training) must successfully complete LMPT at the FLETC or equivalent natural resource training as required by the DoD POST Commission within 1 year of being hired. However, the current BST/CLEO was hired before DODI 5525.17 was signed into effect, and while he has not completed FLETC LMPT training, he has been working in law-enforcement for 16 years (between military police and the Natural Resource CLEP), 13 of which have been as a BST/CLEO for the installations.

The current CLEO has not yet had an opportunity to participate in cultural resources specific training, though is planning to attend such training when available (Personal Communication M. Wright, March 2016).

While the Navy procures firearms and ammunition from the Navy Safety Center, currently weapons and ammunition used in the CLEP are not authorized by the Navy Safety Center. The result has been a shortage of ammunition available for the CLEO program. The military armory is not available for CLEO program support. The current CLEP utilizes donated weapons that have cleared background checks and obtained ICO approval for use on installation. (Personal communication, M. Wright, 3 March, 2016). Per CNRMA instruction 11015.3, Installation Security Officers assist NR personnel in obtaining required weapons qualifications. The establishment of procedures for procurement of firearms and ammunition to fulfill CLE duties has been identified as a need for the CLEP.

6.1.4 Conservation Law Enforcement Demand

Existing installation natural and cultural resources described in Section 3.0 identify the need for a fully functioning CLEP to adequately protect such resources, and to support implementation and regulation of applicable programs (hunting and fishing, outdoor recreation, etc). The installations all have a need for CLE, based on deterrence and detection. For instance, installations with higher levels of recreational use can have negative impacts on resources, thus conservation education and constant monitoring of recreational use is necessary to ensure permanent damage to natural and cultural resources does not occur at installations with higher demand.

During interviews conducted via email, the current BST/CLEO provided an observational estimate of demand for standard patrol per installation, based on his 13 years of experience performing CLE on the installations (L. McGrogan, April 25, 2016). For NASO and NASO-DNA, the estimated minimum time commitment for standard patrol is 2 days, or 16 hours per week, for each installation. For NALFF the estimated minimum time commitment for standard patrol is 2.5 days, or 20 hours per week. For NSAHR-NWA, the estimated minimum time commitment for standard patrol time is 3.5 days, or 28 hours per week, due to high user demand on the hunting program. These estimates assume a standard 8-9 hour work day.

Additional responsibilities that require a considerable amount of CLEO time and effort include, but are not limited to, administrative duties (estimated at around 10 to 30 hours per week), Annual training (40 hours annually per CLEO), maintenance training and qualification renewal (20 hours annually per CLEO), ticket/summons processing (depends, but approximately 30-40 hours a year), nuisance animal control (16 hours per week, with two officers/NRP personnel required), and after hours/weekend calls (approximately 2-4 hours per week).

With these estimated time commitments in mind, the CLEO predicts the need for a minimum of three full-time officers, with an optimum of 5-6 officers, to adequately and safely perform at a professional level.

6.1.5 Installation Size, Location, and Response Time

While NASO, NASO-DNA, and NALFF contain a relatively small acreage (5,800 ac, 1,900 ac, and 2,600 ac, respectively), because they are located in a densely populated urban area, this increases the likelihood of violations such as trespassing and poaching on these installations. NSAHR-NWA (3,600 ac) is located in a more rural area, but it does not have contiguous perimeter

fencing to prevent trespassing, and poaching is still an issue at this installation. (Personal communication, M. Wright, 3 March 2016).

The distance between installations and increased response time for the BST/CLEO due to travel between facilities should be considered to develop minimum staffing requirements. The current BST/CLEO is based out of NASO, which is approximately 14 miles driving distance from NALFF (approximately 30 minutes driving time), approximately 33 miles from NSAHR-NWA (approximately 45-60 minutes driving time), and approximately 8 miles from NASO-DNA (approximately 15-20 minutes driving time). Local traffic patterns and delays have the potential to add a great deal of variability in travel time between facilities, with the potential to increase BST/CLEO response time to reported violations.

6.2 RECOMMENDATIONS

From the summary of existing conditions above, needs for the current CLEP were identified and recommendations to address these needs are provided below:

Based on the information contained in section 3.0 and section 6.1 of this document, it was determined that the current CLEP is understaffed. Because only one BST/CLEO is available for the four target Installations, a health and safety risk exists for the current officer when back-up is not available from Installation Security or NR Personnel. Increased staffing/manpower is recommended for the CLEP at these installations. Ideally, a two-man team is recommended to be on duty at all times in order to ensure adequate back-up and increased safety for all CLEP personnel. To ensure an adequate staffing rotation, this would require a minimum of three available CLEP personnel (at least two of which being full time and fully certified), such that two officers would be on duty or on call at all times, with a rotational schedule allowing for one officer to be off-duty (for scheduled time off, sick leave, etc.). This also promotes a healthy work-life balance for CLEP personnel.

A recent CLEP vulnerability study/needs assessment conducted by Colorado State University Center for Environmental Management of Military Lands (CSU CEMML) for six Air Force installations in Colorado and Wyoming concluded that those installations containing significant natural resources such as wetlands, species of special concern, natural areas, cultural resources, and recreational opportunities should be provided with the placement of a CLEO (CEMML 2015).

One of the installations assessed in CEMML's study, F.E. Warren Air Force Base, contains 5,866 ac, and is similar to NASO in size and available natural resources. CEMML concluded that F.E. Warren should receive a dedicated CLEO based on presence of significant natural and cultural resources. Other assessed installations (Buckley Air Force Base, Cheyenne Mountain Air Force Station, Peterson Air Force Base, and Schriever Air Force Base) containing a combination of fewer natural/cultural resources and less recreational access were determined to not require a dedicated CLEO, and instead it was recommended that they receive support on an as-needed basis from the placement of full-time CLEOs at F.E. Warren and at the U.S. Air Force Academy. It was also recommended that the Air Force implement a job-sharing situation with environmental programs or cooperating agencies.

Taking CEMML's method for assessing manpower need into consideration, the recommendation for placement of at least two dedicated full-time CLEO to be shared between the four installations assessed in this document is reasonable, with the additional option of a cooperative agreement with the USFWS, VDGIF, and/or NCWRC to meet staffing needs or provide additional support. Ideally,

Navy CLEO personnel would be hired under the GS-1801 or GS-1811 series, as the position descriptions are best suited for CLEO responsibilities (Personal Communication, Michael Wright, March 2016). According to CEMML's study, the hiring of full-time CLEO officers is preferred, as part-time employment of a CLEO is not as conducive to a career-focused professional program and retention becomes problematic if a trained CLEO can find full-time employment elsewhere (CEMML 2015).

The use of seasonal law-enforcement employees (military conservation agents, security forces, master-at-arms, component civilian police, or other law enforcement personnel) to augment the CLEP during times of increased demand (such as during the hunting season) would be another option to help meet staffing recommendations. However, per DODI 5525.17, personnel temporarily or seasonally assigned to CLEPs are not required to complete FLETC LMPT but should be supervised by a fully certified conservation officer and receive on-the-job training specific to conservation law enforcement, and are not to be used to fulfill the full-time CLEO requirement.

It is important to note that, per DODI 5525.17, non-law-enforcement personnel (including General Services 400 series civilians and active duty personnel) may assist conservation officers with case-specific investigations and education and awareness activities, but are not permitted to perform direct law enforcement duties (unless their core personnel document or position description includes law enforcement duties and they have completed LMPT at FLETC) nor are they permitted to carry weapons (unless so authorized and provided by the commander after having received appropriate training and qualification with the authorized weapon).

Clarification regarding requirements for a conservation officer to be considered "fully certified" has been identified as a need for the CLEP. Because the current BST/CLEO has been a CLEP employee prior to DODI 5525.17 being signed into effect, he was not required to receive the FLETC LMPT, and therefore does not currently meet requirements to be considered a designated CLEO. However, he has received additional highly specialized training in natural resources management and CLE, and has served as the BST/CLEO on these installations for 13 years. A grandfather clause is currently in place for the USMC CLEP, which allows for CLEOs hired before DODI 5525.17 and NAVMC DIR 5090.4A to be issued and maintain CLEO credentials. It is recommended that the Navy adopt a similar clause for their CLEP.

This also highlights a need for identification in regards to what trainings qualify as equivalent to the FLETC LMPT, when funding and availability do not allow for completion. This may impact whether an officer may be considered a "fully certified" CLEO to meet the full-time requirements of DODI 5525.17. Per DODI 5525.17, equivalent basic natural resources management training must meet the standards of the natural resources management program of instruction of FLETC LMPT. The DOD POST Commission, in accordance with the authority in DODI 5525.17, are responsible for certifying CLEP equivalent training standards.

Additional cultural resources training has been determined a need for the CLEP based on feedback from the installation NRS. It is recommended that all CLEOs receive cultural resources specific training in order to enforce applicable cultural resources laws and regulations identified in Section 2.0 of this document.

A cooperative agreement with additional federal or state agencies has been identified as an additional resource with which to supplement the CLEP, and is recommended to increase CLEP effectiveness, jurisdictional authority, and manpower requirements. Installations under proprietary

or concurrent jurisdiction may require an MOA in place to authorize enforcement of both federal and state regulations. An MOU could provide increased manpower support and increase jurisdictional authority using outside agency personnel. For instance, an MOA with the VDGIF and NCWRC could provide state authority to full-time NAVY CLEOs, or alternatively, provide state commissioned CLEOs with DOD/Navy law enforcement authority.

Because the Navy has not yet provided a formal instruction or regional CLEP that identifies CLEO training requirements and specific CLEP obligations, the development of such a document is recommended in order to define and clarify the roles and responsibilities for CLE at regional installations, and for incorporation into INRMPs/ICRMPs as directed by DODI 5525.17. This needs assessment provides necessary background information and framework helpful towards the development of a regional instruction.

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APPENDIX A

(DODI 5525.17)

Department of Defense
INSTRUCTION

NUMBER 5525.17
October 17, 2013

USD(P&R)

SUBJECT: Conservation Law Enforcement Program (CLEP)

References: See Enclosure 1

1. PURPOSE. This instruction:

a. Establishes policy, assigns responsibilities, and provides direction for the CLEP in accordance with the authority in DoD Directive (DoDD) 5124.02 (Reference (a)).

b. Defines the organization and authorities of CLEP.

2. APPLICABILITY. This instruction applies to OSD, the Military Departments, the Office of the Chairman of the Joint Chiefs of Staff and the Joint Staff, the Combatant Commands, the Office of the Inspector General of the Department of Defense, the Defense Agencies, the DoD Field Activities, and all other organizational entities within the DoD (referred to collectively in this instruction as the "DoD Components").

3. POLICY. It is DoD policy that:

a. The protection of property and natural and cultural resources under DoD control is accomplished through the enforcement of all applicable federal and State laws and regulations.

b. The CLEP is used to support decisions and management actions by DoD's natural and cultural resources managers regulating the users of these resources to achieve specific goals and objectives.

c. DoD Component law enforcement officials exercise functional oversight over the CLEP and the conservation law enforcement officers (CLEOs) carrying out the program.

d. CLEOs assigned to DoD Component law enforcement elements may be co-located with the conservation program manager at the installation.

e. CLEP Officers conducting criminal investigations will comply with the policies and procedures of DoD Instructions (DoDIs) 5505.07, 5505.11, 5505.14, 5505.16, and 5505.17 (References (b) through (f)).

f. The DoD Component's law enforcement and conservation functions will establish, and mutually support, an implementation method which defines roles, internal and external support agreements, funding responsibilities, accountability, command and control, and expectations which will provide for an effective and efficient CLEP.

g. CLEP roles and responsibilities will be integrated into an installation's Integrated Natural Resources Management Plan (INRMP) and Integrated Cultural Resources Management Plan (ICRMP), where conservation law enforcement is required.

h. The implementation method(s) for each installation CLEP should be proportionate to the conservation law enforcement needed at the installation; therefore, several implementation methods are provided for within this instruction. Although the specific implementation methods at installations can vary, those details should be clearly defined at the appropriate command level and address at a minimum, consistent with this instruction, roles and responsibilities, internal and external support agreements, funding responsibilities, accountability, and command and control.

i. Mutual assistance agreements with other agencies and organizations may be used to maximize enforcement capabilities, when authorized by law.

j. Primary (basic) training for personnel who serve as DoD CLEO is the Federal Law Enforcement Training Center (FLETC) Land Management Police Training (LMPT) Program. Equivalent basic natural resources management training must meet the standards of the natural resources management program of instruction of FLETC LMPT.

k. The DoD Peace Officers Standards and Training (POST) Commission, in accordance with the authority in DoDD 5525.15 (Reference (g)), will certify CLEP equivalent training standards.

4. RESPONSIBILITIES. See Enclosure 2.

5. PROCEDURES. See Enclosure 3.

6. RELEASABILITY. **Unlimited**. This instruction is approved for public release. Copies may be obtained through the Internet from the DoD Issuances Web Site at http://www.dtic.mil/whs/directives.

7. EFFECTIVE DATE. This instruction:

a. Is effective October 17, 2013.

b. Must be reissued, cancelled, or certified current within 5 years of its publication to be considered current in accordance with DoDI 5025.01 (Reference (h)).

c. Will expire effective October 17, 2023 and be removed from the DoD Issuances Website if it hasn't been reissued or cancelled in accordance with Reference (h).

Jessica L. Wright
Acting Under Secretary of Defense for
Personnel and Readiness

Enclosures
1. References
2. Responsibilities
3. CLEP Procedures

Glossary

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ENCLOSURE 1

REFERENCES

(a) DoD Directive 5124.02, "Under Secretary of Defense for Personnel and Readiness (USD(P&R))," June 23, 2008
(b) DoD Instruction 5505.07, "Titling and Indexing Subjects of Criminal Investigations in the Department of Defense," January 27, 2012
(c) DoD Instruction 5505.11, "Fingerprint Card and Final Disposition Report Submission Requirements," July 9, 2010, as amended
(d) DoD Instruction 5505.14, "Deoxyribonucleic Acid (DNA) Collection Requirements for Criminal Investigations," May 27, 2010, as amended
(e) DoD Instruction 5505.16, "Criminal Investigations by Personnel Who Are Not Assigned to a Defense Criminal Investigative Organization," May 7, 2012
(f) DoD Instruction 5505.17, "Collection, Maintenance, Use, and Dissemination of Personally Identifiable Information and Law Enforcement Information by DoD Law Enforcement Activities," December 19, 2012
(g) DoD Instruction 5525.15, "Law Enforcement (LE) Standards and Training in the DoD," April 27, 2012
(h) DoD Instruction 5025.01, "DoD Directives Program," September 26, 2012, as amended
(i) DoD Instruction 4715.03, "Natural Resources Conservation Program," March 18, 2011
(j) DoD Instruction 4715.16, "Cultural Resources Management," September 18, 2008
(k) Title 16, United States Code
(l) Title 10, United States Code
(m) Title 42, United States Code
(n) Title 7, United States Code
(o) Title 43, United States Code
(p) Title 25, United States Code
(q) Title 33, United States Code
(r) United States District Court Violation Notice[1]
(s) Title 50, United States Code
(t) DoD Directive 5210.56, "Carrying of Firearms and the Use of Force by DoD Personnel Engaged in Security, Law and Order, or Counterintelligence Activities," April 1, 2011

[1] Available from the Central Violations Bureau, http://www.cvb.uscourts.gov/index.html

ENCLOSURE 2

RESPONSIBILITIES

1. UNDER SECRETARY OF DEFENSE FOR PERSONNEL AND READINESS (USD (P&R)). The USD(P&R):

a. Establishes overall policy and provides guidance for the DoD CLEP.

b. Monitors implementation of the DoD CLEP.

c. Serves as the central point of contact for CLEP policy issues.

d. Coordinates with other federal agencies on conservation law enforcement matters of national or regional scope.

e. Identifies opportunities for efficiencies in providing CLEP training through increased interagency and DoD Component cooperation.

f. Serves as the CLEP authority for and manages the partnership agreement with the FLETC, known as the Department of Defense Conservation Law Enforcement Consortium (DoDCLEC).

2. UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS (USD(AT&L)). The USD(AT&L):

a. Establishes and monitors Natural Resources Conservation Program policy, in accordance with DoDI 4715.03 (Reference (i)).

b. Ensures that the CLEP is integrated into DoD Natural Resources Conservation Programs and cultural resources management policy and guidance in accordance with DoDI 4715.16 (Reference (j)).

3. DoD COMPONENT HEADS. The DoD Component heads responsible for DoD installations or sites:

a. Establish policies and procedures to implement CLEP within their Component.

b. Integrate CLEP into the Component law enforcement programs.

c. Ensure that, to the extent practicable using available resources, sufficient numbers of natural resources law enforcement personnel are available and assigned responsibility to perform tasks necessary to carry out the CLEP in accordance with chapter 5C of Title 16, United States

Code (U.S.C.) (Reference (k)), including the preparation and implementation of the law enforcement portions of the integrated natural resources management plans.

d. Ensure sufficient levels of conservation law enforcement planning are incorporated into installation INRMPs and ICRMPs where necessary, and to the extent practicable using available resources, and that these plans are fully coordinated with appropriate installation offices.

e. Establish agreements with other agencies and organizations to facilitate mutual working relationships and to maximize enforcement capabilities, when authorized by law.

ENCLOSURE 3

CLEP PROCEDURES

1. OBJECTIVES. CLEP will:

a. Conserve and direct the use of natural and cultural resources in accordance with the INRMP and ICRMP.

b. Ensure installations and military and public users remain in compliance with appropriate environmental, natural, and cultural resource laws and regulations.

c. Provide specialized law enforcement expertise regarding natural and cultural resource matters and protection of government property.

d. Improve inter-jurisdictional conservation law enforcement among the Military Departments, federal, State, tribal, and local law enforcement and land management agencies.

e. Collect and track data on violations.

2. PLANS

a. General. Each installation that is required to prepare an INRMP or ICRMP in accordance with Reference (i) will incorporate within the INRMP or ICRMP the methods, techniques, and strategies that will be utilized to provide law enforcement services to the federal lands, complementing the resource management objectives of the installation.

b. Plan Goals and Objectives. The CLEP section will provide specific goals and objectives to ensure compliance with laws and regulations; to support the overarching goals of the INRMP and ICRMP; and to integrate with other installation security and emergency services plans. These objectives will include:

(1) Providing education and training to the installation populace, workforce, and general public to prevent inadvertent violation of natural resource and cultural resource laws.

(2) Defining areas clearly to prevent hunting, fishing, and other outdoor recreational activities in unauthorized areas.

(3) Reporting non-compliance with laws and regulations in accordance with Military Service criminal data reporting procedures.

(4) Encouraging coordination with the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service.

(5) Reporting and tracking natural and cultural resources crimes and their disposition (both military and civil).

c. Tiering CLEP to the INRMP and ICRMP

(1) Reference (i) and sections 670-670f of Reference (k) require installations that have significant natural or cultural resources to prepare and implement an INRMP or ICRMP that provides for adequate management and enforcement.

(2) The CLEP should provide the maximum feasible protection of military lands and resources under the jurisdiction of the Department of Defense within the funding and manpower levels allocated to support the mission.

(3) The INRMP provides the overall framework for implementing conservation and management activities and enforcement on DoD installations.

(4) The ICRMP provides the overall framework for implementing cultural resources management activities and enforcement on DoD installations.

(5) The conservation law enforcement plan should be an attachment to the INRMP and ICRMP.

3. PERSONNEL AND TRAINING

a. All conservation officers (regardless of previous law enforcement training) must successfully complete LMPT at the FLETC or equivalent natural resource training as required by the DoD POST Commission (Reference (g)) within 1 year of being hired.

b. Military police, security forces, master-at-arms, component civilian police, or other law enforcement personnel who are temporarily or seasonally assigned to CLEPs. These personnel are not required to complete LMPT but should be supervised by a fully certified conservation officer and receive on-the-job training specific to conservation law enforcement. Personnel augmenting CLEPs are only to be used for temporary or seasonal assignment and are not to be used to fulfill the full-time CLEO requirement.

c. DoD Component heads may authorize exceptions for smaller installations or bases that do not require the services of a full-time CLEO year-round to assign CLEP duties to specially trained, dual-function police officers.

d. DoD Components may augment CLEP forces with the following personnel and under the following restrictions:

(1) Military police, security forces, master-at-arms, component civilian police, or other law enforcement personnel who are temporarily or seasonally assigned to CLEPs are not required to complete LMPT but should be supervised by a fully certified conservation officer and

receive on-the-job training specific to conservation law enforcement. Augmented personnel are only to be used for temporary or seasonal assignment and are not to be used to fulfill the full-time CLEO requirement.

(2) Non-law-enforcement personnel, including General Services 400 series civilians and active duty personnel, may assist conservation officers with case-specific investigations and education and awareness activities. They may not:

(a) Carry out direct law enforcement duties unless their core personnel document or position description includes law enforcement duties and they have completed LMPT at FLETC.

(b) Carry weapons in performance of this duty (unless so authorized and provided by the commander after individuals have received appropriate training and are qualified with the authorized weapon).

e. The DoD is a partner organization with the FLETC for conservation law enforcement training including basic training, LMPT Program, and advanced training requirements. The partner organization status is managed through the DoDCLEC. The DoDCLEC consists of the USD(P&R) Office of Law Enforcement Policy and Support and the Military Departments.

f. DoD CLEO should complete a minimum of 40 hours of annual refresher training, specialized to conservation law enforcement. This refresher training is after completion of FLETC LMPT and is not to be considered a replacement for it.

g. DoD CLEO position descriptions, grades, and series should be developed and filled at a level of expertise and professionalism commensurate with other federal agency standards and the specialized duties of the DoD CLEO officers. These responsibilities include, but are not limited to, knowledge and expertise in environmental laws and natural and cultural resource protection and use, troop training and outreach for compliance with environmental laws and regulations, and specialized investigative responsibilities beyond basic law enforcement patrol.

4. AUTHORITY, POWERS, AND JURISDICTION

a. Conservation Officer Authority

(1) Section 2671 of Title 10, U.S.C. (Reference (l)) requires that all hunting, fishing, and trapping on an installation be in accordance with the laws of the State in which it is located. It also states that offenders are guilty of a like offense and subject to a like punishment for an act or omission on the installation that would be punishable if committed within the jurisdiction of the State. On installations under either proprietary or concurrent legislative jurisdiction, State laws may be directly enforceable under State authority.

(2) The Secretary of Defense may enforce all natural resources management laws, pursuant to the authority of section 670e-1 of Reference (k) and cultural resources management laws, pursuant to the authority of sections 470ff of Reference (k) on military installations within

the United States. Although Reference (k) provides authority to enforce natural and cultural resources laws, it does not expressly grant powers to search, seize, or arrest with regard to each statute. Military and civil service law enforcement personnel may temporarily detain civilian offenders until civilian law enforcement authorities arrive. The natural and cultural resource management laws are numerous and are listed in the Table for informational purposes.

Table. Natural and Cultural Resources Laws

NATURAL AND CULTURAL MANAGEMENT	ASSOCIATED LAWS
Airborne Hunting	Section 742j-1 of Reference (k)
American Indian Religious Freedom	Section 1996 of Title 42, U.S.C. (Reference (m))
Antiquities Act	Subchapter LXI of chapter 1 of Reference (k) beginning with section 431
Archaeological and Historic Preservation	Subchapter I of chapter 1A of Reference (k) beginning with section 461
Archaeological Resources Protection	Chapter 1B of Reference (k) beginning with section 470aa
Bald and Golden Eagle Protection	Subchapter II of Chapter 5A of Title 16, U.S.C., beginning with section 668 of Title 16, U.S.C. (Reference (k))
Coastal Barrier Resources	Chapter 55 of Reference (k) beginning with section 3501
Coastal Zone Management	Chapter 33 of Reference (k) beginning with section 1451
Endangered Species	Chapter 35 of Reference (k) beginning with section 1531
Estuary Protection	Chapter 26 of Reference (k) beginning with section 1221
Federal Insecticide, Fungicide, and Rodenticide	Chapter 6 of Title 7 U.S.C., beginning with section 136 (Reference (n))
Federal Land Policy and Management	Chapter 35 of Title 43, U.S.C., beginning with section 1701 (Reference (o))
Noxious Weeds	Chapter 61 of Reference (n) beginning with section 2809

Table. Natural and Cultural Resources Laws, Continued

Fish and Wildlife Conservation	Chapter 49 of Reference (k) beginning with section 2901
Game, Fur-Bearing Animals, and Fish	Subchapter I of chapter 5A of Reference (k) beginning with section 661
Forest and Rangeland Renewable Resources Planning	Chapter 36 of Reference (k) beginning with section 1601
Lacey Act	Chapter 53 of Reference (k) beginning with section 3371
Marine Mammal Protection	Chapter 31 of Reference (k) beginning with section 1361
Migratory Birds	Subchapter II of chapter 7 of Reference (k) beginning with section 703
Migratory Bird Conservation	Subchapter III of chapter 7 of Reference (k) beginning with section 715
Migratory Bird Hunting and Conservation Stamps	Subchapter IV of chapter 7 of Reference (k) beginning with section 718
Multiple Use Sustained Yield of Forests	Sections 528-531 of Reference (k)
National Environmental Policy	Chapter 55 of Reference (m) beginning with section 43421
National Forest Management	Chapter 36 of Reference (k) beginning with section 1600
National Historic Preservation	Subchapter II of chapter 1A of Reference (k) beginning with section 470
National Trails Systems	Chapter 26 of Reference (k) beginning with section1241
Native American Graves Protection and Repatriation	Section 3001 of Title 25, U.S.C. (Reference (p))
Recreational Hunting Safety	Chapter 72 of Reference (k) beginning with section 5201
Rivers and Harbors Act of 1899	Sections 401 and 403 of Title 33, U.S.C. (Reference (q))

Table. Natural and Cultural Resources Laws, Continued

NATURAL AND CULTURAL MANAGEMENT	ASSOCIATED LAWS
Sikes Act	Subchapter I of chapter 5C of Reference (k) beginning with section 670
Soil and Water Conservation	Chapter 40 of Reference (k) beginning with section 2001
Taylor Grazing Act	Chapter 8A of Reference (o) beginning with section 315
Wild and Scenic Rivers	Chapter 28 of Reference (k) beginning with section 1274
Wild Exotic Bird Conservation	Chapter 69 of Reference (k) beginning with section 4901
Wild Horses and Burros	Chapter 30 of Reference (k) beginning with section 1331
Wilderness Act	Chapter 23 of Reference (k) beginning with section 1131

(3) The United States District Court Violation Notice (Reference (r)) is used as the charging document to notify the magistrate court of misdemeanor offenses that occur within its jurisdiction; however, felonies committed on military lands are referred to the local United States Attorney's Office. Felony violations on the installation are within the investigative purview of the appropriate military criminal investigative organization (MCIO). Coordination will be conducted with both the supporting MCIO and the USFWS before proceeding beyond the preliminary stages of a felony investigation so that appropriate coordination can be made with the responsible assigned Assistant United States Attorney.

(4) Section 3375 of Reference (k) allows the Secretaries of Interior and Commerce to use (via agreement) DoD personnel, services, and facilities to the extent necessary for enforcement of any laws relating to fish and wildlife. The agreements are accomplished at the local level under the guidance of the responsible DoD Component.

(5) DoD Component heads may enter into standard agreements with the USFWS for CLEOs to exercise authority under USFWS commission for those laws for which the USFWS is the regulating authority.

b. Conservation Officer Powers

(1) CLEOs draw their powers, when delegated, from the installation commander's authority to protect or secure a facility in accordance with the authority in section 797 of Title 50, U.S.C. (Reference (s)).

(2) CLEOs may use necessary and appropriate force to apprehend suspects in accordance with DoDD 5210.56 (Reference (t)). The primary consideration in the use of force is the timely and effective application of an objectively reasonable level of force required to establish and maintain lawful control. A paramount consideration is the preservation of life and prevention of bodily injury.

5. LAW ENFORCEMENT COORDINATION

a. Coordination with Other Federal and State Agencies. Each DoD Component or its designated lead office should address specific conservation law enforcement issues relevant to its component with other national headquarters offices of federal agencies such as the Departments of Interior, Homeland Security, Commerce, and Agriculture. The major command, regional office, or installation should address conservation law enforcement issues with respective regional offices of federal, State, and tribal fish and game agencies.

(1) National Level Coordination. Each DoD Component is responsible for national-level liaison and contact with the departmental law enforcement officials and all federal law enforcement, security, and intelligence agencies on all matters relating to conservation law enforcement. On national matters pertaining to DoD lands, the USD(P&R) Law Enforcement Policy and Support Office will consult with the appropriate DoD Component.

(2) International Coordination. If an international agreement permits such activity, local liaison is allowed with cooperating foreign agencies adjacent to the international border of the United States relating to matters of mutual concern and assistance. This coordination and cooperation with local foreign law enforcement officials and agencies will be in accordance with applicable legally binding international agreements between the United States and Mexico or Canada, and will be conducted in a circumspect manner to avoid violation of the sovereignty of the other country.

(3) Regional Level. The major command or regional office is the appropriate level for interagency inter-governmental coordination and environmental planning with other federal, State, and tribal agencies. The regional office or major commands should conduct all coordination and communication for regional and multi-State issues.

(4) State and Local Level. The major command or regional criminal investigative office, installation lead criminal investigator, and conservation officer are concurrently responsible for liaison with local, State, tribal, and federal agencies on matters relating to natural and cultural resource law enforcement.

(5) Individual Cooperation. Criminal investigators and conservation officers are expected to make every effort to cooperate with and assist officials of State fish and game agencies and law enforcement officials of other federal, State, tribal, and local agencies located in their geographic area of responsibility for the purpose of enforcing natural and cultural resource laws on DoD installations.

b. Law Enforcement Agreements

(1) Small Installation Agreements. Installations that do not require full-time conservation officers due to limited resources, but require periodic patrols and response as needed for enforcement of natural and cultural resource management laws, may enter into appropriate agreements, when authorized by law, with local law enforcement agencies, State fish and game agencies, sheriff's offices, or other federal agencies.

(a) Typically, these installations require an INRMP or ICRMP, but do not have large acreage or complex issues such as endangered species, coastal resources, or extensive cultural resources.

(b) These agreements should identify the roles and responsibilities of the installation and the cooperating agency or agencies where the cooperating agency is the lead in all conservation law enforcement activities. An example of an installation agreement is provided at the Figure.

(2) Large Installation Agreements. Appropriate agreements, when authorized by law, are also available for use on large installations and ranges that have DoD conservation officers. Installation-specific agreements may be developed to address complex or multi-jurisdictional issues such as border patrol, coastal zone management, and shared land use.

Figure. Sample Law Enforcement Agreement

[Date]

AGREEMENT
BETWEEN THE [*Insert Title of DoD Official*] AND THE
(*FEDERAL OR STATE AGENCY*)
FOR THE PROVISION OF NATURAL RESOURCES LAW ENFORCEMENT

This agreement, entered into this _____ day of _____ 20____, by the [*Insert DoD Component Name*] for (*INSTALLATION NAME*) and [*name of other party*] (hereinafter referred to as the parties). Witnessed that:

WHEREAS, the Secretary of Defense is authorized by the Sikes Act to enforce on DoD installations all federal laws relating to the management of natural resources, and

WHEREAS, it is the responsibility of [*Insert DoD Component Name*] to conserve natural resources and provide adequate law enforcement on its lands; and

WHEREAS, the [*Insert Name of other party*] has the authority to enforce State and local laws relating to the management of natural resources on such lands; and

Figure. Sample Law Enforcement Agreement, Continued

WHEREAS, it is in the best interests of the [*Insert DoD Component Name*] to obtain the assistance of the [*Insert Name of other party*] in the enforcement of State and local laws on [*Insert DoD Component Name*] lands.

NOW, THEREFORE, the parties hereto mutually agree as follows:

Article 1. Plan of Operation.

(a) [*Insert DoD Component Name*] and the [*Insert Name of other party*] have agreed to a plan of operation which describes the scope and extent of natural resources law enforcement to be provided to [*Insert DoD Component Name*] by the [*Insert Name of other party*] in accordance with this agreement. Such plan of operation, as concurred in by the [*Insert Name of other party*], is attached hereto as Appendix A and made a part hereof. The plan of operation will be reviewed before the beginning of each federal fiscal year and the [*Insert DoD Component Name*] will determine if it is still current and whether there are sufficient funds available to pay the [*Insert Name of other party*] charges for the next fiscal year.

(b) It is recognized and understood that the [*Insert DoD Component Name*] and the [*Insert Name of other party*] may, at the request of either, renegotiate the plan of operation. The renegotiated plan of operation will, upon written acceptance thereof by both parties, supersede Appendix A.

Article 2. Obligations of the [*Insert Name of other party*].

(a) The [*Insert Name of other party*] agrees to furnish normal, emergency, and unanticipated enforcement of State and local civil and criminal laws relating to management of natural resources on [*Insert DoD Component Name*] lands and waters in accordance with the schedules and duties described in the plan of operation, with payment by [*Insert DoD Component Name*] in accordance with Article 3 of this agreement.

(b) The [*Insert Name of other party*] agrees to provide personnel, equipment, and supplies required to provide the natural resources law enforcement requested by the [*Insert DoD Component Name*] in accordance with paragraph (a) of this article.

(c) The [*Insert Name of other party*] agrees to prepare a daily enforcement log of a format provided or approved by the [*Insert DoD Component Name*] and to submit this log to [*Insert DoD Component Name*] at least once a month throughout the effective period of the current plan of operation.

(d) The [*Insert Name of other party*] agrees to assign only those personnel who are qualified and trained pursuant to the requirements of applicable federal and State laws and regulations to undertake the law enforcement to be provided under Article 2(a) of this agreement in support of [*Insert DoD Component Name*]. Where State and local standards for the qualifications of law enforcement personnel do not exist, the [*Insert Name of other party*] will advise [*Insert DoD Component Name*] of the experience, qualifications, and training of those personnel expected to be assigned law enforcement duties under this agreement and assign such duties to them only with the approval of the [*Insert DoD Component Name*].

Article 3. Obligations of the [*Insert DoD Component Name*].

Subject to the availability of funds, the [*Insert DoD Component Name*] agrees to pay the [*Insert Name of other party*] for the total cost of the law enforcement support to [*Insert DoD Component Name*], to be provided in accordance with the obligations agreed to be undertaken by the [*Insert Name of other party*] in Article 2 of this agreement, including the costs of operation and maintenance of such equipment as is required for the provision of such support to [*Insert DoD Component Name*] identified in the plan of operation under Article l of this Agreement. At the request of the [*Insert Name of other party*], partial payments may be made as the law enforcement support to [*Insert DoD Component Name*] is performed based on billings as identified in the plan of operation under Article I of this agreement and approved by the [*Insert DoD Component Name*].

Figure. Sample Law Enforcement Agreement, Continued

Article 4. Period of [*Insert DoD Component Name*].

The period of this agreement is from the date of execution until terminated by mutual agreement, or on written notice from either party to the other, as set forth in Articles 6 and 10 of this agreement.

Article 5. Disputes.

(Insert clause from DoD 3210.6-R, "Department of Defense Grant and Agreement Regulations", April 13, 1998, with Change 2, October 24, 2001)

Article 6. Default.

In the event that either party to this agreement fails to meet any of its obligations hereunder, the other party may immediately terminate this agreement. Such termination will be effected by written notice of either party to the other.

Article 7. Exclusion of Federal Employee Benefits.

It is understood and agreed that the services to be provided by the [*Insert Name of other party*] and its employees are not considered to fall within the scope of federal employment, that the [*Insert Name of other party*] and its employees are not considered as agents or employees of the U.S. Government, and that none of the benefits of federal employment will be conferred under the terms of this agreement.

Article 8. Release of Claims.

The [*Insert Name of other party*] agrees to secure insurance in a form and amount satisfactory to the [*Insert DoD Component Name*] for liability arising from the negligence of [*Insert Name of other party*] in performing services under this agreement. Such insurance will name the United States as a named insured. The cost of such insurance may be included as a cost under Article 3 of this agreement.

Article 9. Transfer or Assignment.

The [*Insert Name of other party*] will not transfer or assign this agreement, nor any rights acquired thereunder, nor grant any interest, privilege, or license whatsoever in connection with this agreement without the approval of the [*Insert DoD Component Name*].

Article 10. Termination for Convenience.

[*Insert DoD Component Name*] or [*Insert Name of other party*] may, on 30 days written notice, terminate this agreement without cause. If this agreement is so terminated, the [*Insert DoD Component Name*] will be liable only for payment in accordance with the payment provisions of this agreement for services rendered prior to the effective date of termination.

Article 11. Equal Opportunity.

(Insert clause from DoD 3210.6-R, "Department of Defense Grant and Agreement Regulations," April 13, 1998, as amended)

Article 12. Gratuities.

(Insert clause from DoD 3210.6-R, "Department of Defense Grant and Agreement Regulations", April 13, 1998, as amended)

Figure. Sample Law Enforcement Agreement, Continued

Article 13. Examination of Records by Comptroller General.

The [*Insert Name of other party*] agrees that the Comptroller General of the United States or any of his or her duly authorized representatives will, until the expiration of 3 years after final payment under this agreement, have access to and the right to examine any directly pertinent books, documents, papers, and records of the [*Insert Name of other party*] involving transactions related to this agreement.

Article 14. Audit by the [*Insert DoD Component Name*].

Upon request, the [*Insert Name of other party*] must provide, and the [*Insert DoD Component Name*] will have the right to examine, books, records, documents, and other evidence of accounting procedures and practices, sufficient to reflect properly all direct and indirect costs of whatever nature claimed to have been incurred and anticipated to be incurred for the performance of this agreement.

Article 15. Amendments.

Any changes in the provisions of this agreement must be made by formal amendment signed by both parties.

IN WITNESS HEREOF, the parties hereto have executed this agreement, as of the day and year first written above.

GLOSSARY

PART I. ABBREVIATIONS AND ACRONYMS

CLEO	Conservation Law Enforcement Officer
CLEP	Conservation Law Enforcement Program
DoDCLEC	Department of Defense Conservation Law Enforcement Consortium
DoDD	DoD directive
DoDI	DoD instruction
FLETC	Federal Law Enforcement Training Center
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Installation Natural Resources Management Plan
LMPT	Land Management Police Training
MCIO	military criminal investigative organization
POST	Peace Officers Standards and Training
U.S.C.	United States Code
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology, and Logistics
USD(P&R)	Under Secretary of Defense for Personnel and Readiness
USFWS	United States Fish and Wildlife Service

PART II. DEFINITIONS

Unless otherwise noted, these terms and their definitions are for the purpose of this instruction.

Defense criminal investigative organizations. The four criminal investigative organizations of DoD: Defense Criminal Investigative Service, U.S. Army Criminal Investigation Command, Naval Criminal Investigative Service, and Air Force Office of Special Investigations.

dual-function conservation officer. A natural resources professional who is assigned law enforcement duties consisting of at least 50 percent of overall duties. Dual-function conservation officers should maintain equivalent training and qualifications as full-time conservation officers.

ICRMP. A plan that defines the process for the management of cultural resources on DoD installations by integrating the entirety of the installation cultural resources program with ongoing mission activities, to allow for ready identification of potential conflicts between the installation's mission and cultural resources, and identify compliance actions necessary to maintain the availability of mission-essential properties and acreage.

INRMP. An integrated plan focused, to the maximum extent practicable, on ecosystem management that shows the interrelationships of individual components of natural resources management (e.g., fish and wildlife, forestry, land management, and outdoor recreation) to mission requirements and other land use activities affecting an installation's natural resources. INRMPs ensure natural resource conservation programs and military operations are integrated and consistent with stewardship and legal requirements through cooperation among DoD, USFWS, and State fish and wildlife agencies.

MCIOs. The three military criminal investigative organizations of DoD: U.S. Army Criminal Investigation Command, Naval Criminal Investigative Service, and Air Force Office of Special Investigations.

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APPENDIX B

(NAVMC DIR 5090.4 A, Memorandum of Agreement with the USFWS)

CONSERVATION LAW ENFORCEMENT PROGRAM

APPENDIX A

MARINE CORPS AND U.S. FISH AND WILDLIFE SERVICE MEMORANDUM OF AGREEMENT

DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
2 NAVY ANNEX
WASHINGTON, DC 20380-1775

IN REPLY REFER TO
5090
LPL/1
21 MAY 2003

Kevin Adams, Chief,
Office of Law Enforcement
U.S. Fish and Wildlife Service
MS-LE 3000
4401 N. Fairfax Drive
Arlington, VA 22203

Dear Mr. Adams:

Attached is a Memorandum of Agreement for cooperative law enforcement for the protection and conservation of fish, wildlife, archaeological, and natural resources on lands controlled by the Marine Corps. Please sign, keep a copy for your files, and return the original to my office.

I am pleased to enter into this cooperative agreement as the mutual benefits to be gained will allow us to better fulfill our resource protection obligations, while providing enhanced stewardship of the public lands entrusted to the Marine Corps.

Ms. Heidi Hirsh of my staff is available to answer any questions you may have regarding this matter. She may be reached at 703-695-8240.

Sincerely,

R. S. COLEMAN
Brigadier General, U.S. Marine Corps
Assistant Deputy Commandant
Installations and Logistics (Facilities)

CONSERVATION LAW ENFORCEMENT PROGRAM

APPENDIX A

MARINE CORPS AND U.S. FISH AND WILDLIFE SERVICE MEMORANDUM OF AGREEMENT

MEMORANDUM OF AGREEMENT
for
Cooperative Law Enforcement
between the
U.S. Fish and Wildlife Service
and the
U.S. Marine Corps

This Memorandum of Agreement (MOA) is a cooperative agreement entered into under authority of the Fish and Wildlife Revenue Enhancement Act of 1998 (16 U.S.C. Section 742*l*(b)) between the U.S. Fish and Wildlife Service, hereinafter "Service" or "Chief, Office of Law Enforcement," and the U.S. Marine Corps, hereinafter "USMC." This cooperative agreement shall serve as a master agreement for all USMC installations and U.S. Fish and Wildlife Service law enforcement offices.

Individual installation cooperative agreements may be negotiated and signed by the appropriate Service and USMC representatives. However, individual agreements are not mandatory. Individual agreements that have been signed and are presently in effect shall be updated to reflect the requirements of this Agreement. Individual agreements must comply with this MOA.

Whereas, the Congress of the United States has found that the protection and conservation of fish, wildlife, and other natural and cultural resources is in the best interest of the public and has enacted various laws to provide for protection and conservation of wildlife and native plants.

Whereas, the United States Congress has given the Secretary of the Interior the authority to enforce certain laws dealing with the protection and conservation of fish, wildlife, and other natural resources and this authority has been delegated to the Director of the Service and to certain qualified individuals.

Whereas, the Service and the USMC recognize that mutual benefits will accrue to the law enforcement efforts of each by entering into a Memorandum of Agreement to share law enforcement expertise, training, intelligence information, equipment, and other facilities, and to designate law enforcement officers to efficiently enforce all laws administered by the Service and USMC relating to fish, wildlife, and other natural and cultural resources.

Whereas, the Service has determined that it is necessary and appropriate to utilize certain persons, services, and facilities of the USMC to assist in providing effective enforcement of Federal conservation laws on the lands and waters under USMC jurisdiction.

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Whereas, the USMC has determined that it is necessary and appropriate to utilize certain persons, services, and facilities of the Service to assist in providing effective enforcement of Federal conservation laws on the lands and waters under USMC jurisdiction.

Therefore, the parties agree that:

A. Re-Delegation of Federal Authority

(1) Under the authority provided by 16 U.S.C. § 742*l*(b), the Chief, Office of Law Enforcement, hereby delegates to the USMC and those certain persons designated in accordance with the terms specified herein ("USMC Conservation Law Enforcement Officers") the authority to enforce the following Federal laws dealing with the protection and conservation of fish, wildlife, and natural and cultural resources of the United States and regulations issued pursuant thereto within any limitations prescribed by regulations of the Department of Defense:

Lacey Act and Lacey Act Amendments of 1981 (18 U.S.C. 42, 16 U.S.C. 3371-3378)

Migratory Bird Treaty Act (16 U.S.C. 703-712)

Archeological Resources Protection Act of 1979 (16 U.S.C. 470aa-ll)

Endangered Species Act of 1973 (16 U.S.C.1531-1544)

Marine Mammal Protection Act (16 U.S.C. 1361-1384, 1401- 1407)

Migratory Bird Hunting and Conservation Stamp Act (16 U.S.C. 718-718k)

Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)

Airborne Hunting Act (16 U.S.C. 742j-1)

National Wildlife Refuge System Improvement Act (16 U.S.C. 668dd-668ee)

This Agreement does not delegate authority to enforce the import and/or export provisions of the statutes above unless the designee is under the direct supervision of a Service special agent.

(2) The Chief, Office of Law Enforcement specifically delegates to the USMC and the USMC Conservation Law Enforcement Officers the same authority to search, seize, arrest, and exercise other law enforcement functions under the laws specified in paragraph A(1) of this Agreement, as if the USMC and the USMC Conservation Law Enforcement Officers were employed by the Department of the Interior and authorized by the Secretary of the Interior to enforce those laws.

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(3) This Agreement between the Service and the USMC may not be used to re-delegate Federal law enforcement authority to any person convicted of a misdemeanor crime of domestic violence or otherwise prohibited from possessing firearms, within the meaning of 18 U.S.C. § 922(g).

B. Designation of Federal Authority by USMC of USMC Conservation Law Enforcement Officers

(1) The USMC, through the Installation Commanding General, may designate individuals to exercise the authority to enforce the conservation laws and regulations of the United States as specified above. This designation may only be to a person who meets criteria (a) or (b) and (c) and (d):

(a) Is presently employed and has been for at least one (1) year as a conservation law enforcement officer at a USMC installation and is trained, qualified, and authorized to carry a firearm and who is assigned conservation law enforcement duties at the installation; or

(b) Completed the Natural Resource Police Training Program, the former Land Management Police Training Program, or the Criminal Investigator Training Program, at the Federal Law Enforcement Training Center (FLETC), and completes a one (1) year probationary period; and who

(c) Is proficient in the use of firearms as demonstrated by meeting the firearms qualification and re-qualification standards required of the USMC installation, complies with the USMC Conservation Law Enforcement Program, and agrees to read, understand, and follow the Service Use of Force and Firearms policies when acting under this Agreement. These policies are attached and will be transmitted to all officers so delegated under this Agreement; and

(d) Has not been convicted of a misdemeanor crime of domestic violence or is not otherwise prohibited from possessing firearms, within the meaning of 18 U.S.C. § 922(g).

(2) The USMC shall notify the Service of the full name, address, date of birth, and social security number of each designee. This designation shall become effective upon the filing of such information with the Service's designated representative. The USMC shall issue an identification card to each designee, along with a copy of this Agreement and the Service Use of Force and Firearms policies.

If at any time, any person designated to exercise authority under this Agreement fails to meet any of the criteria set forth in paragraph B(1) above, terminates DOD employment, or is reassigned to non-law enforcement duties, the USMC shall terminate the designation

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when the USMC becomes aware of these circumstances. The USMC will collect that person's identification card and immediately notify the Service.

Information about the addition of designated officers should be provided to the Service within 30 days. The USMC will provide a complete up-to-date list of persons holding authority under this Agreement to the Service by January 15 of each year.

(3) Designated USMC Conservation Law Enforcement Officers may exercise authority to enforce the conservation laws and regulations specified in paragraph A(1) on USMC installations and lands or waters adjacent to installations under exigent circumstances, such as to arrest or detain individuals who are suspected of committing unlawful actions on the USMC installation and then flee. They may exercise this authority anywhere within the jurisdiction of the United States when under the direct supervision of a Service special agent.

(4) The Service may, by written notice to the USMC, terminate any designation made by the USMC.

(5) The USMC shall continue to provide, as appropriate, workmen's compensation in accordance with laws and regulations applicable to USMC civilian employees for work-related injuries incurred by USMC Conservation Law Enforcement Officers while performing duties under this Agreement. Designated individuals may also be considered eligible for compensation under subchapter III of chapter 81 of Title 5, United States Code when activities are initiated and approved by the Service.

(6) While performing duties under this Agreement, USMC Conservation Law Enforcement Officers shall:

(a) Be considered investigative or law enforcement officers of the Department of the Interior for the purposes of the tort claim provisions of Title 28, United States Code and 5 U.S.C. 8401(17); and

(b) Be considered officers or employees of the United States within the meaning of section 111 and 1114 of Title 18, United States Code.

C. Procedures for Investigating Federal Offenses

The following procedures shall govern investigations or prosecutions of Federal offenses made under this Agreement:

(1) The USMC installation will refer appropriate violations of Federal law or regulation to the Service's designated representative as expeditiously as possible.

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(2) The USMC installation shall submit in a timely manner, copies of all investigative reports to the Service's designee on law enforcement activities conducted under authority of this Agreement.

(3) All potential investigations that may result in a felony prosecution will be coordinated with the Service. All potential investigations against any person who may claim Native American treaty rights must be coordinated with the Service.

(4) Each USMC installation shall coordinate with the local Service law enforcement office to establish protocol and liaison with regard to all Federal prosecutions relating to violations of Federal laws and regulations specified in A(1), occurring on USMC installations.

D. Coordination

(1) The Service designee and the USMC representatives shall meet periodically and when necessary for the following purposes:

(a) Identifying enforcement problems in areas of concurrent jurisdiction that may require joint enforcement operations or investigations;

(b) Identifying enforcement problems that may require covert investigation;

(c) Identifying the need for specialized law enforcement equipment;

(d) Discussing new techniques and methods for the detection and apprehension of violators of conservation laws and the exchange of law enforcement information in general;

(e) Reviewing training programs and identifying the need for additional instruction in Federal laws, policies, interpretations, and other appropriate subjects; and

(f) Establishing procedures for the care, handling, identification, and storage of evidence and/or seized property.

E. Actions to be Taken by the Parties

(1) The Service will provide to the USMC, subject to available resources and manpower, copies of Federal laws and regulations and pertinent Service policy and interpretations and the assistance of special agents and equipment for specific enforcement operations.

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(2) The USMC will provide to the Service, subject to available resources and manpower, copies of regulations applicable to USMC installations and pertinent policy and interpretations and assistance by USMC Conservation Law Enforcement Officers and use of equipment for specific enforcement operations that occur on the USMC installations.

F. Terms, Amendment, Effective Date, and Termination

(1) This Agreement shall become effective upon the date last signed and executed by the duly authorized representatives of the parties and shall remain in full force and effect until terminated in writing by either party. Representatives of the USMC and Service will review the Agreement at least every ten (10) years. The Agreement may be terminated, without cause, by either party upon thirty (30) days written notice.

(2) The Agreement may be revised or amended by consent of the parties, but such revisions or amendments shall not be effective until produced in writing and signed by both parties. Local agreements made under this master agreement cannot eliminate a requirement set by this Agreement.

(3) Before delegating authority under this Agreement, the USMC will provide the Chief, Office of Law Enforcement a roster of Marine Corp Conservation Law Enforcement Officers and installations that will be authorized to enforce the laws specified in paragraph A(1) under this Agreement. The Chief, Office of Law Enforcement will forward this information to his/her designee.

R.S. COLEMAN
Brigadier General
U.S. Marine Corps
Assistant Deputy Commandant
Installations & Logistics

Date: 21 MAY 2003

KEVIN R. ADAMS
Chief, Office of Law Enforcement
U.S. Fish and Wildlife Service

Date: 6-5-03

Attachments

U.S. Fish and Wildlife Service Use of Force Policy
U.S. Fish and Wildlife Service Firearms Policy
U.S. Fish and Wildlife Service Regional Law Enforcement Office Contact Information

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Law Enforcement — **Part 442 Firearms and Use of Force**
Chapter 1 Firearms — **442 FW 1**

1.1 Purpose. This chapter establishes Service policy concerning firearms issued, carried, and/or used by Service law enforcement officers in the performance of their official law enforcement duties.

1.2 Scope.

A. This chapter applies to all Service Law Enforcement Officers. The term law enforcement officer includes Special Agents, Refuge Officers including both full-time and collateral duty officers, and other Service employees that have been granted Service law enforcement authority and who have met the requirements of this chapter and other applicable Service requirements.

B. Nothing in this chapter shall preclude the use of, nor govern the use of firearms in the performance of non-law enforcement activities by Service employees. Non-law enforcement activities in which a firearm may be used include dispatching of injured animals, self-defense against wildlife, predator or stray animal control, covert hunting situations, or similar situations that do not involve the use of a firearm as a force option against a person or persons.

1.3 Policy and Authority.

A. Policy. All Service law enforcement officers shall be properly trained in the use of firearms and equipped with firearms appropriate for the law enforcement duties performed, and unless restricted by the authorities section of this part, shall carry firearms in the performance of their official duties.

B. Authority. Service law enforcement officers are authorized to carry and use firearms as follows:

(1) Service law enforcement officers are authorized to carry and use firearms in the performance of their official law enforcement duties by virtue of the power to arrest contained in the statutes enforced, and as expressly authorized under the Lacey Act Amendments of 1981 [16 USC 3375(b)].

(2) Wildlife inspectors are not authorized to carry firearms in the performance of their official duties unless specifically authorized. Such authorization must have the concurrence of the Chief, Division of Law Enforcement.

(3) Notwithstanding the authority granted by statute, only those law enforcement officers who meet the training standards established by the Service are authorized to carry or utilize firearms in the performance of their official duties.

1.4 Responsibilities.

A. Regional Directors will ensure compliance with all provisions of this chapter. The Regional Director is assisted by the Assistant Regional Director (ARD) for Law Enforcement who is also referred to as the Special Agent in Charge, and the ARD for Refuges and Wildlife. Responsibilities specific to the ARDs are identified throughout the chapter.

B. The Assistant Director - Refuges and Wildlife is responsible for development and maintenance of the Service policy and procedure governing the use of firearms. The Assistant Director is assisted by the Chief, Division of Law Enforcement and the Special Agent in Charge, Branch of Training and Inspection. The Assistant Director is also authorized to develop and issue a Firearms Instructor Handbook. See paragraph 1.10.

11/22/05, FWM 472 — **LAW ENFORCEMENT**
Supersedes 445 FW 4, FWM 306, 12/31/96

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1.5 Authorized Firearms and Ammunition. Only Service issued weapons may be utilized for law enforcement purposes. The carrying of personal weapons for official law enforcement purposes is prohibited. Firearms and related equipment issued to a Service law enforcement officer upon conferral of law enforcement authority shall remain with the law enforcement officer upon transfer or reassignment as long as he or she retains law enforcement authority. Upon separation from the Service or relinquishment of law enforcement authority, all firearms and related equipment will be returned to the Branch of Training and Inspection, Division of Law Enforcement.

A. Service Sidearms.

(1) The standard issue sidearm for all Service law enforcement officers shall be a stainless steel, six (6) shot, double action revolver with a barrel length of two and one half (2) to four (4) inches inclusive, in .357 magnum caliber; or a double action semi-automatic pistol in .45 ACP, .40 Smith and Wesson, .357 Sig, 9mm parabellum calibers, or other calibers that fire a .355 inch diameter or larger bullet and have been authorized by the Division of Law Enforcement. The action in the semi-automatic pistol may be in either of two configurations: (1) double action only in which all trigger pulls are in the double action mode, or (2) mixed double and single action in which the first shot is double action and subsequent shots are single action. The semi-automatic sidearm will have a magazine capacity of at least seven rounds, a magazine release mounted on the side of the frame, an external hammer with a hammer drop lever/decocking lever for the double/single action design, a firing pin safety lock which will allow it be carried safely with a round in the chamber, no external safety which would require manipulation prior to firing in the double action mode, and no magazine disconnect which would prevent the weapon from being fired with the magazine removed.

(2) Operation requirements, such as covert investigations and other special assignments or conditions, may necessitate carrying an alternate sidearm other than the standard issue pistol or revolver. Any double action, semi-automatic pistol or steel frame revolver of at least .38 Special or .380 (9mm KURZ) with a capacity of at least five cartridges owned by the Service may be issued and carried for special law enforcement purposes when authorized by the ARD for Law Enforcement/Special Agent in Charge or ARD for Refuges and Wildlife. When such authority is granted, the law enforcement officer is required to qualify or re-qualify with the alternate sidearm under the same standards applicable to the standard issue handgun.

(3) Service law enforcement officers are authorized to carry a second, concealed back-up sidearm for safety purposes. The back-up sidearm must meet the standards set in either paragraphs (1) and (2) above, and the law enforcement officer must successfully meet the qualification/re-qualification standards established by the Service for back-up sidearms.

B. Shotguns and Rifles.

(1) The standard issue shotgun shall be a 12 gauge pump or semi-automatic police type weapon with a barrel length of eighteen to twenty-one inches, and fitted with rifle sights or optical/electronic sights.

(2) The standard issue rifle for law enforcement purposes shall be a bolt action or semi-automatic in .223 (5.56) or .30 caliber. Approval from the ARD for Law Enforcement/Special Agent in Charge or Assistant Regional Director for Refuges and Wildlife shall be required if non-standard rifles are to be issued and used for law enforcement purposes.

C. Select Fire Weapons. The carrying and use of select fire (fully-automatic) weapons by Service law enforcement officers is not authorized.

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D. Ammunition.

(1) Except for training purposes, only factory manufactured new (as opposed to remanufactured) ammunition may be acquired and carried for use in sidearms used for law enforcement purposes. This ammunition shall be loaded with full metal jacketed or semi-jacketed controlled expansion bullets. Information on suitable, caliber specific, duty ammunition may be obtained from the Branch of Training and Inspection, Division of Law Enforcement.

(2) Target ammunition, reloads, or cartridges loaded with wadcutter bullets may be used for practice, but not when firing a qualification or re-qualification score for record, nor may they be carried for duty purposes. Law enforcement officers will qualify and re-qualify with the same or ballistically equivalent ammunition which normally carried on duty.

(3) Shotgun ammunition utilized for duty purposes shall be factory manufactured 12 gauge, number 00 buck or rifled slugs, or other suitable rounds as recommended by the Branch of Training and Inspection, Division of Law Enforcement.

(4) Only new, commercial factory, or military arsenal manufactured, center-fire rifle ammunition of full metal jacket or jacketed controlled expansion design will be carried or used for law enforcement purposes. For training purposes only, commercially manufactured reloads, of similar bullet design, may be substituted for duty ammunition. Specific recommendations on ammunition may be obtained from the Branch of Training and Inspection, Division of Law Enforcement.

(5) To ensure that all law enforcement officers remain proficient with their weapons, each officer shall be provided with an appropriate number of rounds to meet all re-qualification requirements and to practice with each weapon authorized to be carry. This ammunition shall be in addition to any ammunition provided to the officer for the annual 40 hour in-service training. It shall be the responsibility of the ARD for Law Enforcement/Special Agent in Charge or Assistant Director for Refuges and Wildlife to ensure that this ammunition is provided and fired on an annual basis.

1.6 Carrying and Transporting Firearms. Only Service law enforcement officers who qualify and re-qualify in accordance with this part are authorized to carry firearms for law enforcement purposes.

A. When To Carry. Special Agents and other full-time law enforcement officers are subject to call any time and, therefore, are authorized to carry firearms at all times. Other Service law enforcement officers shall carry firearms when engaged in law enforcement duties, reasonably expected to be engaged in law enforcement duties, or if specifically authorized under specific circumstances. Such specific authorization must be in writing, and signed by the officer's Project Leader or higher level management.

B. Foreign Countries. Service law enforcement officers are not authorized to possess firearms while engaged in law enforcement duties in foreign countries. However, certain conditions might arise that would necessitate that firearms be carried. If a Service law enforcement officer is cognizant of the fact that such a situation might arise, he or she must obtain written permission from the legal authority in the respective host country and from the U.S. State Department. Furthermore, the Chief, Division of Law Enforcement, must concur with this request.

C. Commercial Aircraft. Public Law 87-197, 49 USC 1472(1), provides criminal penalties for the carrying of a firearm aboard a commercial aircraft. The statute specifically states that this prohibition does not apply to agents of the Federal government who are authorized or required within their official capacities to carry firearms. Pursuant to this statute, the Department of Transportation has issued regulations regarding

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carrying firearms on commercial air carriers. These regulations (as contained in 14 CFR 108) require Federal agents meet the following conditions when it is necessary for the firearm to be carried while aboard any commercial aircraft:

(1) The Service law enforcement officer shall notify the airline at least one hour prior to departure (or in the case of an emergency, as soon as practicable) that he or she is a Federal agent who has a need to travel armed. Among other things, this allows the carrier to comply with its regulatory requirements to notify crew members and other law enforcement personnel of the presence and location of each armed person aboard the aircraft.

(2) Armed Service law enforcement officers must identify themselves by displaying their credentials to the appropriate airline and security personnel before carrying a firearm on a commercial aircraft.

(3) The armed Service officer **shall not** consume alcoholic beverages while on board the aircraft, or eight hours before the flight.

(4) In order not to cause undue alarm to any passenger or have the firearm become a target of opportunity for any person, the Service law enforcement officer will exercise the utmost discretion to ensure that the firearm is not observable while in flight status.

(5) When traveling by air on official law enforcement business, Service law enforcement officers shall determine whether the immediate requirements of the particular mission make it necessary for a firearm to be carried on their person.

(6) No firearm shall be carried aboard a commercial aircraft by a Service law enforcement officer when traveling on personal business. However, firearms may be placed in checked baggage in accordance with Paragraph (9) below.

(7) Whenever a firearm is to be carried aboard an aircraft, the Service law enforcement officer shall adhere to all of the above procedures. It should be noted that despite the fact that the Service law enforcement officer feels that the scope of the enforcement mission requires that he/she carry a firearm on board an aircraft, airlines are not required to transport armed law enforcement officers and may deny boarding to the armed officer.

(8) Except as required when checking baggage with the airlines, Service law enforcement officers will not surrender any firearm to airline personnel in order to obtain a boarding pass from the airline.

(9) When in the judgement of the Service law enforcement officer the immediate requirements of a particular law enforcement mission do not warrant the carrying of a firearm aboard the aircraft, the firearm may be placed in checked baggage in accordance with the following requirements:

(a) The Service law enforcement officer must ensure that the firearm is **unloaded**, secured within hard-sided luggage, or placed in a hard-sided container within soft-sided luggage; and placed in luggage to which only the officer transporting the firearm retains the key or combination to the lock.

(b) The Service law enforcement officer must advise the airline that the above procedures have been followed, and if requested, allow airline personnel to inspect the weapon at the ticket counter when the luggage is checked.

(c) The Service law enforcement officer shall ensure that the "firearms" tag is placed inside the shipping

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container (luggage), and not affixed to the outside.

(10) Under no circumstances will a Service law enforcement officer carry OC-10, Cap-Stun, other pressurized Oleoresin capsicum agents, mace, tear gas, chemical agents, or other gaseous products in a pressurized container on board an aircraft, or place such items in their checked baggage or luggage.

1.7 Initial Firearms Training.

A. Service Sidearms.

(1) Permanent Personnel. Initial training in the use of an approved Service sidearm shall be accomplished by the law enforcement officer-trainee's successful completion of the Basic Criminal Investigators School (CI), or the Basic Law Enforcement Course for Land Management Agencies (LM) as administered by the Federal Law Enforcement Training Center (FLETC). All law enforcement officer-trainees must fire a minimum score of 80 percent or better on the course of fire utilized for qualification purposes during this basic training. In addition, when firearms training is incorporated into either the Special Agent Basic (SABS) or the Refuge Officer Basic (ROBS); all Service officer-trainees attending must successfully complete this training by firing a minimum score of 80 percent on al qualification courses fired for record. The inability of a Service law enforcement officer-trainee to qualify at the 80 percent or better level will result in his/her failure to successfully complete this required basic training.

(2) Seasonal Personnel. In order to meet basic training requirements for carrying Service sidearms, seasonal law enforcement officers must successfully complete 1) a law enforcement training course approved through the National Park Service Training Program for Seasonal Employees, or 2) a law enforcement training course approved by the Department of the Interior and the Service as a substitute to the Basic Law Enforcement Course for Land Management Agencies. Any waivers to 1) or 2) above must be approved by the Chief, Division of Law Enforcement. When recency of training exceeds three years, seasonal employees may retain law enforcement authority, and may continue to be authorized to carry Service firearms only if they have been actively involved in law enforcement since their initial training, and have re-qualified every six months or prior to resuming their seasonal duties.

(3) Sidearm Specific Training.

(a) The initial training referred to in paragraphs (1) and (2) above must be specific to the type of sidearm (i.e. revolver vs semi-automatic pistol) that the Service law enforcement officer will be issued upon conferral of authority. If a different type of sidearm was used during initial training, the Service law enforcement officer must successfully complete the appropriate transitional firearms program for the weapon he or she will be issued. The appropriate transitional firearms program shall be specified by the Branch of Training and Inspection.

(b) The appropriate transitional firearms training must be completed prior to the Service law enforcement officer being issued a Service approved sidearm of a different type than the one used during initial training. After receiving transitional training, the officer must be issued an appropriate weapon within ninety (90) days. If the sidearm cannot be issued within this ninety (90) day time frame, a refresher training course authorized by the Branch of Training and Inspection will have to be completed.

B. Service Shotguns. Initial training in the use of an approved Service shotgun shall be accomplished by the Service law enforcement officer-trainee's successful completion of the CI Program, or the LM Program as administered by FLETC. If this initial training has not been received by the law enforcement officer, the office must demonstrate proficiency with the shotgun by qualifying in accordance with paragraph D below

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prior to being issued this weapon.

C. Service Rifles. Service law enforcement officers are authorized to carry approved rifles for law enforcement purposes only when they have successfully completed the required rifle training specified by the Branch of Training and Inspection.

1.8. Firearms Qualification and Requalification

A. Qualification. Initial qualification by all Service law enforcement officer-trainees is accomplished by firing a minimum score of 80 percent or better during the CI Program, the LM Program, the appropriate seasonal program as described in paragraph A(2) above or the appropriate transitional program as described in 1.7A(3)(a)above.

B. Requalification. After initial qualification, all Service law enforcement officers shall receive a minimum of four (4) hours of firearms training annually. In addition, every law enforcement officer must requalify every six (6) months, with each Service weapon they wish to carry. Re-qualification shall be accomplished by firing for record the required score of at least 80 percent on an authorized course of fire for each Service weapon which will be carried for law enforcement purposes. Law enforcement officers will also receive refresher or additional training in weapon handling, tactics, and other firearms skills necessary to effectively use their issued weapons.

(2) All Service law enforcement officers must fire an authorized reduced-light course annually with their primary sidearm.

C. Scores. All scores fired for record during initial qualification and re-qualification must be fired under the supervision of a certified range officer or certified firearms instructor.

D. Records. All firearms records shall be maintained on Form 3-2085, Firearm Training Record, Exhibit 1 and forwarded to the ARD for Law Enforcement/Special Agent in Charge or designee and shall constitute the official record. For refuge law enforcement officers, the official record shall be forwarded to the Regional Refuge Law Enforcement Coordinator or designee. This official record shall only indicate that the Service law enforcement officer passed or failed the qualification or re-qualification standard. These records must be maintained for not less than five (5) years. The records shall indicate the date of firing, time of day, weather conditions, course of fire, number of rounds, ammunition type, weapon used and range location. In addition, the records shall identify the certified range officer or certified firearms instructor under whose supervision the firing occurred, and note any specialized instructions given to individual shooters.

E. Targets. All scores fired for record shall be fired on approved targets. Approved targets are specified for each course of fire. The firing of a score for record on any target not specified in each course of fire shall require the prior approval of Branch of Training and Inspection, and shall be noted on the Firearms Training Record.

F. Authorized Courses of Fire.

(1) Except as noted below, only the courses of fire approved and maintained by the Branch of Training and Inspection may be used by Service law enforcement officers for re-qualification purposes.

(2) Other Courses of Fire. If under unusual circumstances a law enforcement officer is unable to fire an approved course of fire specified in this chapter due to a remote duty station location, no appropriate firing

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range facilities, or other limiting factor; the officer may re-qualify on any approved practical police course used by any police agency in the surrounding area. Service law enforcement officers using an alternate course of fire, however, shall obtain prior approval from their ARD or designee. All the other requirements in this chapter shall remain the same.

1.9 Certified Firearms Instructors.

A. Within each region the ARD for Law Enforcement/Special Agent in Charge and ARD for Refuges and Wildlife shall designate employees within their respective programs to serve as Service Designated Firearms Instructors (SDFI). To serve as a SDFI an employee must have graduated from a basic Firearms Instructor Training Course at the Federal Law Enforcement Training Center or an equivalent course of instructor approved by the Branch of Training and Inspection. The employee must also have served as a primary or assistant instructor at one or more Service firearms training/re-qualification sessions within the past year. Designated Firearms Instructors assist the Lead Regional Firearms Instructor.

B. Within each region the ARD for Law Enforcement/Special Agent in Charge and the ARD for Refuges and Wildlife shall designate employees within their respective programs to serve as Lead Regional Firearms Instructors. The primary role of Lead Regional Firearms Instructors is to oversee firearms training, re-qualification, and weapon familiarization at the field level for those employees with law enforcement authority. Lead Regional Firearms Instructors are responsible for planning, organizing, implementing and evaluating the firearms training program within their respective programs.

C. Certification.

(1) The Branch of Training and Inspection will maintain a list of all individuals qualified to serve as Service Designated Firearms Instructor, and a list of those persons designated as the Lead Regional Firearms Instructors for each region. Such information shall be available to the ARD for Law Enforcement/Special Agent in Charge and the ARD for Refuges and Wildlife to be considered prior to designation of Firearms Instructors. The Special Agent in Charge, Branch of Training shall be notified in writing of all designations.

(2) Service Designated Firearms Instructor designations will remain in effect until such time as an instructor fails to conduct or assist in the presentation of one training/re-qualification session in two consecutive years or the designation is changed by the responsible ARD.

(3) Reinstatement as a Service Designated Firearms Instructor must be initiated by written request to the ARD for Law Enforcement/ Special Agent in Charge or Assistant Regional Director for Refuges and Wildlife. Reinstatement will be granted only after successful completion of a Service refresher or other approved refresher course as specified by the Branch of Training and Inspection, if the individual has not maintained qualifications as indicated in paragraph (2) above.

D. Non-Service Firearms Instructors. When special circumstances exist and a Service Designated Firearms Instructor is not available to conduct re-qualification this duty may be performed by a certified range officer or certified firearms instructor employed and designated by any bona fide Federal, State, County, or Municipal police agency. The reporting requirements as contained in this chapter must still be completed for any re-qualification conducted by non-Service firearms instructors.

E. In-Service Training for Firearms Instructors. Every three years, a 24 hour in-service training session will be conducted for Service firearms instructors. The Branch of Training and Inspection shall be responsible for the development and coordination of these training sessions. The ARD for Law Enforcement/Special Agent in Charge and ARD for Refuges and Wildlife shall nominate those firearms

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instructors who will attend this training. However, attendance is mandatory for Designated Lead Regional Firearms Instructors.

1.10 Firearms Instructors Handbook. The Branch of Training and Inspection is responsible for the development, coordination, issuance and revision of the Firearms Instructor Handbook. The Handbook will contain applicable copies of the Department and Service firearms policies and guidelines; approved courses of fire; lesson plans; re-qualification reporting procedures and formats; and other information deemed necessary for proper administration of the Service's firearm programs.

1.11 Firearms Maintenance, Inspection, and Storage.

A. Maintenance. Each law enforcement officer is responsible for the care and routine cleaning of all assigned firearms. To ensure reliability, all ammunition carried in the firearm and ammunition carriers shall be replaced semi-annually. Law enforcement officers are not authorized to disassemble any Service firearm beyond the level specified during the training received for that firearm. Nor may they or anyone else modify in any way the internal/external parts of any firearm. The addition of after-market grips to a Service sidearm is authorized with the approval of a Service Armorer. The addition of accessories or other modifications to Service owned firearms used for law enforcement purposes may only be done by Service Armorers or by the factory, or other certified armorers with the approval of a Service Armorer.

B. Inspection and Repair. Service firearms shall be inspected at least annually by a certified armorer to ensure proper functioning. Certified armorers may disassemble Service firearms as necessary to inspect and analyze problems with the mechanical functioning of the weapons. If a firearm is found to have mechanical modifications that pose a safety hazard or if malfunctions or excessive wear are observed, the firearm is to be immediately removed from service until repaired or replaced. If immediate repairs are not possible, the law enforcement officer shall be issued a replacement firearm of the same type until such time as the officer's weapon is repaired. Firearms found to be unreliable, or in need of excessive repair, must be surveyed and, if appropriate, replaced. All repairs made to any Service firearm must be documented. Records of all annual firearm inspections and repairs shall be maintained by the ARD for Law Enforcement/Special Agent in Charge or designee. For refuge Law Enforcement officers, these records shall be maintained by the Regional Refuge Law Enforcement Coordinator or designee.

C. Storage.

(1) Service officers are responsible for the safe and secure storage of all firearms assigned to them. Service firearms that are not routinely carried shall be stored at Service facilities in a vault, gun locker, or other location which is secured in such a manner as to substantially reduce the possibility of theft or unauthorized removal. These firearms shall be unloaded, with the action open (out of battery).

(2) Service law enforcement officers may leave firearms that are routinely used for law enforcement operations in Service vehicles. Care should be exercised by law enforcement officers in removing and securing the firearms so as not to draw any undue attention which might result in the theft or unauthorized removal of the firearms.

(3) Service firearms carried in vehicles must be secured in locked boxes, trunks, or other locations which will reduce the risk of theft or unauthorized removal, unless their use is imminent. Firearms shall not be stored in vehicles that are not in routine use and which are left unattended for extended periods of time.

(4) If at all possible, firearms should be stored at the law enforcement officer's duty station. However, when it is impractical to do so, or operational requirements dictate otherwise, law enforcement officers are authorized to store them at their residence, provided appropriate safeguards are taken. Family members

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should be educated not to handle these firearms. Firearms stored at a residence must stored under lock and key, unloaded, actions open (out of battery) with the ammunition stored separately.

D. Loss of Firearms. Service law enforcement officers shall verbally report the loss or theft of any Service firearm to his or her immediate supervisor, the local Federal Bureau of Investigation office, and the pertinent local police jurisdictions. This report should include weapon make, model number, serial number, and caliber. These oral reports must be followed by a written report from the law enforcement officer within seventy two (72) hours. The officer's immediate supervisor shall forward a copy of the report to the ARD for Law Enforcement/Special Agent in Charge or ARD for Refuges and Wildlife for compliance with report of survey requirements in accordance with 310 FW 7, Report of Survey.

1.12 Service Designated Armorer.

A. Within each region the ARD for Law Enforcement/Special Agent in Charge and the ARD for Refuges and Wildlife shall designate employees within their respective programs to receive training and serve as Service Designated Armorers (SDA). Service Designated Armorers will perform routine inspection, maintenance, and repair of Service firearms.

B. Service Designated Armorers must have graduated from a factory sponsored training course for the specific firearm(s) for which certification is required, and must successfully meet all factory re-certification requirements.

C. The Branch of Training and Inspection shall be advised of all Service Designated Armorer designations and shall maintain a list of all Service Designated Armorers. This list shall include the name, duty location, Division identification, and what weapon certification is held by each armorer.

/sgd/ Denise E. Sheehan, Assistant Director – Budget, Planning and Human Resources
for DIRECTOR

Date: November 22, 2005

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Law Enforcement — **Part 442 Firearms and Use of Force**
Chapter 2 Use of Force Policy — **442 FW 2**

2.1 Purpose. This chapter establishes a uniform policy regarding the use of force by Service officers in the performance of their official law enforcement duties.

A. This policy is intended to provide Service officers with an understanding of the various force options available to them, and when the application of a particular option or level of force would be considered legally permissible and reasonably necessary to perform their duties, and to protect themselves and others.

B. For the purposes of this Part 442, the term Service law enforcement officer, Service officer, or officer means any Service employee authorized to carry and utilize firearms in the performance of their official law enforcement duties.

2.2 Policy. Service law enforcement officers will use only that force necessary and reasonable to overcome the resistance offered by a suspect or individual. The level of force used by a Service officer must not be excessive or unjustified.

2.3 Definitions. The following terms and definitions are to be used in the practical application of the use of force.

A. Force. Physical presence, action or exercise of strength to compel another to act or refrain from certain behavior. It may include physical touching of another, striking, kicking, the use of chemical agents and other intermediate force weapons, restraints, and/or firearms.

B. Non-lethal Force. Force used to control a suspect or prisoner, or other person when justified, which does not normally result in serious injury or death. This usually includes physical touching of a suspect, and may be in the form of control techniques, Oleoresin Capsicum, batons, or restraining devices.

C. Deadly Force. Force which is intended or likely to cause death or serious bodily harm. Most often, deadly force involves the use of a firearm aimed at a suspect. Deadly force actually encompasses any means or instrumentality which may inflict death or serious bodily injury.

D. Unjustified or Excessive Use of Force. Force without justification or excuse; or the application of force clearly beyond that called for given the suspect's level of resistance.

2.4 Application of Force.

A. Levels of Control/Force. The levels of control or force utilized by Service officers to overcome a suspect's/individual's resistance are categorized as follows.

(1) Officer's Presence

(2) Verbal Direction

(3) Soft, empty hand control

(4) Hard, empty hand control

(5) Chemical Agents (Oleoresin capsicum)

(6) Impact Weapons

11/22/05, FWM 473 — **LAW ENFORCEMENT**
Supersedes 442 FW 1, FWM 247, 03/29/96

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Chapter 2 Use of Force Policy — **442 FW 2**

(7) Deadly Force

B. Use of Restraints. Service officers may routinely use handcuffs, flex-cuffs, legcuffs and body chains to justifiably control, restrain, and transport persons. Restraining devices will be applied properly and in accordance with the training received so as to minimize the risk of unnecessary injury.

C. Avoidance of Risk. Service officers should not take undue risks that could result in death or serious bodily harm. Whenever possible, officers should attempt to defuse and stabilize any dangerous situation(s) by using communication skills and/or waiting for backup assistance. Officers are never required to take UNREASONABLE risks and may opt to disengage or withdraw if such action can be safely accomplished without further endangering themselves, other officers or the public.

D. Degree of Force. Service officers will only use that degree of force that is legally permissible; reasonably necessary to perform their duties; and is required to protect themselves and others. The degree of force applied depends on the circumstances and facts of a particular incident, and is governed by the following conditions:

(1) The degree of resistance or force threatened or exhibited by the suspect(s), including the suspect's possession or non-possession of a deadly weapon; and

(2) The officer's perception of that resistance, including the jeopardy of death or serious bodily harm to the officer or others implied by the suspect.

E. Deadly Force Policy. The use of deadly force is the highest level of force that can be employed by a Service officer. It will normally involve the aimed discharge of a firearm at a person with the intended effect to be the immediate incapacitation of that person. The following deadly force policy will apply to all Service officers:

A SERVICE OFFICER MAY ONLY DISCHARGE HIS OR HER FIREARM DIRECTLY AT ANOTHER PERSON WHEN THE OFFICER REASONABLY BELIEVES THAT THE OFFICER OR ANOTHER INDIVIDUAL IS IN IMMINENT DANGER OF DEATH OR SERIOUS BODILY INJURY.

2.5 Chemical Agents.

A. Oleoresin capsicum (OC). The only approved chemical agent that may be used by Service officers is Oleoresin capsicum. The Service recognizes OC as a non-lethal force alternative which can be used to defends or against and control actively resistant or violent offender/individuals. Based on the Service officers reasonable perception that OC is necessary to avoid a physical confrontation, OC may be used immediately PRIOR to hard, empty hand control techniques, impact weapons, or deadly force.

B. Authorization. Only those Service officers who have successfully completed Service approved training in the use of OC are authorized to carry and use this agent. Only Service owned and issued OC is authorized.

2.6 Impact Weapons. Service officers who have successfully completed the required training are authorized to use a baton (either straight or collapsible). This weapon may only be used by Service officers when the offender is engaged in physically aggressive resistance which puts the officer at risk of bodily harm. Batons may only be used in accordance with the training received.

2.7 Firearms

A. Guidelines. The following guidelines will govern the use of firearms by Service officers.

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(1) A firearm will be fired directly at a person only with the intent of rendering the person incapable of continuing the action or activity that justified the use of deadly force. The use of deadly force will be justified based upon the circumstances known to the officer at that time, and where the immediate application of deadly force is the only reasonable means by which the person can be quickly and dependably incapacitated or stopped.

(2) Firing at a fleeing suspect is not justified unless the Service officer has reasonable cause to believe the fleeing person poses an immediate threat of serious bodily injury or death to the officer or others, has the means to carry out that threat, and manifests an intent to do so.

(3) Warning shots can pose a hazard to innocent persons, therefore their use by Service officers is not authorized.

(4) In the presence of the public, a sidearm should only be drawn when the Service officer has cause to believe it may be needed, and to leave it in the holster would place the officer at a distinct disadvantage.

(5) Shoulder weapons (shotguns and rifles) may be displayed only when appropriate and when their use may be required.

B. Authorization. Only those Service officers who have successfully completed Service approved training on the use of firearms and are currently qualified are authorized to carry and use firearms. Only Service owned and issued firearms are authorized.

/sgd/ Denise E. Sheehan, Assistant Director – Budget, Planning and Human Resources
for DIRECTOR

Date: November 22, 2005

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Law Enforcement — **Part 442 Firearms and Use of Force**
Chapter 3 Reporting and Board of Review — **442 FW 3**

3.1 Purpose. This chapter establishes procedures for reporting the use of force or the discharge of firearms by Service officers and for convening a Board of Review (BOR) in such instances.

3.2 Scope.

A. This chapter applies to the use of force only where serious bodily injury has occurred, or the intentional or unintentional discharge of a firearm, by Service officers while performing law enforcement duties.

B. This chapter does not apply to the discharge of a firearm for training, qualifying, or non-law enforcement purposes.

3.3 Responsibilities.

A. Assistant Director-Refuges and Wildlife. The Assistant Director ensures the development of Service policy governing the use of force and that the policy remains current. The Assistant Director is assisted by the **Chief, Division of Law Enforcement.**

B. Regional Director. The Regional Director convenes and acts on the report of a Board of Review in accordance with this chapter and provides for logistical and clerical support as needed. The Regional Director also ensures that personnel involved in use of force incidents are offered psychological counseling.

C. Deputy Director - Staff. Within the Washington Office, responsibilities identified for the Regional Director are assumed by the Deputy Director - Staff.

D. Chairperson, Board of Review. The chairperson will ensure that the BOR fulfills its duties in accordance with this chapter and submits its final report to the Regional Director within the allotted time.

3.4 Reporting Requirements.

A. Service Officer.

(1) Whenever a Service officer has been involved in a use of force incident where serious bodily injury has occurred, or has discharged a firearm, except for training or non-law enforcement purposes, the involved officer shall as soon as possible verbally notify the immediate supervisor.

(2) The officer should notify local law enforcement authorities of use of force incidents, advise them of any arrests, and request that a crime scene investigation be initiated.

(3) Within seventy-two (72) hours, the involved officer shall prepare and submit a written report detailing the circumstances that resulted in the discharge of the firearm or use of force. This report shall be submitted to the officer's immediate supervisor. It is the official report of the incident and is not considered a statement covered by section 3.6

B. Supervisory Personnel.

(1) Upon receipt of the officer's verbal notification, the immediate supervisor shall as soon as possible notify

11/22/05, FWM 474 — **LAW ENFORCEMENT**
Supersedes 442 FW 2, FWM 247, 03/29/96

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the appropriate Assistant Regional Director and the Chief, Division of Law Enforcement.

(2) The Chief, Division of Law Enforcement shall notify other Service/Department personnel as deemed appropriate, or as may be required by Department policy.

3.5 Other Actions Attendant to Incidents with Serious Bodily Injury or Death. Based on the initial facts known regarding the firearm discharge or other use of force, the following actions shall be taken.

A. Medical Aid. The officer should render or arrange for emergency medical aid for all injured persons when it is safe for the officer to do so.

B. On-Scene Presence. Upon receipt of the Service officer's notification, the immediate supervisor or other designated person shall:

(1) Report to the scene of the incident, or to where the involved officer is located. If the immediate supervisor is unable to report in a timely manner, the supervisor will arrange for another Service officer to immediately report to the scene or the officer's location.

(2) If the supervisor or designate deems it appropriate, take custody of all firearms that have been discharged by Service officers during the incident and retain them in the supervisor's custody until the conclusion of the BOR investigation; unless the weapons are being held by the local law enforcement agency. All such weapons shall be made available to the BOR for testing and other uses if the board deems it appropriate.

C. Administrative Leave. The officer will be placed on administrative leave with full pay pending the conclusion of the review by the BOR. The involved officer may be returned to restricted or non-restricted duties prior to the completion and submission of the BOR's final report when the Regional Director and Chief, Division of Law Enforcement concur that it is appropriate to do so.

3.6 Statements by Service Officers.

A. A Service officer should not give any oral or written statements to anyone, including the investigative agency at the scene until he/she has contacted his/her immediate supervisor. Depending on the seriousness of the incident, the involved officer may wish to wait 24 hours before making any statements regarding the incident.

B. With the exception of the official notifications and report of the incident required in section 3.4A, all statements, either oral or written, required to be made by Service officers to their supervisors or the BOR are for internal Service administrative purposes ONLY. Such statements will not be used in any criminal or civil proceeding that may result from the incident. Any officers involved in a use of force incident will be afforded up to forty-eight (48) hours to seek private legal counsel prior to making any statements. Should the officer retain private counsel, it will be at the officer's own expense. If retained, private counsel may be present during any questioning of the involved officer, and may provide assistance with the preparation of all oral and written statements.

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3.7 Psychological Counseling.

A. The Service shall make available to all Service officers and their immediate families, at no cost to them, professional psychological counseling whenever the officer has been involved in a use of force incident or other traumatic incident that may affect the officer or his/her family.

B. The use of this resource is entirely at the discretion of the officer or his/her family, except that the Regional Director may require such counseling when making a fitness for duty determination based on a recommendation by the BOR. The psychological counseling provided by the Service shall be of a reasonable duration and is intended to assist the officer and his/her family in dealing with the initial shock or psychological trauma that may result from the incident.

C. The offer of psychological counseling does not preclude the officer from obtaining counseling from anyone he/she desires, but at the officer's own expense.

D. Health care professionals involved in providing this service, absent a court order, will not divulge to any investigative body the contents of any discussions they have had with the officer or members of his/her family. The only exception to this will be the requirement to offer comments to the Service as to the officers fitness for duty.

3.8 Board of Review. Whenever a Service officer is involved in a use of force incident where serious bodily injury has occurred, or where the officer has discharged a firearm, either intentionally or unintentionally, excluding discharges during training and for non-law enforcement purposes; a Board of Review shall be convened to gather information and facts, conduct interviews, document, and make recommendations concerning any administrative actions that may be taken by the Service as a result of the incident.

A. Convening Authority. The Regional Director will convene the BOR as soon as practicable. Specifically, within 72 hours of being notified of an incident or discharge, the Regional Director will issue a document that impanels the members of the BOR, identifies the chair, states the purpose of the investigation, provides instructions by referencing this chapter, and specifies the date when the final report is due.

B. Composition.

(1) The BOR will consist of a special agent from the Division of Law Enforcement's Branch of Training and Inspection; a management official knowledgeable and/or experienced in the field of operation in which the incident or discharge occurred; and a field officer knowledgeable and/or experienced in the field of operation in which the incident or discharge occurred, and selected by officer involved. In the event more than one officer is involved, two field officers shall be selected by the officers involved.

(2) The BOR will be chaired by the special agent from the Branch of Training and Inspections.

(3) The management official selected must have law enforcement authority and shall not be in the direct line of supervision of the officer or officers involved in the incident or discharge being reviewed.

C. Duties. The BOR shall review the instance to:

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(1) Determine whether the incident or discharge was appropriate. In arriving at such determination the BOR shall:

(a) consider all property damage and personal injury or death to any persons involved;

(b) consider whether officers involved complied with existing Service policy;

(c) identify any weakness or defects in exiting Service policy; and,

(d) determine whether Service policy was effectively communicated.

(2) Recommend appropriate action to reduce likelihood of recurrence of the incident or discharge.

(a) Recommendations may address the need to review or revise existing procedures; provide additional training to parties involved both directly or indirectly; or take appropriate administrative action against parties involved, both directly and indirectly.

(b) The BOR will no recommendation concerning criminal or civil action.

(c) In the event that administrative action is recommended, the BOR will not recommend a specific administrative action to be taken.

(3) The BOR will clearly identify its "judgement calls" where they may differ from the judgements of others involved.

D. Report.

(1) The final report shall be concurred in by a majority of BOR members, and be signed by those concurring members. Any member that disagrees with the findings and recommendations of the Board, will submit a minority report. The final report(s) shall be submitted within thirty (30) days of impanelment to the convening authority (Regional Director.)

(2) The final report of the BOR is an internal document to be considered by management for the purpose of reviewing all use of force incidents and determining appropriate action. As such, the report does not constitute or contain an official position of the Service.

/sgd/ Denise E. Sheehan, Assistant Director – Budget, Planning and Human Resources
for DIRECTOR

Date: November 22, 2005

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U.S. Fish and Wildlife Service Regional Law Enforcement Office Contact Information

JURISDICTION	SPECIAL AGENT IN CHARGE
REGION 1: California, Hawaii, Idaho, Nevada, Oregon, Washington, American Samoa, Commonwealth of the Northern Mariana Islands, and Guam,	SAC U.S. Fish and Wildlife Service/Law Enforcement 911 N.E. 11th Avenue Portland, OR 97232-4181 Main: 503-231-6125 Fax: 503-231-6197
REGION 2: Arizona, New Mexico, Oklahoma, and Texas	SAC U.S. Fish and Wildlife Service/Law Enforcement 500 Gold Ave SW, RM 9021 Albuquerque, NM 87102 Main: 505-248-7889 Fax: 505-248-7899
REGION 3: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin	SAC U.S. Fish and Wildlife Service/Law Enforcement P.O. Box 45 Federal Building Fort Snelling, MN 55111-0045 Main: 612-713-5320 Fax: 612-713-5283
REGION 4: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Puerto Rico, and the U.S. Virgin Islands	SAC U.S. Fish and Wildlife Service/Law Enforcement P.O. Box 49226 Atlanta, GA 30359 Main: 404-679-7057 Fax: 404-679-7065
REGION 5: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia	SAC U.S. Fish and Wildlife Service/Law Enforcement 300 Westgate Center Drive Hadley, MA 01035 Main: 413-253-8274 Fax: 413-253-8459
REGION 6: Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, and Wyoming	SAC U.S. Fish and Wildlife Service/Law Enforcement P.O. Box 25486 – DFC Denver, CO 80225 Main: 303-236-7540 Fax: 303-236-7901
REGION 7: Alaska	SAC U.S. Fish and Wildlife Service/Law Enforcement 1011 E. Tudor Road, Mail Stop 151 Anchorage, AK 99503-6199 Main: 907-786-3311 Fax: 907-786-3313
REGION 9: Headquarters Office	SAC U.S. Fish and Wildlife Service/Law Enforcement 4401 N. Farifax Drive, Mail Stop LE3000 Arlington, VA 22203 Main: 703-358-1949 Fax: 703-358-2271

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APPENDIX C

The installation CLEP is currently using the following ammunition:

12 ga Federal 2 3/4 #6 shot

12 ga Federal 3 1/2 # 1shot

12 ga Remington 2 3/4

12 ga Remington 2 3/4

12 ga Remington 3" #1 shot

12 ga Remington 3" #2 shot

12 ga Remington 3" BBB

12 ga Remington Nitro-steel 3" #1

12 GAUGE BIRDFRITE SCARE CARTRIDGES, aka Bangers

12 Gauge Nitro-Steel High Velocity Magnum Load Shotshell, 3" Shell, #1 Zinc-Plated Shot, 1-1/4 oz., 1390 fps, 25 Rounds Per Box

12 Gauge Remington Sportsman Hi-Speed Steel, 2-3/4", #6 Steel Shot, 1 oz., 1365 fps, 25 Rounds per box

12 GAUGE SHELL CRACKERS, aka Bangers

22 cal

Assorted for launcher

CCI 22 cal. Mini mag

CCI 22cal shot shell

CCI mini mag

CCI shot shell

Daisy

daisy .177 cal pellets

daisy .22 cal pellets

Federal 308 win

Federal 22 cal.

Federal 7mm

Federal premium 3 1/2"

Federal premium 3"

Federal rifle 308 win

Margo 12 ga scare
Margo supplies
Moog Feuerwerk jet firecracker
Moog jet fire cracker
PMC Pistol
PMC Pistol Cart.
PMC subsonic
PMC subsonic 22 cal
Quick silver
Reed Bird bangers
Reed Joseph bird banger
Reed Joseph screamer
Reed Screamer's
Remington 2 3/4"
Remington 22 subsonic
Remington 3"
Remington 3" # 1
Remington 3" BBB
Remington 9 pellet 00 bk
Remington Nitro-Steel Magnum
Remington subsonic
Starter 6mm caps
Winchester 12 ga 3" #2 shot
Winchester Supreme 3 1/2"
Zink Feuerwerk cracker
Zink Feuerwerk bird bomb
Zink Feuerwerk pyro- cracker

Enclosure 24 NASO Environmental Management Sytem Internal Audit Plan

ENVIRONMENTAL QUALITY ASSESSMENT

INTERNAL ASSESSMENT PLAN

OPNAV M-5090.1 Chapter 18

NAVAL AIR STATION OCEANA-

DOCUMENT TITLE:

Naval Air Station Oceana Internal Assessment Plan

CONTENTS:
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DOCUMENT OWNER: NAVFAC MIDLANT ENVIRONMENTAL MANAGEMENT COORDINATOR	AUTHORIZED BY: NAVAL AIR STATION OCEANA INSTALLATION ENVIRONMENTAL PROGRAM DIRECTOR 2/27/2017 X Terry N Chamberlain Terry Chamberlain

REV NO.	EFFECTIVE DATE	DESCRIPTION OF REVISION
A	6/30/04	Original Issue
B	3/5/08	Complete revision (update of roles and responsibilities and assessment areas)
C	10/26/12	Complete revision
D	12/20/13	Update of Hazardous Waste section, and Appendices A, B, and C
E	12/22/14	Annual Review & Update
F	2/1/2016	Annual Review and Update

TABLE OF CONTENTS

A. INTRODUCTION

Chapter 18 of OPNAV M-5090.1 requires all Navy shore installations to prepare an Internal Assessment Plan (IAP) describing "how a comprehensive internal compliance assessment will be accomplished across the facility over the course of a year."

This IAP meets the requirements in Chapter 18 by:

- Describing Public Works Department (PWD) Naval Air Station Oceana (NASO) approach to executing the internal assessments;
- Identifying internal assessment roles and responsibilities;
- Identifying the frequencies of inspections and compliance evaluations conducted by PWD NASO Environmental staff and tenant command personnel; and
- Identifying PWD NASO process/practice inventory.

The IAP focuses on the environmental management of each of the following media areas:

- Air Emissions
- Cultural Resources
- Environmental Management
- Hazardous Materials
- Hazardous Waste
- Natural Resources
- Pesticide
- Petroleum Oils and Lubricants (POL)
- Solid Waste
- Storage Tank
- Wastewater
- Storm Water
- Water Quality
- Other (NEPA, Noise, CERCLA, Program Management, Waste Munitions, and EMS)
- Toxic (PCBs, Asbestos, Radon, and Lead-Based Paint)

Each media section presented in Section C of this IAP describes the plans, procedures, requirements, and responsibilities for each media covered under the Internal Assessment process for NASO, Dam Neck Annex, Dare County, and Fentress Air Field. Environmental programs at each location are overseen and managed by the NAVFAC Mid-Atlantic, PWD NASO. Henceforth in this document, the term “PWD NASO” will refer to the four installations.

Each media section identifies specific actions and plans to properly assess each media and includes a description for how the media is to be managed, a list of specific tasks for installation personnel to perform, a list of specific tasks the media manager will perform, frequency of each inspection/audit, and assigned responsibilities.

All scheduled Tier 1 (where applicable) inspections and Tier 2 oversight inspections conducted by PWD NASO Environmental Protection Specialists (EPS) are recorded through

EMSWeb. Building locations, areas, environmental equipment and checklists are maintained in EMSWeb. Appendix A of this document references the list of EPS environmental checklists maintained in EMSWeb. Audit/Inspection schedules for Tier 1 and Tier 2 inspections define the equipment/areas being inspected and the frequency of the inspection. Appendix B of this document references the list of Tier 1 and Tier 2 inspection schedules that are maintained in EMSWeb. For a full list of equipment and areas being inspected, please refer to EMSWeb. Results of inspections, assigned root causes for deficiencies, and the status of Plans of Action & Milestones (POA&M) for corrective actions and process improvement are all tracked in EMSWeb.

All Tier 3 internal comprehensive evaluations of compliance assessment conducted by PWD NASO Environmental Media Managers (MM) are recorded through EMSWeb. Appendix A of this document references the list of Navy ListBuilder checklists available in EMSWeb that may be used to conduct the Tier 3 assessments. Tier 3 assessment schedules built under PWD NASO in EMSWeb should cover the following areas:

- Air Emissions
- Cultural Resources
- Hazardous Waste
- Natural Resources
- NEPA
- P2/ Pest Management/Toxics
- POL
- Storage Tanks
- Wastewater
- Storm Water
- Water Quality

Since the EMS that covers PWD NASO is a regional EMS, the internal conformance audit will be located at the Hampton Roads Regional level.

During the 4th quarter of each calendar year, the PWD NASO EMS Coordinator will document the completion of all Internal Assessments conducted by PWD NASO environmental media managers in an Internal Assessment Document (IAD). The IAD will provide the results of internal assessments and include identified deficiency numbers, status of assigned root cause(s), and status of Plans of Action & Milestones (POA&M) for corrective actions and process improvements. All of the previous information will be recorded and managed throughout the year in EMSWeb.

B. ROLES AND RESPONSIBILITIES

Installation Commanding Officer (CO)

1. Ensure the IAP is developed and implemented within all PWD NASO Departments and tenant commands and that it addresses all facilities and processes within the fence line.
2. Ensure the IAP is reviewed and updated at least annually.

PWD NASO Installation Environmental Program Director (IEPD)

1. Provide oversight to environmental media managers and Installation EPS to ensure that inspections and compliance evaluations are conducted in accordance with the IAP.
2. Review internal assessment activities within each environmental media area to ensure that internal assessment requirements and objectives are being met.
3. Communicate with the installation CO regarding plans, status, and results of the internal assessment.
4. Provide a liaison to PWD NASO Departments and tenant commands, as appropriate, on internal assessment issues.

PWD NASO Environmental Protection Specialists (EPS)

1. Provide environmental oversight, coordination, and training to all PWD NASO Departments and tenant command process owners.
2. Conduct inspections/compliance evaluations of all pertinent processes according to the schedule delineated in the IAP Inspection Summary
3. Lead Environmental Protection Specialists (LEPS) will coordinate with installation staff and Media Managers (MM) to ensure that equipment lists, inspections assignments and locations are reviewed and up-to-date each quarter, and ensure inspections are being entered into EMSWeb.

PWD NASO EMS Coordinator

1. During the 4th quarter of each calendar year the EMS Program Manager will document the completion of all Internal Assessments conducted by the Media Managers and process owners in a compiled Internal Assessment Document (IAD).

PWD NASO Environmental Media Managers (MM)

1. Identify permit/regulatory required inspections and inform the LEPS.
2. Provide environmental oversight, coordination, and training to PWD NASO Departments and tenant command process owners as requested by the Installation Environmental Director or EPS.
2. When required, provide process owners with point-of-use checklists to facilitate inspections.
3. Periodically review and revise checklists.
4. Conduct inspections/compliance evaluations of all pertinent processes according to the schedule delineated in the IAP Inspection Summary

5. Utilizing the US Navy Listbuilder generated / validated environmental media checklist, conduct an annual internal ECE.
6. Coordinate efforts with process owners to identify root causes of all deficiencies deemed significant and develop corrective actions and process improvements to address root causes.
7. If necessary, identify and coordinate funding requests for corrective actions and process improvements.
8. Coordinate with installation staff (including IEPDs and Lead EPS's) to ensure that equipment lists are reviewed and up-to-date each quarter, and ensure inspections are being entered into EMSWeb.
9. Assist the EMS Program Manager by annually reviewing and updating this document and the inspection requirements to ensure continuous improvement within the Environmental Management System (EMS) at PWD NASO.
10. During the 4th quarter of each calendar year environmental media managers will document the completion of all Internal Assessments in media chapters compiled in the Internal Assessment Document (IAD).

PWD NASO Process Owners

1. Assist Environmental Media Managers and EPS with inspection and monitoring identified in the IAP Inspection Summary.
2. When appropriate and feasible, correct identified deficiencies immediately.
3. Contact Environmental media managers regarding identified deficiencies and corrective actions taken.
4. Support media managers in problem-solving and root-cause identification activities.

Facilities Engineering Command

1. If necessary, identify and coordinate funding requests for Station corrective actions and process improvements.
2. Provide oversight and assistance to PWD NASO Environmental Media Managers on the development and implementation of their IAP.

C. MEDIA SUMMARIES

AIR EMISSIONS

I. MEDIA OVERVIEW

Operations and processes that have a potential to emit to the outdoor air are regulated by the Environmental Protection Agency (EPA) under the Clean Air Act (CAA). The federal regulations are found in the Code of Federal Regulations (CFR). The Virginia Department of Environmental Quality (VDEQ) regulations incorporate EPA regulations and can add additional requirements. Regulations are typically written to pertain to specific industrial processes, and applicability can depend on the size of the facility and type of air permit that covers the facility. Typical records required by air permits include:

- Types and amounts of fuel burned at generators and boilers
- Monthly amounts of materials used at blast and/or paint booths
- Periodic visible emission checks at steam plants, generators, wood shops, and blast booths
- Periodic compliance checks of solvent parts washers and gasoline vapor recovery systems
- Records to demonstrate compliance with ozone depleting substance regulations
- Records to demonstrate compliance with asbestos regulations (see Toxics section).

NAS Oceana has a Title V air permit. The Title V permit outlines all applicable EPA and Virginia regulatory requirements covering air emission units within these areas. There are also individual air permits for construction/operation of significant operations, but these requirements are included in the Title V permit.

Dam Neck has a facility-wide State Operating air permit listing all air emission units at the facility, along with required recordkeeping for those units. Dam Neck must also comply with Federal regulations for internal combustion engines, boilers, ozone depleting substances, and asbestos, even though they are not specifically referenced in the facility-wide permit.

NALF Fentress has an exemption letter issued by the Virginia Department of Environmental Quality. The total emissions from all the regulated operations and processes are below the levels requiring a permit.

For a full list of permits, please refer to Appendix C of this document.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH

Compliance with Federal, State, and individual permit required inspections will be assessed primarily by the EPS via site inspections, with management review by the Media Manager annually. The EPS will obtain assistance from the air media manager for compliance issues that are not routine in nature.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS

NAS Oceana Environmental Protection Specialist staff makes site visits to numerous environmental assets. EMSWeb is being used at Oceana and Dam Neck to keep track of all inspections and internal assessments. Refer to EMSWeb for a list of the inspections currently conducted by the Oceana EV staff and internal assessments that have been conducted by the MM staff. Type of sites/assets inspected under the Air program include but are not limited to:

- Combustion equipment, including boilers and generators
- Paint booths & painting operations
- Paint gun washers
- Blast booths, glove boxes, and blasting operations, including pier-side vessel maintenance
- Parts washers (solvent cleaning)
- Woodworking equipment
- Refrigerant recovery and service to air conditioning and refrigeration equipment
- Fuel dispensing, including loading and unloading of bulk petroleum products

C. PRACTICE OWNER/OPERATOR TASKS

- Keep operating records as required by air permit and directed by media manager and/or EPS

D. EPS TASKS

- Conduct quarterly compliance oversight inspections through EMSWeb.
- Provide corrective action and on-the-spot training to practice owners/operators
- Request Media Manager intervention or support as needed.

E. MEDIA MANAGER TASKS

- Ensure corrective actions are initiated for findings identified during compliance inspections
- Review inspection findings by the Installation Environmental staff monthly to determine if intervention or additional support is needed.
- Develop a POAM for open findings exceeding 90 days.
- Review this document annually and update as needed.
- Interface with any outside agency, such as regulators.
- Ensure recordkeeping systems are in place to demonstrate compliance with air permit requirements.
- Conduct internal audits of the Air program through EMSWeb annually.

CULTURAL RESOURCES

I. MEDIA OVERVIEW

Historic properties and areas of archaeological sensitivity and archaeological sites have been identified at Naval Air Station Oceana and its special areas. The historic properties identified are listed below:

Naval Air Station Oceana:

- Bell House Historic Property (privatized)
- 53 Archaeological Sites
- Areas of Archaeological Potential

Naval Auxiliary Landing Field Fentress:

- 21 Archaeological Sites
- Areas of Archaeological Potential

Dam Neck Annex:

- Surface-Launched Guided Missile Training School Historic District including 3 historic buildings as contributing resources (potentially eligible, under further evaluation)
- 14 Archaeological Sites

Due to the presence of historic properties, Naval Air Station Oceana is required to comply with the various federal laws, Executive Orders, DoD policies and Navy policies governing cultural resources management. The National Historic Preservation Act of 1966, as amended, (NHPA) is the primary piece of federal historic preservation legislation that guides the cultural resources program for Naval Air Station Oceana. Specifically, Sections 106 and 110 of the NHPA, provide specific requirements that Naval Air Station Oceana must meet in planning for and implementing a project and in managing and utilizing historic properties in its ownership or under its jurisdiction. Under the NHPA, when a proposed project has the potential to effect a historic property, Naval Air Station Oceana is required to consult with the State Historic Preservation Officer (Virginia Department of Historic Resources), and, as appropriate the Advisory Council on Historic Preservation, federally-recognized Native American Indian tribes, and other interested parties. This consultation process is typically referred to as the Section 106 review process. A project cannot be awarded until the Section 106 review process is complete.

Naval Air Station Oceana and Naval Auxiliary Landing Field Fentress are covered under a Regional Programmatic Agreement for the Navy's Historic Buildings in Hampton Roads (RPA). The RPA was executed in November 1999 between the Commander, Navy Region, Mid-Atlantic, the Virginia State Historic Preservation Officer and the Advisory Council on Historic Preservation. The RPA is still in effect and streamlines the Section 106 review process as it relates to historic buildings and historic districts. The RPA does not include actions affecting archaeological resources or those actions pertaining to Bell House Historic

Property, which was privatized in 2005. Dam Neck Annex is not covered by this RPA at this time.

The Cultural Resources Program for all Navy installations in Hampton Roads including Naval Air Station Oceana and its special areas is regionally managed through the NAVFAC MIDLANT Environmental Business Line. An Integrated Cultural Resources Management Plan (ICRMP) has been completed in November 2013 to assist in the management of CR throughout the Hampton Roads area installations. Naval Air Station Oceana is included in the ICRMP. This Plan was prepared pursuant to Department of Defense Instruction (DoDI) 4715.16 (18 September 2008), Secretary of the Navy Instruction 4500.35, Chief of Naval Operations Instruction 5090.1C (30 October 2007, replaces 5090.1B), and in compliance with the National Historic Preservation Act (NHPA) of 1966, as amended; the National Environmental Policy Act of 1969 (NEPA); Executive Order No. 11593 (Protection and Enhancement of the Cultural Environment); and Executive Order No. 13287 (Preserve America). The annual update to the ICRMP is currently underway and expects to be completed September 2016.

Section II identifies key activities conducted by the NAVFAC MIDLANT Cultural Resources media manager such as reviewing proposed projects, preparation of CR correspondence to the Virginia State Historic Preservation Officer; review of CR reports and studies, provide cultural resources training to Navy personnel, and communication with PWD-Oceana and Hampton Roads IPT personnel.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH

Compliance with cultural resources requirements are geared towards conservation, preservation, management and enhancement of historic properties as directed by the multitudes of laws, regulations and policies. In general, cultural resources laws and regulations do not lend themselves well to specific location inspections, but dictate an inspection of the overall management of the installation and its historic properties.

The Cultural Resources program will be annually reviewed to ensure the proper management of historic properties. The annual review will include the following:

- Review of the proper documentation associated with the Section 106 review processes including correspondence letters and executed MOAs;
- Review of the ICRMP and planned updates;
- Review of recently completed architectural surveys and archaeological investigations and any Section 110 actions; and
- If appropriate, periodic site visits to construction sites to ensure conditions or stipulations of a Section 106 consultation are complete with project implementation.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS: N/A

C. PRACTICE OWNER TASKS: N/A

D. PWD-OCEANA INSTALLATION TASKS: N/A

E. NAVFAC MIDLANT MEDIA MANAGER TASKS: N/A

- Conduct internal audits of the Cultural Resources program through EMSWeb annually.
- As received, review each submitted environmental checklists to identify cultural resources concerns and requirements and to determine the required consultation.
- Prepare cultural resources related correspondence and ensure cultural resources consultations and the Section 106 and Section 110 review process is completed for each required project before project award.
- As appropriate, work with the Facilities Planning Department, FEAD and HR IPT during the design and construction phrases of projects to ensure the protection of historic properties.
- As appropriate, perform periodic site visits to construction or work sites to ensure conditions or stipulations of a Section 106 consultation are being implemented;
- Ensure annually that the appropriate cultural resources documentation has been completed for each received project, and it is in the Cultural Resources file.
- Ensure annually the ICRMP is reviewed and updated as necessary.
- Ensure annually review recently completed cultural resources surveys and work with the Facilities Planning Department to identify areas requiring further survey in the upcoming 3 years;
- Ensure annually that the Facilities Planning Department personnel have received Cultural Resources training and are integrating cultural resources management early in the planning process.
- Obtain necessary funding and support to correct identified discrepancies, including the preparation of EPR exhibits when needed.

HAZARDOUS MATERIALS

I. MEDIA OVERVIEW

Hazardous Materials (HM) are not managed through the PWD NASO Environmental Division. The environmental department has a hand in overseeing HM from a perspective of reviewing resident commands requested HM for inclusion on 'Authorized Use Lists' and EPCRA 312 & 313 reporting. Additionally, environmental staff ensures any outdoor storage of HM in industrial areas are done so with the appropriate use of Best Management Practices (BMPs) to minimize polluted storm water runoff.

The Installation Safety office covers Hazardous Material Control & Management (HMC&M). Safety Office support includes respective workplace inspection (annual workplace inspections required by OSHA-more frequent in high hazard areas), program evaluation, personnel education and training, reviewing Safety Data Sheets (SDS) prior to purchase and addition to activity AUL, promote the use of Consolidated Hazardous Material Reutilization and

Inventory Management (CHRIMP) and Hazardous Waste Minimization (HAZMIN) center, and developing instructions. Perform periodic review of supported activity AUL to eliminate unnecessary HM and substitute less hazardous products where feasible. IC responsibilities are outlined in OPNAVINST 5100.23G. Governing instructions are OSHA 29CFR1910.106 and 29CFR1910.1200, OPNAVINST 5100.23G. Under this program, activities are provided HMC&M training via Enterprise Safety Applications Management Systems (ESAMS) website. Safety professionals are trained in Introduction to Hazardous Material (Ashore), course A-493-0031 at Naval Occupational Safety and Health, and Environmental Training Center (NAVOSHENVTRACEN) prior to inspections or SDS reviews.

II. INSPECTIONS/OVERSIGHT EVALUATIONS:

A. APPROACH

The only inspections performed through the environmental department are Storm Water Pollution Prevention inspections at industrial sites with outdoor storage. Annual Site Compliance Evaluations are also performed at these sites.

Environmental Practice Inventories (EPIs) are performed at several industrial sites with HM storage where AUL lists are requested for assistance in EPCRA reporting.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

See EMSWeb for list of sites where stormwater inspections are performed and see EPCRA Manager for a list of EPI sites.

C. PRACTICE OWNER/OPERATOR TASKS:

- Secure latest copy of AUL from FLC.
- Submit appropriate paperwork to HAZMIN Center for new items to be added to the AUL.
- Ensure Hazardous Materials are stored in accordance with requirements.

D. PWD NASO ENVIRONMENTAL PROTECTION SPECIALISTS TASKS:

- Conduct SWPPP inspections to oversee that HM are stored outdoors with appropriate BMPs in place.
- Assist in updating EPIs

E. NAVFAC MIDLANT MEDIA MANAGER (MM) TASKS:

EPCRA:

- Review AUL requests
- Conduct some site visits to update EPIs

HAZARDOUS WASTE

I. MEDIA OVERVIEW

The management and disposal of Hazardous Waste (HW) is regulated by the Environmental Protection Agency (EPA) under the Resource Conservation and Recovery Act (RCRA). The Virginia Department of Environmental Quality (VDEQ) regulations incorporate EPA regulations and can add additional requirements.

Each base and its associated annexes are identified by their EPA ID# and managed according to their designated generator status (i.e. Large Quantity (LQG), Small Quantity (SQG), and Conditionally Exempt Small Quantity Generator (CESQG)). Generator status is determined by the amount of HW generated per month which is subject to change based on operations.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH

To ensure compliance with Federal, State and Navy regulations, site generators will conduct weekly inspections of their Hazardous Waste < 90 / 180 Day Accumulation Areas (HWAA) and Environmental Protection Specialists (EPS) will conduct quarterly inspections, or more frequently if requested by the Hazardous Waste Program Manager. In addition to periodic inspections, annual internal audits will be performed by Regional Hazardous Waste Program Managers. External audits will be performed on a triannual basis by HW Compliance staff from other Facility Engineering Commands (FECs). Regulations associated with Hazardous Waste management are dependent upon Generator status.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS

EMSWeb is being used at all Hampton Roads installations to record and track all inspections and internal assessments. Refer to EMSWeb for a list of inspections currently conducted by the Public Works Department (PWD) staff and internal assessments that have been conducted by the Media Managers.

Types of sites/assets inspected under the Hazardous Waste program include but are not limited to:

- Hazardous Waste Satellite Accumulation Areas (SAA)
- Hazardous Waste < 90 /180 Day Accumulation Areas (HWAA). Whether the site is designated as a < 90 or <180 day site is dependent on the installations generator status.
- Universal Waste Accumulation Areas (UWAA)

C. PRACTICE OWNERS TASKS

- Conduct inspections of the HWAAs, SAA's and UWAA's and all other locations where it is either known or anticipated that hazardous waste may be generated.
- Record and file inspections in the form of completed checklists and applicable notes for <90/180 Day HWAAs every seven days. Maintain files for 3 years.
- Promptly resolve issues requiring correction, at the lowest level possible, and follow up with appropriate training and subsequent inspections, as needed.
- Report non-corrected compliance findings of inspections to the Hazardous Waste Media Manager as soon as possible.
- Ensure personnel hazardous waste training to perform assigned duties is kept current.

D. ENVIRONMENTAL PROTECTION SPECIALISTS TASKS

- Conduct quarterly inspections of the HWAAs. More frequent inspections may be required if requested by the Hazardous Waste Program Manager.
- Conduct quarterly inspections of all hazardous waste satellite and universal accumulation areas and all other locations where it is either known or anticipated that hazardous waste may be generated. More frequent inspections may be required if requested by the Hazardous Waste Program Manager.
- Record and file quarterly inspections in the form of completed checklists, EMSWEB checklists, and applicable notes. Maintain files for 3 years.
- Review findings provided by the practice owners to determine if intervention or support is needed.
- Provide corrective action / on-the-spot training to practice owners, as needed, to ensure that practice owners are aware of the requirements.

E. NAVFAC MIDLANT MEDIA MANAGER TASKS

- Ensure corrective actions are initiated for findings identified during compliance inspections
- Review inspection findings by the Installation Environmental staff monthly to determine if intervention or additional support is needed.
- Develop a POAM for open findings exceeding 90 days.
- Annually prepare EPRs covering all aspects of the hazardous waste program.
- Ensure personal hazardous waste training is sufficient to perform assigned duties and kept current.
- Prepare biennial report to capture hazardous waste generation at all large quantity generators.
- Review this document annually and update as needed.
- Escort any outside agency, such as regulators, to the appropriate locations.
- Annually review the HW generation records and discuss potential pollution prevention initiatives with the P2 Media Manager.
- Conduct annual internal audits of the Hazardous Waste program through EMSWeb.
- Provide corrective action / on-the-spot training to practice owners, as needed, to ensure that practice owners are aware of the requirements.

NATURAL RESOURCES

I. MEDIA OVERVIEW

The Natural Resources (NR) Program for NASO, NASO DNA, and NALFF properties is managed in accordance with applicable federal, state, and local government regulatory requirements and DoD, Navy and Installation Policies/Instructions and Standard Operating Procedures (SOPs). How the installation's NRs are managed is dictated in the Integrated Natural Resources Management Plan (INRMP) that is assigned to the installation. There are two INRMPs for NASO: NASO & NALFF INRMP and NASO DNA INRMP.

These INRMPs outline conservation efforts and establishes procedures to ensure compliance with related environmental laws and regulations during INRMP implementation over the five-year duration of the plan. Development of these INRMPs included input from state and federal stakeholders in addition to cross coordination with other appropriate Navy programs. As required under the Sikes Act Improvement Act (SAIA), these INRMPs reflect mutual agreement of agencies concerned with the conservation, protection, and management of fish and wildlife resources, including the USFWS, NOAA NMFS, and the VDGIF. These INRMPs provide the direction for natural resources management at Naval Air Station (NAS) Oceana (NASO), Naval Auxiliary Landing Field (NALF) Fentress (NALFF), and NASO Dam Neck Annex (DNA) (collectively referred to as the Installation); however, it does not replace or affect any federal laws, or state responsibility and authority for protecting fish and wildlife resources. There are several agriculture outlease areas that are managed for natural resources and are covered by the NASO & NALFF INRMP. These INRMPs cover a five-year period, but as ecosystems are dynamic and Installation requirements are subject to frequent modification, natural resources management must be flexible. To accommodate these changes, these INRMPs are reviewed and updated annually by Installation personnel and revised and reapproved after five years in coordination with USFWS, NOAA NMFS, and VDGIF. The Installation Appointed NR Manager (NRM) has the responsibility of maintaining the currency of this document.

These INRMPs integrate all aspects of NR management, including the various components of the Environmental Compliance Programs, Environmental Restoration Program (ERP), and Cultural Resources Program, as well as the management of sensitive species, wetlands, watershed and floodplain protection, wildlife, grounds maintenance, pest management, and outdoor recreation, with the current military mission. In accordance with the SAIA and OPNAVINST M- 5090.1, these plans provide for:

- fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation;
- fish and wildlife habitat protection and enhancement;
- wetland protection, enhancement, and restoration;
- integration of, and consistency among, the various activities conducted under the plan;
- establishment of specific natural resources management objectives and time frames for proposed actions;
- sustained use by the public of natural resources to the extent such use is consistent with the needs of fish and wildlife management and subject to Installation safety and security requirements;

- enforcement of natural resources laws and regulations; and
- no net loss in the capability of military lands to support the military mission of the Installation.

A current list of applicable laws, regulations and policies associated with the NR management on the installation is available in the installation INRMPs, maintained by the NRM.

II. INSPECTION/OVERSIGHT EVALUATIONS

A. APPROACH

To ensure compliance with applicable laws, regulations and policies the INRMP identifies multiple actions geared towards conservation, preservation, and enhancement of the natural environment. Natural resources laws and regulations do not lend themselves well to specific location inspections, but dictate an inspection of the overall land management of the facility and the surrounding ecosystem, community, and/or watershed.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

Reference the current installation INRMPs, maintained by the installation NRM.

C. PRACTICE OWNER TASKS:

Reference the current installation INRMPs, maintained by the installation NRM.

D. PWD NASO NATURAL RESOURCE SPECIALIST TASKS:

Reference the current installation INRMPs, maintained by the installation NRM.

E. NAVFAC MIDLANT MEDIA MANAGER TASKS:

Reference the current installation INRMPs, maintained by the installation NRM.

PEST MANAGEMENT

I. **MEDIA OVERVIEW**

Pesticide operations at the installations covered under this IAP will be conducted in accordance with the installation Integrated Pest Management Plan.

The majority of the pest control services at PWD NASO are provided by the NAVFAC MIDLANT Regional Environmental Services (EV Services) pest control shop under the Environmental Services Performance Work Statement (PWS). The pest control shop is located in building 613 at the Dam Neck Annex. Contract pest control companies also provide pest control to some NEX facilities. Vegetation management is provided by NAS

Oceana's Natural Resources Section, MWR personnel, and the grounds maintenance contractor. The PWS requires that terminal buildings and facilities be kept pest-free.

All industrial and grounds pest control work will be performed by DoD or Virginia-certified commercial applicators. Certification must be in the categories of the work performed.

Pesticide applications will be recorded using approved NAVFAC Online Pesticide Reporting System (NOPRS). Data files will be submitted to Applied Biology, NAVFACLANT, at least monthly.

All pesticides shall be approved by Applied Biology, NAVFAC LANT prior to use. These materials will be stored in accordance with their EPA-approved labels.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH

Compliance inspections will be conducted regularly following periodic schedule. The O&M Contractor shall perform its own regular inspections as required by the contract. The Pesticide Program Media Manager will conduct annual review of documentation.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS

1. **Navy Exchange (NEX)**
   The NEX sells pesticides to private consumers. Responsibilities include:
   - Ensure that pesticides for retail sale are safely displayed on shelves;
   - Properly dispose of pesticides and containers if the product has exceeded its shelf life or the EPA registration has been cancelled;
   - Ensure that store employees are properly trained on the emergency procedures in the event of a spill; and
   - Maintain and make available on request Material Safety Data Sheets for pesticides that are stocked.

2. **Commissary**
   Veterinary technicians from the U.S. Army Veterinary Detachment are responsible for quality assurance and food inspection of the Commissary and all messing facility and retail sale foods on Base. Responsibilities include:
   - Ensure that pesticides for retail sale are safely displayed on shelves;
   - Ensure delivered food products are free from pest infestation;
   - Ensure proper sanitation and hygiene to prevent pest problems;
   - Ensure control of pests that occur in the Commissary;
   - Report pest infestations that require professional pest management services;
   - Conduct surveillance for pests which damage, destroy and contaminate food stored in the Commissary and installation facilities.

C. CONTRACT PEST MANAGEMENT SERVICE PROVIDER (PMSP) TASKS:

Contract PMSPs at PWD NASO are required to be certified as commercial pesticide applicators by the State of Virginia. Unlicensed individuals are not allowed to apply pesticides on Base.

- Conduct pest management operations in accordance with the contract specifications;
- Comply with all DoD, federal, state and local pest management regulations;
- Report pesticide usage to the IPMC on a monthly basis; and
- Cooperate fully with and communicate all pest management issues and requirements via the contract PAR.

D. CONTRACT GROUNDS MAINTENANCE TASKS:

Grounds contractors that apply herbicides or pesticides are required to be certified as commercial pesticide applicators by the State of Virginia. Unlicensed individuals are not allowed to apply pesticides on base.

- Comply with all DoD, federal, state and local pest management regulations;
- Vegetation control on right-of-way, road sides, utilities, and ditches.
- Report pesticide usage on a monthly basis; and
- Cooperate fully with and communicate all pest management issues and requirements via the contract PAR.

E. ALL INSTALLATION PERSONNEL TASKS:

- Apply appropriate sanitary and pest exclusionary practices to prevent pest infestations;
- Attempt to control minor pest infestations through mechanical or other means before requesting a PMSP; and
- Coordinate and cooperate fully with PMSPs in scheduling pest management and preparing the areas for pesticide treatment.
- Be enrolled in the Self-help program and keep annual training current.

F. INTEGRATED PEST MANAGEMENT COORDINATOR TASKS:

- **IPMP Maintenance** – Once the Integrated Pest management Plan (IPMP) has been developed and implemented, it must be reviewed annually and updated as necessary. The installation Integrated Pest Management Coordinator (IPMC) is responsible for maintaining the IPMP.
- **Internal Review** – An internal review of the pest management program is conducted annually by the IPMC in coordination with the Pest Management Service Providers (PMSPs) and other functional area Points of Contact (POC). The review should include updating contract information, applicator certifications, pesticides and pest management operations to be used on the installation, and updating pesticide use records. An Internal Assessment Plan (IAP) for the pesticide program should be used by the IPMC as a tool to review compliance issues during the internal review. A

sample IAP can be found in Appendix I and other compliance self-assessments can be found in Appendix D of the installation IPMP.

- **Off-site Review –** The IPMC may request a review by a NAVFAC LANT Applied Biology Professional Pest Management Consultant (PPMC) for review of regulatory requirements, reporting and pesticide approval procedures.
- **On-site Review** – An on-site review of the entire pest management program shall be performed by the NAVFAC LANT Applied Biology PPMC at least every 3 years to ensure compliance with the IPMP. The review may be performed more frequently if extensive program problems exist.
- **IPMP Rewrite** – The IPMP shall be rewritten every 5 years to reflect new contracts, personnel, pest management practices, and regulatory changes.

G. PESTICIDES INTERNAL ASSESSMENT SUMMARY

Table 1-1: PEST MANAGEMENT PROGRAM REQUIREMENTS – NASO, Dam Neck Annex, Fentress

Requirement	Description	Reference	Responsibility
PLANNING	Review and revise the Integrated Pest Management Plan annually.	OPNAV 6250.4C Series; DoDINST 4150.07	IPMC
RECORDING	Record all pest management operations conducted on the Base after each operation.	OPNAV 6250.4C Series; DoDINST 4150.07	All pesticide applicators
MAINTAINING	Maintain records of all pest management operations conducted on Base on-site indefinitely	OPNAV 6250.4C Series; DoDINST 4150.07	IPMC in coordination with PMPARs
REPORTING	Compile and report all pest management operations to NAVFAC Atlantic Applied Biology monthly.	OPNAV 6250.4C Series; DoDINST 4150.07	IPMC in coordination with PMPARs
PESTICIDE APPLICATOR QUALIFICATION	Ensure that all personnel applying pesticides on installations have current DoD pesticide applicator certification if in-house or state commercial applicator certification if contracted.	OPNAV 6250.4C Series; DoDINST 4150.07	IPMC in coordination with PMPARs
COMPLIANCE	Ensure that all program elements are in compliance with all Federal regulations. The Base is also encouraged to comply with County and State regulations.	OPNAV 6250.4C Series; DoDINST 4150.07	IPMC in coordination with PMPARs
PESTICIDE APPROVAL	Compile and submit list of new pesticides to NAVFAC Atlantic Applied Biology for approval for use on the Base.	OPNAV 6250.4C Series; DoDINST 4150.07	IPMC in coordination with PMPARs
CONTRACT REVIEW	Review pest management contract specifications for compliance with the Integrated Pest Management Plan and submit to NAVFAC Atlantic Applied Biology for final review and approval prior to advertising.	OPNAV 6250.4C Series; DoDINST 4150.07	Facilities Support Contracts, PMPARs

PETROLEUM OIL AND LUBRICANTS (POL) / STORAGE TANKS

I. MEDIA OVERVIEW

Storage tanks are federally regulated by 40 CFR 112 – Oil Pollution Prevention, also known as the Spill Prevention, Control and Countermeasures (SPCC) rule. 40 CFR 112 dictates requirements for Storage Tank compliance and the development and implementation of facility SPCC Plans. In addition, some aboveground storage tanks (ASTs) with a capacity greater than 660 gallons are regulated by the Virginia Department of Environmental Quality (VADEQ) 9 VAC 25-91-10 – Facility and Aboveground Storage Tank Regulation. Underground storage tanks (USTs) are regulated by the federal government in 40 CFR 280 and 281, and by the Commonwealth of Virginia in 9 VAC 25-580. Storage tank systems are also required to comply with National Fire Protection Association requirements and any applicable local fire codes.

Compliance inspections of ASTs and portable containers are performed in accordance with the most recent version of the "STANDARD OPERATING PROCEDURE (SOP) FOR ABOVEGROUND STORAGE TANKS (AST) AND CONTAINERS GREATER THAN OR EQUAL TO 55-GALLONS OF PETROLEUM, OIL, OR LUBRICANT (POL) STORAGE CAPACITY FOR CNIC NAVAL INSTALLATIONS WITHIN HAMPTON ROADS VIRGINIA", and the inspection checklists included in this AST SOP. The AST SOP also describes applicable training, record keeping, tank installation/closure notification, and spill notification requirements. Regulations associated with Storage Tank management are dependent upon several factors, such as capacity, contents, intended use, etc.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

Internal Assessments will be conducted through continuous inspections by the practice owners. Compliance with Federal, State, and individual permit requirements will be assessed primarily by the Environmental Protection Specialist (EPS) quarterly via site inspections, with management review by the Petroleum Tank Media Manager (MM) annually. The EPS will obtain assistance from the tank media manager for compliance issues that are not routine in nature.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

EMSWeb is being used at PWD NASO to keep track of all required inspections and internal assessments. Because inspection sites change on a routine basis, they were not listed in this plan. Refer to EMSWeb for a list of the inspections currently conducted by the PWD staff and internal assessments that have been conducted by the Petroleum Tank MMs. Type of sites/assets inspected under the POL/Storage Tank program includes but are not limited to:

- Aboveground Storage Tanks (ASTs)

- Portable Containers
- Underground Storage Tanks (USTs)

Additionally, fuel storage tanks are recorded in the tanks database maintained by NAVFAC MIDLANT MM.

C. PROCESS OWNER TASKS:

- Receive applicable training on storage tank inspections from Program Manager or via ECATTS as described in the AST SOP.
- Perform daily/weekly and/or monthly visual inspections of applicable installation storage tanks as described in the AST SOP
- For storage tanks with open top secondary containment, maintain berm discharge log
- Maintain inspection records for 5 years

D. PWD NASO ENVIRONMENTAL PROTECTION SPECIALIST TASKS:

- Receive training on Storage Tank inspections from Program Manager or via ECATTS as described in the AST SOP
- Perform quarterly compliance inspections of installation Storage Tanks
- Maintain inspection records for 5 years if process owner does not maintain the records at the site of the tank.
- Document inspection findings in EMS Web
- Ensure inspections assigned to process owners are performed.

E. NAVFAC MIDLANT MEDIA MANAGER TASKS:

- Continuously maintain and update installation SPCC Plan
- Ensure completion of review and evaluation of the Spill Prevention Control and Countermeasures (SPCC) Plan every five years, and annual updates to include Professional Engineer (PE) signature for technical amendments.
- Work with other POL/Storage Tank program MMs to assure Hampton Roads AST SOP is updated to reflect current regulatory requirements.
- Ensure corrective actions are initiated for findings identified during compliance inspections
- Review inspection findings by the Installation Environmental staff monthly to determine if intervention or additional support is needed.
- Develop a POAM for open findings exceeding 90 days.
- Review findings provided by the Installation Environmental staff to determine if intervention or support is needed
- Facilitate and coordinate VADEQ and EPA installation inspections with the IEPD.
- Ensure that compliance inspections are performed on schedule by EPS's and Process Owners
- Ensure corrective actions are initiated for findings identified during compliance inspections
- Ensure compliance with regulatory requirements is included in the annual budget to support all aspects of the Storage Tank program on a continuous basis

- Ensure tenant's Storage Tank inspection training is sufficient to perform assigned duties and is kept current
- Ensure completion of formal annual review and update of the Facility Response Plan (FRP). .
- Submit registrations and notifications to the Virginia Department of Environmental Quality (VDEQ)
- Reconcile the Navy and VDEQ tank databases every 5 years.
- Ensure that Daily, Weekly and Monthly Inspections for ASTs are being performed.
- Ensure that Annual Periodic Inspections for all ASTs are being performed.
- Ensure that Annual Gauge Calibrations for ASTs subject to VDEQ regulations are being performed. Ensure the satisfactory completion of Formal External Inspections for ASTs.
- Ensure that initial formal internal inspections are performed within 5 years after the date of installation.
- All ASTs subject to VDEQ regulations shall undergo an external re-inspection every 5 years after initial formal external inspection has been conducted.
- Ensure the satisfactory completion of the Formal Internal Inspections for ASTs as required by the Steel Tank Institute (STI) and VDEQ.
- Ensure the satisfactory completion of Tank Leak Tests for ASTs as required by the Steel Tank Institute (STI).
- Ensure the satisfactory completion of Piping Pressure Testing Certifications for ASTs prior to being placed into service and every 5 years thereafter.
- Ensure the satisfactory completion of Secondary Containment Evaluations or Certifications for ASTs prior to being placed into service and every 10 years thereafter.
- Review maintenance logs for repair issues and compliance, including tank integrity and pipe testing.
- Update tank database as needed.
- Ensure the satisfactory commencement and completion of ASTs/USTs closure procedures.
- Ensure availability and maintenance of records for regulated USTs which include documentation of operation of corrosion protection equipment, documentation of UST system repairs, release detection compliance reports (print outs from Automatic Tank Gauging Systems), results of the site investigation conducted at permanent closure, and operator's training documentation.
- Ensure availability and maintenance of records for ASTs which includes records relating to all required measurements and inventory of oil at the facility; records of required tank/pipe testing; records of spill events and other discharges of oil from the facility; supporting documentation for developed contingency plans; and operator's training documentation.

SOLID WASTE

I. MEDIA OVERVIEW

The Solid Waste program is managed through the NAVFAC MIDLANT. It consists of solid waste disposal and recycling. In accordance with Executive Order 13693, NASO strives to meet solid waste reduction goals. The solid waste generated by the installation will be monitored with respect to the waste disposed versus waste recycled on the installation. Appropriate lines of communication will be established to receive information on volumes and costs associated with solid waste. When a recycling program has been established on the installation, evaluation of the cost per ton to recycle in relation to the cost of disposal will be conducted. For cost information, concerning solid waste, the Regional Solid Waste Director will be contacted for information.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

PWD NASO will be assessed through regular audits and field inspections for evaluating the financial, administrative, and operational program areas of the NAS Oceana ISWMP.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

PWD NASO is presently part of the Storefront recycling operation. As such it operates under the cognizance of the Mid-Atlantic Regional ISWMP. The recycling manager dictates all management practices for the ISWMP.

Locations to be assessed include:

- Solid waste dumpsters
- Recycling points

C. PWD OCEANA RECYCLING SPECIALIST TASKS:

- Complete monthly inspections and forward information to the media manager

D. ISWMP REGIONAL OPERATIONS MANAGER TASKS:

- Establish a recycling program on the installation, and achieve the annual percent waste reduction goals established by the Regional Environmental Management System Cross-Functional Team.
- Conduct Semi-Annual compliance assessments of PWD Oceana's ISWMP.

E. ISWMP INTERNAL ASSESSMENT SUMMARY:

PROGRAM	PRACTICE	INSPECTION FREQUENCY PLANNED	INSPECTION RESPONSIBILITY	COMPLIANCE EVALUATION FREQUENCY	COMPLIANCE EVALUATION RESPONSIBILITY
Recycling	Identify Quantity and Cost of Waste Disposal	Quarterly	NAS Oceana Recycling Specialist	Semi-Annually	Regional ISWMP Operations Manager
	Identify Material Composition of Waste Dumpsters	Quarterly	NAS Oceana Recycling Specialist	Semi-Annually	Regional ISWMP Operations Manager

F. RECYCLING SITE-SPECIFIC COMPLIANCE QUESTIONS

1. Is high-grade office paper separated, collected, and recycled?
2. Is non-contaminated corrugated cardboard collected and recycled?
3. Are separated recyclable materials contained or bundled to avoid spillage?
4. Are separated recyclable materials stored so they do not pose a fire, health, or safety hazard, or provide food/harborage for pests?
5. Are separated recyclable materials collected frequently enough to avoid pest attraction/breeding or any other nuisances?
6. If equipment is used to compact, collect, or transport recyclable materials, is the equipment constructed and operated to minimize health and safety hazards?

STORMWATER (INDUSTRIAL & NON-INDUSTRIAL)

I. MEDIA OVERVIEW

Industrial Stormwater:
NASO has an individual Virginia Pollutant Discharge Elimination System (VPDES) industrial activity stormwater discharge permit issued by the Virginia Department of Environmental Quality (VDEQ) that regulates industrial processes that discharge into State Waters which includes Waters of the US. Dam Neck Annex has a general VPDES industrial activity stormwater discharge permit. Both permits require installations to develop and implement a Stormwater Pollution Prevention Plan (SWPPP) which identifies potential pollutants and describes best management practices that will be used to reduce the discharge of pollutants from stormwater runoff.

There is no stormwater permit for Fentress and stormwater inspections are not required.

Non-Industrial Stormwater:
Both NASO and Dam Neck Annex are regulated under the Virginia Stormwater Management Program (VSMP) General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4).

In Virginia the Department of Environmental Quality (DEQ) has been delegated by the Environmental Protection Agency (EPA) as the regulatory authority for the Municipal Separate Storm Sewer System (MS4) permit program. DEQ is responsible for ensuring that the regulated community in Virginia complies with the Virginia Stormwater Management Program (VSMP) permit regulations, which encompass stormwater discharges associated with non-industrial practices and regulated construction activities. Phase I or Phase II MS4 permit coverage is issued to the operators of stormwater systems that meet specific criteria under the Clean Water Act (CWA) for being labeled a regulated MS4. Unless specifically waived by the regulatory authority, federal facilities located within an "urbanized area" as defined by the latest decennial Census are considered regulated operators and are required to receive covered under the Phase II MS4 General Permit. In the Hampton Roads region naval installations that meet the regulated operator criteria currently receive consolidated coverage from DEQ under the VSMP Phase II MS4 General Permit.

As a regulated MS4 permittee, Command Navy Region Mid-Atlantic (CNRMA) must ensure implementation of a stormwater program to reduce the discharge of pollutants to the "maximum extent practicable", protect local water quality, and satisfy that appropriate water quality requirements of the Clean Water Act. In accordance with the conditions of the Phase II MS4 General Permit, a regional MS4 Stormwater Program Plan has been developed which identifies the 6 minimum control measures (MCM) undertaken on a regional level to meet permit requirements. The six minimum control measures required to be addressed under the Phase II MS4 General Permit are:

- Public Education and Outreach
- Public Involvement and Participation
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post Construction Runoff Control
- Good Housekeeping & Pollution Prevention

The MS4 Stormwater Program Plan specifies the implementation schedule and the roles and responsibilities for all best management practices to be employed to address each MCM of the General Permit. The Phase II MS4 Program Media Manager is responsible for ensuring that the regional MS4 stormwater program conforms to the roles and responsibilities identified in the approved MS4 Program Plan. DEQ is responsible for the approval of the MS4 Program Plan to ensure it complies with the requirements of the VSMP Phase II MS4 General Permit.

The VSMP Phase II MS4 General Permit includes reporting requirements which specify that an annual report will be completed and submitted to the regulatory authority by October 1 of each year. The annual report must document efforts undertaken by the permittee during the reportable permit cycle to comply with the approved program plan and permit requirements. The Phase II MS4 Program Media Manager is responsible for completion and submission of the MS4 program annual reports to the regulatory authority. DEQ is responsible for the regulatory review of the MS4 Program annual reports to ensure program efforts are in compliance with permit requirements.

For a more detailed and complete list of roles and responsibilities, please refer to the MS4 Stormwater Program Plan.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

NAS Oceana's Virginia Pollutant Discharge Elimination System (VPDES) Permit and Dam Neck Annex's VPDES Permit both regulate industrial processes that discharge into State Waters which includes Waters of the US. Under these VPDES Permits:

- PWD Environmental will perform regular inspections of the installation's oil water separators (OWS) and associated valves that discharge to the storm system, as well as compliance oversight inspections of the tenant operations.
- PWD Environmental will perform BMP inspections of areas prescribed in the SWPPPas required.

For the MS4 Permit Program, post construction stormwater BMPs are inspected regularly by the NAVFAC MIDLANT MM. Additionally, regulated land disturbing activities are inspected to ensure compliance with the MS4 Permit and the Virginia Stormwater and Erosion & Sediment Control Regulations.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS

The Stormwater Programs will be assessed to ensure compliance with applicable regulatory requirements. In addition, Stormwater best management practices will be assessed at designated locations. Work practices at all other locations where material storage areas are exposed to storm water will be assessed to ensure that pollutants are not discharged to State Waters.

EMSWeb is being used at PWD NASO to keep track of all inspections and internal assessments. Because inspections change on a routine basis, they were not listed in this plan. Refer to EMSWeb for a list of the inspections currently conducted by the PWD staff and internal assessments that have been conducted by the MM staff.

Please refer to the VPDES Permit, the installation's Stormwater Pollution Prevention Plan (SWPPP) and EMSWeb for an updated summary of stormwater internal assessment summary.

C. PWD NASO ENVIRONMENTAL PROTECTION SPECIALIST TASKS

- Inspect OWSs and valves associated with OWSs as required.
- Record and file inspections as required by the SWPPP. Maintain files per regulatory requirements.
- Promptly resolve routine issues which require correction, at the lowest level possible, and follow up with appropriate training and subsequent inspections as needed.

- Report findings of all inspections to the NAVFAC MIDLANT Water Program Manager as necessary to coordinate correction of non-routine deficiencies and provide POA&M updates quarterly to show all deficiencies.
- Ensure tenants and practice owners are receiving annual SWPPP training.
- Work with tenants to ensure required inspections and necessary corrective actions are completed within 30 days per the Permit. Conduct follow up inspections as needed and document corrections.

D. NAVFAC MIDLANT MEDIA MANAGER TASKS

- Prepare Discharge Monitoring Reports (DMR), as required by submission to the Department of Environmental Quality (DEQ).
- Maintain rain gauge log of daily rainfall totals.
- Ensure corrective actions are initiated for findings identified during compliance inspections
- Review inspection findings by the Installation Environmental staff monthly to determine if intervention or additional support is needed.
- Develop a POAM for open findings exceeding 90 days.
- Facilitate VPDES VADEQ installation inspections.
- Coordinate and hold SWPPP Committee Meetings as required.
- Ensure that the annual site compliance evaluation is completed by Permit-specified deadline.
- Conduct annual review of the SWPPP and modify/update plan as required.
- Update outfall sampling plan and stormwater drainage maps as necessary.
- Ensure Illicit Discharge Studies and corrective actions are initiated according to Permit requirements.
- Ensure Permit requirements are included in the annual budget to support all aspects of the VPDES Program on a continuous basis.
- Review sampling results verify compliance with the VPDES Permit.
- Ensure that the VPDES Permit reapplication is submitted within the required time frame.

E. INTEGRATED PRODUCT TEAM (IPT)/OIL RECOVERY TECHNICIAN TASKS

- Quarterly inspect pretreatment devices and perform maintenance as necessary.

WASTEWATER

I. MEDIA OVERVIEW

NAS Oceana's and Dam Neck Annex's Industrial Wastewater Discharge Permits (HRSD Permits) regulate industrial processes that discharge into the sanitary sewer systems at each respective installation.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

NAS Oceana discharges an approximated average of 570,000 gpd of sanitary sewage to a local municipal authority, Hampton Roads Sanitation District (HRSD). The HRSD permit requires regular monitoring sampling and regulates industrial wastewater discharges at the facility.

- NAVFAC MIDLANT Environmental PWD will perform regular inspections of the installation's oil water separators (OWS) and associated sediment traps and valves that discharge to the sanitary sewer system.
- NAVFAC MIDLANT Utilities will perform weekly inspections of Pump Station SD-600.
- NAVFAC MIDLANT Utilities will perform annual meter certification of Pump Station SD-600 and provide report to Media Manager for regulatory submittal.

NAS Oceana, Dam Neck Annex discharges an approximated average of 236,000 gpd of sanitary sewage to a local municipal authority. The sanitary sewage discharge permit requires regular monitoring sampling and regulates industrial wastewater discharges at the facility.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS

The Wastewater Programs will be assessed to ensure compliance with applicable regulatory requirements. EMSWeb is being used at PWD NASO to keep track of all inspections and internal assessments. Because inspections change on a routine basis, they were not listed in this plan. Refer to EMSWeb for a list of the inspections currently conducted by the PWD staff and internal assessments that have been conducted by the MM staff.

Please refer to the HRSD Permits, the installation's Pretreatment Device Management Plans (PDMP) and EMSWeb for an updated summary of wastewater internal assessment summary.

C. PWD NASO ENVIRONMENTAL PROTECTION SPECIALIST TASKS (NASO and DN):

- Perform regular inspections of the installation's oil water separators (OWS) and associated sediment traps and valves that discharge to the sanitary sewer system.
- Inspect all other Pretreatment Devices including Neutralization Tank, Pulper, Sediment Traps, etc. as required.
- Record and file inspections as required by the HRSD Permits. Maintain files for a minimum of 3 years.
- Promptly resolve routine issues which require correction, at the lowest level possible, and follow up with appropriate training and subsequent inspections as needed.
- Report findings of all inspections to the NAVFAC MIDLANT Water Program Manager as necessary to coordinate correction of non-routine deficiencies and provide POAM updates quarterly to show all deficiencies.

D. NAVFAC MIDLANT MEDIA MANAGER TASKS (NASO and DN):

- Prepare reports to include meter readings and monitoring results, as required by submission to HRSD.
- Ensure corrective actions are initiated for findings identified during compliance inspections.
- Review inspection findings by the Installation Environmental staff monthly to determine if intervention or additional support is needed.
- Develop a POAM for open findings exceeding 90 days.
- Facilitate HRSD installation inspections.
- Modify/update PDMPs where needed.
- Ensure Permit requirements are included in the annual budget to support all aspects of the Wastewater Program on a continuous basis.
- Review sampling results verify compliance with the HRSD Permits.
- Ensure that the HRSD Permit reapplications are submitted within the required time frames.
- Provide training to tenant commands on prohibited discharges, where necessary.
- Ensure the following reports are completed and submitted to HRSD by the permit specified deadlines: Meter Certifications, Inflow and Infiltration Updates, Sampling Schedules.

E. INTEGRATED PRODUCT TEAM (IPT)/OIL RECOVERY TECHNICIAN TASKS (NASO and DN):

- Quarterly inspect pretreatment devices and perform maintenance as necessary.

F. NAVFAC MIDLANT UTILITIES TASKS (NASO and DN):

- Perform weekly inspections of Pump Stations SD-600, 612, 259, and 374.
- Collect monthly meter readings from Pump Stations SD-600, 612, 259, and 374. Provide meter readings by 5th of following month for regulatory submittal by the 10th of the month.
- Perform annual meter certification of Pump Stations 612, 259, and 374 and provide reports to Media Manager for regulatory submittal.

III. MEDIA OVERVIEW

NALF Fentress has an onsite Navy owned and operated wastewater treatment plant. Installation has a DEQ Virginia Pollution Abatement (VPA) Permit that governs the spray application of treated domestic wastewater onto neighboring Navy owned, agricultural leased fields. Under this permit, NAVFAC Utilities will:

- Operate and maintain the wastewater treatment plant and components of the spray application system.
- Comply with VPA Permit and Nutrient Management Plan requirements.

A. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

The Wastewater Program will be assessed to ensure compliance with Federal, State and local permit requirements. Please refer to EMSWeb for an updated internal assessment summary.

B. NAVFAC UTILITIES TASKS (FENTRESS):

- Maintain Class IV wastewater operator licensures.
- Inspect components of wastewater treatment plant system.
- Record and file inspections. Maintain files per regulatory requirements.
- Promptly resolve routine issues which require correction, at the lowest level possible, and follow up with appropriate training and subsequent inspections as needed.
- Report findings of all inspections to the NAVFAC MIDLANT Water Program Manager as necessary to coordinate correction of non-routine deficiencies and provide POAM updates quarterly to show all deficiencies.
- Maintain Operations and Maintenance Manual and update as necessary. Notify NAVFAC MIDLANT Water Program Manager if any revisions or updates are required.
- Complete sampling requirements required by permit.
- Notify NAVFAC MIDLANT Water Program Manager if there are any bypasses or upsets of the plant.

C. NAVFAC MIDLANT MEDIA MANAGER TASKS (FENTRESS):

- Review findings provided by the installation to determine if intervention or support is needed.
- Review and confirm accuracy of all operating records and monitoring data provided by NAVFAC Utilities on a monthly basis.
- Prepare VPA Monitoring Reports, as required by submission to the Department of Environmental Quality (DEQ) on a monthly and annual basis.
- Facilitate VPA VADEQ installation inspections.
- Ensure Permit requirements are included in the annual budget to support all aspects of the VPA Program on a continuous basis.
- Review sampling results verify compliance with the VPA Permit
- Ensure that the VPA Permit reapplication is submitted within the required time frame.
- Ensure that the Nutrient Management Plan is updated every three years and submitted to VADEQ.
- Report any updates to the Operations and Maintenance Manual and/or Nutrient Management Plan to VADEQ.
- Report any bypasses or upsets of the plant to VADEQ.

POTABLE WATER

I. MEDIA OVERVIEW

The Safe Drinking Water Act (SDWA) exists to ensure the quality of drinking water supplied by public water systems. Compliance with the SDWA at this installation requires a combination of monitoring and recurring certifications (inspections). The potable water media manager is ultimately responsible for the monitoring requirements of the SDWA. The NAVFAC MIDLANT Certification Management Department is responsible for maintaining and certifying cross connection and of backflow prevention equipment. Additionally, the NAVFAC MIDLANT Utilities Department is responsible for overall operation and maintenance of the water system.

The NAS Oceana water distribution system serves a population of approximately 7,900 customers. Average daily demand is 300,000 gallons per day. The Virginia Department of Health regulates the water system as a Class V waterworks (permit #3810430) and it is categorized as a Community Water System according the SDWA criteria.

All water is supplying the water system is purchased from the City of Norfolk through two interconnections with the City of Virginia Beach, thus classifying the system as a consecutive system. One interconnection is located on Laskin Road near Interstate 264, and the second interconnection is located on London Bridge Road near the back gate. Water is fed into a 1,000,000-gallon ground level tank and re-pumped into the Oceana distribution system where pressure is maintained between 50 and 62 psi. There are two potable elevated towers, one ground level storage tank, and 42 miles of distribution piping that redistribute water on the base.

In summary, the water system at NASO consists of the following components:

- 2 water pump stations
- 1 potable ground level reservoir
- 3 potable elevated storage tanks
- 350 fire hydrants
- 850 valves
- 160 meters
- 42 miles of potable water line
    - 69% cast iron
    - 29% ductile iron
    - 2% PVC

The Dam Neck Annex water distribution system serves a population of approximately 3,000 customers. Average daily consumption at the installation is approximately 200,000 gallons per day. Water is provided for both domestic and fire protection uses. A separate fire protection system is located within the boundaries of the SPECWAR compound at the north end of the base.

The Virginia Department of Health regulates the water system as a Class V waterworks (permit # 3810195) and it is categorized as a Community Water System according the SDWA criteria. All water supplying the water system is purchased from the City of Norfolk through three metered connections with the City of Virginia Beach, thus classifying the system as a consecutive system. A wheeling fee is paid to the City of Virginia Beach to deliver water from the City of Norfolk to Dam Neck.

In summary, the water system consists of the following components:

- 3 water pump stations
- 1 potable elevated storage tank
- 129 fire hydrants
- 400 valves
- 10 miles of potable water line
  - 65% cast iron
  - 6% ductile iron
  - 5% asbestos cement
  - 24% PVC

The NALF Fentress potable water system serves a population of approximately 40 customers. Daily consumption at the installation averages around 3,500 gallons per day. Water is provided only for domestic uses. A separate non-potable system is maintained for fire protection. There are two shallow groundwater supply wells and a water treatment plant serving the installation. The treatment plant employs conventional treatment for iron and manganese removal, softening, disinfection, and corrosion control. The capacity for the plant is 10,800 gallons per day. The potable distribution system consists of around 1,000 feet of small diameter copper piping. The groundwater wells feed into a 5,000 gallon raw water storage tank. Treated potable water is stored in a 1,000 gallon hydro-pneumatic tank located at the water treatment plant.

The Virginia Department of Health regulates the water system (permit # 3550615) and it is categorized as a Non-Transient Non Community Water System according the SDWA criteria.

In summary, the water system consists of the following components:

- 1 water treatment plant
- 2 groundwater supply wells
- 1 raw water storage tank
- 1 potable hydro-pneumatic tank
- 3 valves
- Approximately 1,000 feet of small diameter copper piping

For a full list of permits, please refer to Appendix C of this document.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH: N/A

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

Required potable water routine monitoring/ certification programs:

- Bacteriological Monitoring (Total Coliform and E.Coli)
- Lead and Copper Monitoring
- Disinfectants, and Disinfection By Products Monitoring
- Lead In Priority Area Testing
- Asbestos Monitoring
- Backflow Prevention Testing and Certification
- Nitrate and Nitrite (Fentress Only)

C. NAVFAC MIDLANT UTILITIES TASKS (PRACTICE OWNER/OPERATOR):

- Ensuring that the budget for SDWA compliance is adequate.
- Overall operation and maintenance of water system
- Maintenance of appropriate operator licenses

D. PWD NASO ENVIRONMENTAL PROTECTION SPECIALIS TASKS: N/A

E. NAVFAC MIDLANT MEDIA MANAGER TASKS:

- Develop and update SDWA compliance sampling plans as necessary and submit these plans to the Virginia Department of Health for approval.
- Ensure that all compliance samples and operational records are reported on time and recorded appropriately.
- Ensure public notifications are distributed to consumers, as necessary.
- Produce and distribute Annual Water Quality Report (also known as Consumer Confidence Report)
- Ensure local, state, and Federal rules/regulations, U.S. Navy policy, executive orders, and instructions are followed.
- Coordinate sanitary survey inspections with VDH and address corrective actions in coordination with NAVFAC Utilities and NAVFAC Certification Management Division, as applicable Address and document water quality complaints in coordination with NAVFAC Utilities, NAVFAC Facilities, and Installation Preventive Medicine Officer
- Conduct internal audits annually and document findings, Plan of Action and Milestones, and corrective actions in EMSWeb .

F. NAVFAC MIDLANT CERTIFICATION MANAGEMENT DEPARTMENT TASKS:

- Find and eliminate existing cross-connections and prevent new cross-connections.

- When cross-connections cannot be eliminated, install, inspect, and test backflow preventers.
- Keep an inventory of all existing backflow preventers.
- Certify all backflow preventers as required by the regulatory agency. If there is no regulatory requirement, then all backflow preventers should be certified at least once every 6 months for high hazards and once every 12 months for low hazards by a certified inspector.
- Repair or replace defective backflow preventers. Retain cross connection and backflow preventer inspection and maintenance records for at least 5 years.

OTHER

NEPA

I. MEDIA OVERVIEW

The National Environmental Policy Act (NEPA) of 1970 requires that the Federal Government assess all proposed actions for potential impacts to the environment. It does not advocate environmental preservation at all costs, but simply to determine potential environmental impacts and to consider them alongside the technical and economic considerations that are inherent factors in Federal decision making.

At the Commander Navy Region Mid-Atlantic Hampton Roads area installations, the NEPA determination process begins with the submittal of an Environmental Checklist (EC) and multimedia review by installation media specific environmental experts. The EC helps to determine what level of NEPA needs to be completed prior to implementation of the proposed action. This EC is typically done very early in the planning process. A signed and completed EC determines whether the action will require NEPA documentation, can be performed under a Record of Categorical Exclusion (aka RCE or CATEX) or not, or if an Environmental Assessment (EA) needs to be completed, which will help determine if there is a Finding of No Significant Impact (FONSI) or if an Environmental Impact Statement (EIS) needs to be issued. The Navy has 45 agency-specific actions they have determined will normally have no significant individual or cumulative effect on the quality of the human environment. If a project is determined to fit into one of the actions that requires the preparation of an RCE document, the RCE is prepared by Facilities Planning Department staff and signed by the installation Commanding Officer, or an individual to whom such authority is delegated, prior to any work being performed. Currently, the CO can delegate signature authority for RCE documentation to the Public Works Officer (PWO), without further sub-delegation, per CNRMA CATEX guidance dated 27 August 2012. If an EA is required, any decisions that are made must have concurrence and signature by the Commander, Navy Region Mid-Atlantic.

II INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

The NEPA program will be reviewed annually to ensure that proper documentation is in place for proposed projects and/or activities. The purpose of these reviews is not to duplicate the efforts of others, but to confirm and support actions and recommendations resulting from these efforts. These reviews will be conducted for all projects or activities which may affect the environment.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS: N/A

C. PRACTICE OWNER TASKS:

- Practice Owners are responsible for the preparing the draft Record of Categorical Exclusion, securing the necessary signature to complete the RCE, and returning the signed RCE to the Facilities Planning Department within 21 days of RCE completion.
- For NEPA determinations to be valid, Practice Owners are responsible for incorporating environmental checklist comments into plans, specifications, and construction contracts so that they are complied with.

D. PWD NASO ENVIRONMENTAL PROTECTION SPECIALIST TASKS:

The EPS may request guidance from the Facilities Planning Department on project or activity NEPA compliance and may recommend the submission of environmental checklists.

E. NAVFAC MIDLANT MEDIA MANAGER TASKS:

- As requested, coordinate with the Facilities Planning Department (FPD) to provide guidance on the proper submission of NEPA environmental checklists.
- As received, coordinate each submitted environmental checklist with Media Manager/Subject Matter Experts to identify environmental issues/requirements/concerns and to determine the level of National Environmental Policy Act (NEPA) documentation required (Record of Categorical Exclusion (CATEX), Environmental Assessment (EA), or Environmental Impact Statement (EIS).
- Weekly, provide the FPD with updates on environmental checklist status indicating the need for external agency consultations that could impact project costs and scheduling.
- Once all comments have been received from Media Manager/Subject Matter Experts, ensure that completed environmental checklists are returned to the Facilities Planning Department (and/or other submitting personnel) in a timely manner (ideally, within three days).
- Annually, ensure that NEPA documentation contains the appropriate justification for Records of Categorical Exclusion (RCE or CATEX), Environmental Assessments (EA), or Environmental Impact Statements (EIS). In coordination with the FPD, ensure that completed NEPA environmental checklists and signed Records of Categorical Exclusion are contained in project files (uploaded into the EMSWeb as

part of the documentation and storage of the Administrative Record) and Environmental Assessments or Environmental Impact Statements are contained in project files (uploaded into the OPNAV N45 Environmental Planning Library). As requested, ensure that Facilities Planning Department personnel receive training on the NEPA process and in the proper preparation of NEPA documentation (ECs, RCEs, etc.).

- Ensure annually that all completed EA projects have been issued a Finding of No Significant Impact (FONSI) and that a Notice of Award (NOA) has been published in a local newspaper.
- Annually, ensure that all EIS projects have been issued a signed Record of Decision (ROD) and that a Notice of Availability (NOA) has been published in a local newspaper.
- Annually, conduct internal audits of the NEPA program.

NOISE

I. MEDIA OVERVIEW

The Environmental Department does not manage or participate in overseeing a Noise pollution program.

Installation Safety Office participates in overseeing a HEARING CONSERVATION & NOISE ABATEMENT program. BUMED centrally manages the hearing conservation program. Commanding Officers of shore activities are required to institute a hearing conservation program where a potential noise hazard has been identified by Industrial Hygiene (IH). This includes requirements such as providing medical evaluations IAW IH survey, labeling noise hazardous equipment/areas, and training. The governing instructions are OSHA 29CFR1910.95, OPNAVINST 5100.23G.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

Safety office's support includes respective evaluation, inspection (annual workplace inspections required by OSHA. More frequent in high hazard areas), Industrial Hygiene survey coordination (under BUMED performs noise measurements), education and training, and developing activity instructions if requested. The safety office receives a copy of the IH survey and utilizes for inspections and references.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

No environmental inspections or assessments are performed through the Environmental Department for this program.

C. PRACTICE OWNER TASKS:

OPNAVINST 5100.23G requires safety offices to maintain documentation of workplace inspections and training. The medical department maintains employees' health record with audiogram results. The medical department also retains all noise measurement data as well as audiometric records and information.

D. PWD NASO INSTALLATION TASKS: N/A

E. NAVFAC MIDLANT MEDIA MANAGER TASKS: N/A

CERCLA/ENVIRONMENTAL RESTORATION

I. MEDIA OVERVIEW

The primary governmental entities involved in the cleanup of past contamination on any DON installation are DON, U.S. EPA, and the respective state. DON is responsible for the execution of its ER Program; however it does so with guidance from the Office of the Secretary of Defense (OSD). The Department of the Navy Environmental Restoration (NERP) Manual (August 2006) defines and summarizes the organizational responsibilities of the participants involved in the successful implementation of the ER Program. Specifically related to the Internal Assessment Program, the NERP Chapter 2 defines the actions for components of DON in the execution of its ER Program. The actions of the Commander, Navy Installations Command (CNIC), includes those for the Area Environmental Coordinator/Regional Environmental Coordinator and those provided by the individual facilities under the roles prescribes for the Installation Commanding Officer/Commanding General. As the DON's real estate and construction agent, NAVFAC is responsible for the acquisition, construction, operation and maintenance, and when no longer needed, disposal of the Navy's shore infrastructure. As such, NAVFAC manages and executes the DON's ER Program by providing management of the ER program and its execution at the project levels, and provides environmental engineering technical support, contracting and legal support, and coordinates with other DON components regarding ER actions. The NERP Chapter 2 defines the specific ER program execution action for the elements of NAVFAC, specifically for NAVFAC (Headquarters), NAVFAC Commands (FACs), NAVFAC Facilities Engineering Commands (FECs) including the roles and responsibilities of the Remedial Project Manager, Contracting Officer (KO), Contract Specialist, Resident Officer In Charge of Construction (ROICC), Contracting Officer Representative (COR), and Contractor Support for the ER Program.

II INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

Inspections and assessments of these programs are managed solely by the remedial project managers with assistance of contractors.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

POL Remediation Program

- There are 9 sites located at PWD NASO that are managed under the POL Remediation Program. Operation and Management reporting regarding these sites is conducted via a Small Business contract. Monitoring wells at these sites are typically gauged and monitored monthly. Free Product Recovery Reports are submitted to VDEQ on a quarterly schedule for each site in the Program. A variety of free product recovery methods are used to move active sites to closure in conjunction with VDEQ requirements. These methods are as simple as free product recovery by hand bailing to a variety of complex mechanical systems.

C. PRACTICE OWNER TASKS: N/A

D. PWD NASO ENVIRONMENTAL PROTECTION SPECIALIST TASKS: N/A

E. NAVFAC MIDLANT MEDIA/PROGRAM MANAGER TASKS:

Tasks of the ER Program Manager:

- Oversee the contractors for management of active sites
- Conduct internal audit of the Environmental Restoration program annually.
- Ensure the timely execution of the ER program
- Develop and prepare scopes of work & Government estimates
- Evaluates contractors proposals and work
- Leads in pre-proposal meetings and/or negotiations
- Provides program information (schedules, correspondence, project descriptions, justification, status reports)
- Serves as the Contracting Officer's Representative
- Responsible for maintaining relationships with, and routinely meeting with Federal and State regulators and enforcement agencies to discuss environmental standards and actions
- Serves on Restoration Advisory Boards (RABs)
- Represents the Navy at Public meetings
- Supports NAVFAC ER program goals, execution and requirements
- Ensures NORM database is kept up to date and accurate (site data, cost to complete, risk ranking, project schedules thru 2040)

Tasks of the POL Restoration Program Manager:

- Oversee the contractors for management of active sites
- Conduct annual internal assessments
- Manage the groundwater remediation permits
- Submit Discharge Monitoring Reports (DMRs) where appropriate and other required submittals to state regulator

WASTE MUNITIONS

I. MEDIA OVERVIEW

The EPA and the Virginia Department of Environmental Quality (VDEQ) regulate the management and disposal of Waste Military Munitions (WMM) through the hazardous waste regulations. Naval Air Station Oceana and Dam Neck Annex do not typically generate WMM, however in the event that WMM are generated, it will be managed in a <90-day Hazardous Waste Accumulation Area (HWAA) or Satellite Accumulation Area (SAA) in accordance with the installation's Explosive Hazardous Waste Management Plan. At no time are WMM stored in a Naval Air Station Oceana or Dam Neck Annex Universal Waste Accumulation Area.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

Please refer to the Hazardous Waste Section of this Internal Assessment Plan for detailed Inspections/Oversight Evaluations on HWAA's and SAA's.

ENVIRONMENTAL MANAGEMENT SYSTEM

I. MEDIA OVERVIEW

CNRMA Hampton Roads Environmental Management System is implemented within the Hampton Roads Area for all installations, commands, tenants, and contractors. The EMS covers all regulated and other activities, products, and services with a focus on mission-supported activities that may impact the environment, covering media and program areas as defined in pertinent Federal, state, and local regulatory and DoD and U.S. Navy policy requirements.

It is the goal of management, as outlined in the Environmental Policy, that protection of the environment be enhanced by minimizing environmental impacts associated with mission-supporting activities in a sustainable, cost-effective and technically feasible manner. The Environmental Policy commits to:

- Continual improvement of environmental performance;
- Compliance with all applicable environmental legislative, regulatory, policy and other requirements;
- Ensuring implementation of pollution prevention measures and waste minimization programs; and
- Setting, reviewing, and achieving environmental objectives and targets through Plan-of-Action and Milestones, (POAMs) to reduce risk to the environment and mission.

The overall intent of the environmental policy for the Installation Commander is summarized and communicated to personnel at their installation with the acronym "CARE":

- **C - C**omply with all the rules
- **A - A**lways improve
- **R - R**educe waste
- **E - E**liminate pollution

The NASO Commanding Officer has established an EMS Policy Statement endorsed through signature which indicates his commitment to the program. The Policy will be reviewed and assessed within 3 months of a new Installation Commanding Officer taking command.

P2 is incorporated into EMS objectives, targets, and POA&Ms. Environmental Practice Inventories (EPIs) are conducted in order to document current work practices and communicate with other media managers as needed to document potential pollution opportunities.

An internal evaluation of both conformance and compliance is performed at each Navy EMS Appropriate Facility within the Hampton Roads area of CNRMA at least annually. Internal audits are critical to the effectiveness of an EMS and to the continual improvement cycle. Failure to properly conduct a comprehensive internal evaluation of conformance/compliance, document the findings, and use the findings for each facility's management review can result in a breakdown of the EMS and an inability to re-declare EMS conformance. Through document and records review, interviews with Installation personnel, and on-site observations, the Internal EMS/Compliance Audits should determine:

- If the CNRMA-HR Regional EMS, as documented in these EMPs and the EMS Description Document, conforms with Navy and CNRMA-EMS criteria;
- If the CNRMA-HR Regional EMS is implemented and maintained in accordance with these EMPs and the EMS Description Document;
- If the compliance posture of each Installation within the Hampton Roads area of CNRMA is in accordance with all applicable Federal, state and local laws and regulations, as well as Navy policy.

II INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH: Tier III Internal Compliance Audits are conducted during the first three quarters of the fiscal year. The annual Tier III Internal Conformance Audit is typically conducted during the 4th quarter of the fiscal year. The annual Tier III Internal Conformance Audit typically consists of site visits and interviews with personnel at both the Installation and the Environmental CORE. The execution of the Tier III Internal Conformance Audit is held until the 4th quarter so that a root cause analysis can be performed on the Tier II and III compliance findings to show where issues within the management system exist.

EPIs have been established at several locations throughout the NAS Oceana area of responsibility that conduct industrial activities. The goal is to update these inventories on an annual basis. Typically, a summer student workforce is used to accomplish this with the assistance of MM and EPSs.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

Planning and conducting the Internal EMS and Compliance Audits proceed as defined in *CNRMA-HR EMS EMP 13 Monitoring and Measurement and Evaluation of Compliance* and *CNRMA-HR Regional EMS EMP-16, Internal Audits.*

A tracking list of the EPIs is maintained on the EVBL shared drive by the Environmental Compliance section and indicates the completion status.

C. PRACTICE OWNER (HAMPTON ROADS EMS COORDINATOR) TASKS:

Compile recommended changes to the Policy Statement and present to the Regional & Installation Command Staff and Environmental Installation Program Director annually or more frequently as required. Disseminate outreach material regarding the environmental policy statement and related awareness materials through various channels to all CNRMA personnel; including Installation Departments, Tenants, and Contractors.

- Document internal conformance audit and corresponding findings in EMSWeb.
- Maintain all records associated with the Internal Audit.
- Coordinate with EQMB for review, comment, and approval of the Audit Report.
- Coordinate with the responsible parties to develop POA&Ms to address non-conformances identified in the Audit Report, in accordance with procedures established in the *CNRMA-HR Region EMS EMP-14, Non-Compliance, Non-Conformance and Corrective and Preventive Action.*
- Maintain all EMS audit documentation for consideration and inclusion in the annual Management Review.

D. PWD NASO INSTALLATION TASKS:

EIPD Tasks:

- Provide briefing on Policy Statement, including roles and responsibilities within the CNRMA EMS, to new Installation Commander and have new statement signed.
- Document briefing with new Installation Commander and forward to the HR EMS Coordinator.
- Annually review the Environmental Policy with the Installation Commander and make changes as necessary.
- Provide copy of the Policy Statement and any other pertinent EMS documents to the Installation Commanders.
- Review the Internal EMS Audit Report and POA&M.
- Take action, as appropriate, to address identified non-conformities/non-compliance findings.

EPS Tasks:

- Support the Environmental Installation Program Director in disseminating outreach material regarding the environmental policy statement and related awareness materials to all CNRMA personnel; including Installation Departments, Tenants, and Contractors.
- Recommend to the HR EMS Coordinator changes to the Policy and ensure it remains suitable to the CNRMA mission and the EMS goals.
- Support the audit team in providing necessary documentation to effectively perform internal audit.
- Assist in conducting annual updates of the EPIs.

E. NAVFAC MIDLANT MEDIA MANAGER (MM) TASKS:

- Support the HR EMS Coordinator in disseminating outreach material regarding the environmental policy statement and related awareness materials to all base personnel; including Installation Departments, Tenants, and Contractors.
- Recommend to the HR EMS Coordinator changes to the Policy to ensure it remains suitable to the CNRMA mission and EMS goals. Support the HR EMS Coordinator in collecting compliance data and documenting audit findings in EMSWeb, in accordance with procedures established in the *CNRMA-HR Region EMS EMP-14, Non-Compliance, Non-Conformance and Corrective and Preventive Action.*
- Coordinate with all other Media Managers and installation personnel to assess compliance issues, P2 opportunities, and progress toward any required reduction goals.
- Establish new EPIs when deemed necessary.
- Review EPI Reports to determine if intervention or support is needed.
- Conduct EPIs as requested or as follow-up or assistance to the installation.
- Conduct internal audits of the media programs annually through EMSWeb.

EMERCENCY PLANNING AND COMMUNITY RIGHT TO KNOW ACT

I. MEDIA OVERVIEW

The Navy is required to report Emergency Planning and Community Right to Know Act (EPCRA) information under Executive Order 12856 and Federal Requirements with Right-to-Know Laws. EPCRA guiding documents include Executive Orders 13693, 40 CFR 355 through 372, and DoD guidance document, "**Consolidated EPCRA Policy for DOD Installations, Munitions, Activities, and Operational Ranges.**" The EPCRA program is intended to encourage and support emergency planning at the state and local levels and provide information about potential chemical hazards to the public. The required annual reports for EPCRA include EPCRA section 311, 312, and 313 reports. Additionally, letters to the Local Emergency Planning Committee (LEPC) should be reviewed to ensure they are current.

II INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

EPCRA uses a building block approach where each report builds on information submitted with the previous report. The level of detail and amount of information submitted increases with each report. EPCRA section 312 (commonly called Tier II reports) reporting is essentially an inventory and annual report of quantities of hazardous materials and extremely hazardous substances stored that exceed pre-determined thresholds. EPCRA Section 313 reports (commonly called Toxic Release Inventory (TRI report) document the releases of toxic materials into the environment over pre-determined thresholds. As such, only annual internal assessments are required.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

NAVFACMIDLANT EPCRA MM will conduct oversight and program modifications as required. Locations to be assessed include anywhere that Hazardous Material is used and/or stored.

C. PRACTICE OWNER/OPERATOR TASKS: N/A

D. PWD NASO ENVIRONMENTAL PROTECTION SPECIALIST TASKS:

- Assist the EPCRA Program MM by collecting data to support EPCRA Tier II reporting with the Environmental Practice Inventories
- Assist in updating Environmental Practice Inventories

E. NAVFAC MIDLANT MEDIA MANAGER TASKS:

- Prepare threshold determinations for EPCRA Sections 312 and 313
- Compiling EPCRA section 312 Tier II reports (if required) and issue reports to State Emergency Response Council (SERC) and to applicable Local Emergency Planning Committees (LEPCs).
- Compiling EPCRA section 313 TRI reports (if required) and issuing to the Environmental Protection Agency (EPA).
- Make recommendations to identify and implement potential P2 opportunities that will reduce the TRI reporting requirements.
- Conduct internal audits, document findings, Plan of Action and Milestones, and corrective actions in EMSWeb annually.

TOXICS (ASBESTOS, PCB, LEAD-BASED PAINT, RADON)

I. MEDIA OVERVIEW

Toxics regulations cover a range of environmental issues, including asbestos, PCBs, Radon, and Lead-Based Paint.

Asbestos

Asbestos is regulated under the EPA Clean Air Act, OSHA safety regulations, and Virginia Solid Waste regulations. The key environmental regulatory requirements for asbestos are:

- Surveys of facilities for asbestos prior to demolition
- Regulatory notifications prior to facility demolition or asbestos abatement
- Utilization of proper work practices during demolition/renovation to minimize asbestos release to the air
- Proper disposal of asbestos containing materials

Compliance with Federal and State asbestos regulations relies on the contracting office responsible for the project. The EPS is not generally involved in these projects. The Asbestos Program Manager (APM) located in the Region Public Works Department or a designated installation APM provides guidance to the contracting offices and handles compliance issues as needed. Facility personnel seeking to conduct renovations, demolitions, or disturbance of questionable asbestos materials must contact the APM and NAS Oceana Safety Office at 433-2211 to request asbestos removal or pick-up. A MAXIMO request should be initiated that includes sampling of unknown material.

PCBs

PCBs are regulated under TSCA, Toxic Substances Control Act; 40 CFR Part 761. The key requirements are:

- Determining appropriate cleanup levels (for example, the type of PCB waste or the intended use of the brownfields site).
- Verifying that the cleanup standard has been met and for establishing deed restrictions (where necessary).
- Determining the options available for disposing of PCB wastes.
- Investigating covering/capping PCB-contaminated areas, waste storage, waste container marking, manifesting and recordkeeping requirements.

Lead-Based Paint

Lead Based Paint is regulated under EPA via 40 CFR Part 745. The key requirements are:

- Firms performing renovation, repair, and painting projects that disturb lead-based paint in pre-1978 homes, child care facilities and schools must be certified by EPA
- Firms that they use certified renovators must use renovators who are trained by EPA-approved training providers to follow lead-safe work practices.
- Contractors must use lead-safe work practices and follow three simple procedures, contain the work area, minimize dust and clean up thoroughly.

Radon

Radon is regulated under 40 CFR Parts 141 and 142 of the SDWA (Safe Drinking Water Act), OSHA 29 Part 1910.1096 (worker exposure), and EPA Guidance for Indoor Air Quality. The key requirements are:

- The Safe Drinking Water Act directs the EPA to
  - propose and finalize a maximum contaminant level (MCL) for radon in drinking water. The proposed level is 300 picoCuries per Liter (pCi/L).
  - make available an alternative approach: a higher alternative maximum contaminant level (AMCL – 4000 pCi/L) accompanied by a multimedia mitigation (MMM) program to address radon risks in indoor air.
- Radon is of most concern if the drinking water comes from an underground source.
- The residential indoor air recommended action level is 4 pCi/L. This screening level is also approved by the US Surgeon General. The source of Radon in indoor air is from soil under the house.
- The OSHA worker exposure limit is 100 pCi/L.

II. INSPECTIONS/OVERSIGHT EVALUATIONS

A. APPROACH:

All asbestos abatement and removal is performed by qualified contractor personnel or by NAVFAC MIDLANT Environmental Services Code OPHE13 Asbestos Insulators. The only involvement for other departments within NAVFAC MIDLANT is for incidental disposal not handled by contractor or NAVFAC MIDLANT personnel.

Facility personnel seeking to conduct renovations, demolitions, or disturbance of questionable asbestos materials must contact the Safety Office at 433-3307. A MAXIMO request should be initiated that includes sampling of unknown material. Work practices at all locations where it is either known or anticipated that asbestos may be encountered will be assessed to ensure that asbestos materials are not being improperly handled or disposed. Facilities under minor renovation, such as self-help projects, should also be assessed.

All transformers, capacitors and any other equipment containing PCBs have been removed from installations in the Hampton Roads area. There may be some light ballasts that contain PCBs but these will be removed on a case-by-case basis. As such, there is no need for a continuous inspection program at either installation.

Lead-based paint is addressed on an as identified basis to ensure proper management and disposal of waste. Worker safety is addressed by Industrial Hygiene. Lead-based paint issues as they relate to housing and child care facilities are the responsibility of facilities and the PPV managing partner.

Radon testing performed in the late 1980's did not indicate elevated levels of radon. Radon should be tested for during new building construction and building renovations

which may impact ventilation. Testing and mitigation is the responsibility of facilities and should be included in project scopes.

B. INVENTORY OF BUSINESS AND MANAGEMENT PRACTICES, ASSETS, AND LOCATIONS:

For Asbestos, buildings are assessed as renovations, demolition, and/or construction projects arise. CAA regulations also require asbestos surveys be completed and submitted to EPA/VDEQ prior to building demolition.

C. PRACTICE OWNER TASKS:

D. PWD NASO ENVIRONMENTAL PROTECTION SPECIALIST TASKS:

- Ensure that projects are properly conducted by contacting WAHE-50 above, if any renovation, demolition, or disturbances of suspect asbestos containing materials are observed during routine multi-media inspections, in accordance with CNRMA INST 11011.12A 08 May 2009.
- Environmental Protection Specialist should ensure that the Regional Safety Office has reviewed "work permit" for possible asbestos.

E. NAVFAC MIDLANT MEDIA MANAGER TASKS:

- Comply with applicable regulatory reporting requirements.
- Review this document annually and update as needed.

F. SITE-SPECIFIC COMPLIANCE CHECKLIST QUESTIONS FOR ASBESTOS MANAGEMENT WHEN REQUIRED

1. Does the installation have a listing of all "in-house" abatement personnel and current certificate of training?
2. Has a notification been submitted to the regulatory authority for the project being performed, or is it covered under the annual notification?
3. Are there signs in the area warning personnel that Asbestos hazards are present?
4. Has an enclosure or other means (glove bag) of segregation been utilized to contain any airborne asbestos? Is there a constant negative pressure on the enclosure while work is being performed?
5. Are asbestos workers removing asbestos contaminated clothing before leaving the work area?
6. Has all water in the area been collected for proper disposal?
7. Is all asbestos containing material (ACM) wetted with amended water before removal?
8. Is all ACM removed from the work area in double bags that have been "goose neck" tied?
9. Are the bags labeled with the contents and the facility address?
10. Does the supervisor of the asbestos workers keep a log identifying personnel performing the work and tasks that have been completed?

APPENDIX A

PWD NASO
INTERNAL INSPECTION CHECKLISTS

LIST OF EPS INTERNAL INSPECTION CHECKLISTS

Checklist Template Name	Installation	Media
EPS-DAMNECK-QTRLY-TANK	Dam Neck Annex	Above Ground Storage Tanks
EPS-DAMNECK-QUARTERLY AST OVERSIGHT	Dam Neck Annex	Above Ground Storage Tanks
EPS - DAM NECK - DRUM STORAGE AREAS	Dam Neck Annex	Above Ground Storage Tanks
EPS-DAMNECK-SOLVENT CLEANING	Dam Neck Annex	Air Quality
EPS-DAMNECK-COMBUSTION	Dam Neck Annex	Air Quality
EPS-DAMNECK-QTRLY-WOODWORKING	Dam Neck Annex	Air Quality
EPS-DAMNECK-QTRLY-PROCESS	Dam Neck Annex	Air Quality
EPS-DAMNECK-FUEL DISPENSING	Dam Neck Annex	Air Quality
EPS-DAMNECK-HWAA	Dam Neck Annex	Hazardous Waste
EPS-DAMNECK-SAA	Dam Neck Annex	Hazardous Waste
EPS-DAMNECK-QTRLY-UWAA	Dam Neck Annex	Hazardous Waste
EPS-DAMNECK-QTRLY-REFRIG RECOVERY	Dam Neck Annex	Ozone Depleting Substances
EPS-DAMNECK-GREASE CONTAINER	Dam Neck Annex	Storm Water
EPS-DAMNECK-MONTHLY VALVE	Dam Neck Annex	Storm Water
EPS-DAMNECK-QUARTERLY VALVE	Dam Neck Annex	Storm Water
EPS-DAMNECK-QUARTERLY BMP	Dam Neck Annex	Storm Water
EPS-DAMNECK-QUARTERLY UST	Dam Neck Annex	Underground Storage Tanks
EPS-DAMNECK-GREASE TRAP	Dam Neck Annex	Wastewater
EPS-DAMNECK-QTRLY-OWS	Dam Neck Annex	Wastewater
EPS DAMNECK SEMI-ANNUAL PULPER INSPECTION	Dam Neck Annex	Wastewater
EPS-DARE COUNTY-QUARTERLY AST OVERSIGHT	Dare County Landing	Above Ground Storage Tanks
EPS - DARE COUNTY - QTRLY PORTABLE CONTAINERS	Dare County Landing	Above Ground Storage Tanks
EPS-DARE COUNTY-SOLVENT CLEANING	Dare County Landing	Air Quality
EPS-DARE COUNTY-QTRLY-UWAA	Dare County Landing	Hazardous Waste
EPS-FENTRESS-QTRLY-TANK	Fentress Air Field	Above Ground Storage Tanks
EPS-FENTRESS-QUARTERLY AST OVERSIGHT	Fentress Air Field	Above Ground Storage Tanks
EPS - FENTRESS - QTRLY PORTABLE CONTAINERS	Fentress Air Field	Above Ground Storage Tanks
EPS-FENTRESS-SOLVENT CLEANING	Fentress Air Field	Air Quality
EPS-FENTRESS-COMBUSTION	Fentress Air Field	Air Quality
EPS-FENTRESS-HWAA	Fentress Air Field	Hazardous Waste
EPS-FENTRESS-SAA	Fentress Air Field	Hazardous Waste
EPS-FENTRESS-QTRLY-UWAA	Fentress Air Field	Hazardous Waste
EPS-FENTRESS-GREASE CONTAINER	Fentress Air Field	Storm Water
EPS-FENTRESS-QUARTERLY UST	Fentress Air Field	Underground Storage Tanks
EPS-FENTRESS-GREASE TRAP	Fentress Air Field	Wastewater
EPS-NASO-QTRLY-TANK	NAS Oceana	Above Ground Storage Tanks
EPS-NASO-QUARTERLY AST OVERSIGHT	NAS Oceana	Above Ground Storage Tanks
EPS - NAS Oceana - QTRLY PORTABLE CONTAINERS	NAS Oceana	Above Ground Storage Tanks
EPS-NASO-QTRLY-WOODWORKING	NAS Oceana	Air Quality
EPS-NASO-SOLVENT CLEANING	NAS Oceana	Air Quality

Checklist Template Name	Installation	Media
EPS-NASO-QTRLY-PROCESS	NAS Oceana	Air Quality
EPS-NASO-QTRLY-AEROSACE NESHAP	NAS Oceana	Air Quality
EPS-NASO-COMBUSTION	NAS Oceana	Air Quality
EPS-NASO-FUEL DISPENSING	NAS Oceana	Air Quality
EPS-NASO-QTRLY-UWAA	NAS Oceana	Hazardous Waste
EPS-NASO-SAA	NAS Oceana	Hazardous Waste
EPS-NASO-HWAA	NAS Oceana	Hazardous Waste
EPS-NASO-QTRLY-REFRIG RECOVERY	NAS Oceana	Ozone Depleting Substances
EPS-NASO-LANDFILL	NAS Oceana	Solid Waste
EPS-NASO-QRTLY-LANDFILL	NAS Oceana	Solid Waste
EPS-NASO-BOOM	NAS Oceana	Spill Response & Management
EPS-NASO-QTRLY-BMP	NAS Oceana	Storm Water
EPS-NASO-OUTFALL	NAS Oceana	Storm Water
EPS-NASO-MONTHLY VALVE	NAS Oceana	Storm Water
EPS-NASO-MONTHLY BMP	NAS Oceana	Storm Water
EPS-NASO-GREASE CONTAINER	NAS Oceana	Storm Water
EPS-NASO-QUARTERLY UST	NAS Oceana	Underground Storage Tanks
EPS-NASO-QTRLY-OWS	NAS Oceana	Wastewater
EPS-NASO-MONTHLY OWS	NAS Oceana	Wastewater
EPS-NASO-GREASE TRAP	NAS Oceana	Wastewater
EPS-NASO-BI-WEEKLY VALVE POSITION	NAS Oceana	Wastewater
EPS SEMI-ANNUAL PULPER INSPECTION	NAS Oceana	Wastewater
EPS-NASO-QTRLY-BARREL	NAS Oceana	Wastewater
EPS-NASO-SEMI ANNUAL-MERC	NAS Oceana	Wastewater
EPS-NASO-ANNUAL-NT	NAS Oceana	Wastewater

* Refer to EMSWeb for actual checklist fields and questions

LIST OF NAVY LISTBUILDER TIER 3 INTERNAL CHECKLISTS

Checklist Template Name	Media
620-CNRMA-NASO DAM NECK-DW-16-JAN	Drinking Water/Conservation
620-CNRMA-NASO-DW-16-JAN	Drinking Water/Conservation
620-CNRMA-NAS OCEANA-EMS-16-JAN	Environmental Management (EQA/EMS)
620-CNRMA-NASO DAM NECK-SWWW-16-JAN	Wastewater
620-CNRMA-NASO FENTRESS-SWWW-16-JAN	Wastewater
620-CNRMA-NASO FENTRESS-DW-16-JAN	Drinking Water/Conservation
620-CNRMA-NAS OCEANA-POL-16-JAN	Spill Response & Management
620-CNRMA-NAS OCEANA-STORAGE TANKS-16-JAN	Above Ground Storage Tanks
620-CNRMA-NAS OCEANA-HW-16-JAN	Hazardous Waste
620-CNRMA-NASO-SWWW-16-JAN	Wastewater
620-CNRMA-NASO-CR-16-JAN	Cultural Resources
620-CNRMA-NASO-NEPA-16-JAN	National Environmental Policy Act
620-CRNMA-NASO-NR-16-JAN	Natural Resources
620-CNRMA-NAS OCEANA-HAZARDOUS MATERIAL-16-JAN	Hazardous Material
620-CNRMA-NAS OCEANA-P2-16-JAN	Pollution Prevention
620-CNRMA-NAS OCEANA-PEST MANAGEMENT-16-JAN	Pest Control Management
620-CNRMA-NAS OCEANA-SOLID WASTE-16-JAN	Solid Waste
620-CNRMA-NAS OCEANA-AIR-16-JAN	Air Quality
620-CNRMA-NASO-ASBESTOS-16-JAN	Asbestos

* Refer to EMSWeb for actual checklists used during the Tier 3 Internal Assessments

APPENDIX B

PWD NASO
EMSWEB INSPECTION SCHEDULES

LIST OF TIER II INSPECTION SCHEDULES

Audit / Inspection Title	Installation	Inspector
EPS Quarterly SAA Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Quarterly UWAA Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Quarterly OWS Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Monthly OWS Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS BiWeekly Valve Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Monthly Fuel Pit Valve Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Quarterly Aerospace Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Quarterly UST Inspections (FN) - JJ	Fentress Air Field	Jerry Jackson
EPS Quarterly AST Oversight Inspections (FN) - JJ	Fentress Air Field	Jerry Jackson
EPS Quarterly UST Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Quarterly AST Oversight Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Quarterly BMP Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Semi-Annual Grease Trap Inspections (FN) - JJ	Fentress Air Field	Jerry Jackson
EPS Semi-Annual Grease Container Inspections (FN) - JJ	Fentress Air Field	Jerry Jackson
EPS Quarterly DSA Inspections (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Qrtly Filter Barrel Inspection (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Monthly AST Inspection (OC) - JJ	NAS Oceana	Jerry Jackson
EPS Quarterly Combustion Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly Fuel Dispensing Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly Refrigerant Recovery Inspection (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly Woodworking Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Qtrly Process Operations Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly HWAA Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly SAA Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly UWAA Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly OWS Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly Grease Container Inspection (DN)	Dam Neck Annex	Rebecca Modes
EPS Semi-Annual Grease Trap Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly AST Oversight Inspections (DC)	Dare County Landing	Rebecca Modes
EPS Quarterly UST Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly AST Oversight Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly AST Oversight Inspection (OC) - RM	Dam Neck Annex	Rebecca Modes
EPS Quarterly BMP Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly Solvent Cleaning Inspection (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly UWAA Inspections (DC)	Dare County Landing	Rebecca Modes
EPS Semi-annual Pulper Inspection (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly Valve Inspection (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly Solvent Cleaning Inspection (OC) - RM	Dam Neck Annex	Rebecca Modes
EPS Monthly AST Inspections (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly SAA Inspections (OC) - RM	NAS Oceana	Rebecca Modes
EPS Quarterly SAA Inspections (DC)	NAS Oceana	Rebecca Modes
EPS QUARTERLY DSA INSPECTIONS (DN)	Dam Neck Annex	Rebecca Modes
EPS Quarterly Fuel Dispensing Inspections - SW	NAS Oceana	Scot Waddell
EPS Quarterly Solvent Cleaning - SW	NAS Oceana	Scot Waddell
EPS Quarterly Refrigerant Recovery Inspections - SW	NAS Oceana	Scot Waddell
EPS Quarterly SAA Inspections - SW	NAS Oceana	Scot Waddell
EPS Quarterly Aerospace Inspections - SW	NAS Oceana	Scot Waddell
EPS Quarterly UWAA Inspections - SW	NAS Oceana	Scot Waddell

Audit / Inspection Title	Installation	Inspector
EPS Quarterly Process Operations - SW	NAS Oceana	Scot Waddell
EPS Quarterly Valve Inspection- SW	NAS Oceana	Scot Waddell
EPS Quarterly OWS Inspections - SW	NAS Oceana	Scot Waddell
EPS Quarterly Grease Container - SW	NAS Oceana	Scot Waddell
EPS Semi-Annual Pulper Inspection - SW	NAS Oceana	Scot Waddell
EPS Quarterly HWAA Inspections - SW	NAS Oceana	Scot Waddell
EPS Monthly BOOM Inspections (OC) - SW	NAS Oceana	Scot Waddell
EPS Semi-Annual Grease Trap Inspections - SW	NAS Oceana	Scot Waddell
EPS Quarterly UST Inspections (OC) - SW	NAS Oceana	Scot Waddell
EPS Quarterly BMP Inspections - SW	NAS Oceana	Scot Waddell
OC-LANDFILL-01 EPS QRTLY LANDFILL INSPECTION - SW	NAS Oceana	Scot Waddell
OC-820C-AST-01 EPS Qrtly Tank Inspection Creighton	NAS Oceana	Scot Waddell
EPS BiWeekly Valve Inspection-Waddell	NAS Oceana	Scot Waddell
OC-285-MERC-01 EPS Semi-Annual MERC Inspection-SW	NAS Oceana	Scot Waddell
OC-408-NT-01 EPS ANNUAL NT Inspection - SW	NAS Oceana	Scot Waddell
EPS MONTHLY DIVERTER VALVE INSPECTION- SW	NAS Oceana	Scot Waddell
Copy of EPS Semi-Annual Pulper Inspection - Waddell	NAS Oceana	Scot Waddell
OC-230-AST-02 EPS Monthly AST Inspection - SW	NAS Oceana	Scot Waddell
EPS Monthly AST Inspections (29 Qs) - Waddell	NAS Oceana	Scot Waddell
EPS Quarterly AST Inspection - SW	NAS Oceana	Scot Waddell
EPS-NAS OCEANA- QTRLY PORTABLE CONTAINERS-SW	NAS Oceana	Scot Waddell

*NOTE: Names behind the inspection titles do not necessarily indicate who is currently doing that inspection.

APPENDIX C

PWD NASO
ACTIVE PERMITS

LIST OF ACTIVE PERMITS

Media	Permit #	Registration	Regulator	Facility ID #	Issuance Date	Expiration Date	Installation	Description
Safe Drinking Water	PWS 3810195	N/A	VDH	N/A	8/30/93	N/A	Dam Neck	Potable Water Permit
Storm water	VAR 050407	N/A	VDEQ	N/A	7/1/14	6/30/19	Dam Neck	General VPDES Storm Water Industrial Permit
Wastewater	0008	N/A	HRSD	N/A	10/1/10	9/30/15	Dam Neck	Industrial Wastewater Discharge Permit
Air	N/A	60280	VDEQ	51-810-00006	6/2/10	N/A	Dam Neck	Facility-wide synthetic minor
Air	N/A	61372	VDEQ	51-550-00215	3/7/00	N/A	Fentress	Permit Exemption
Safe Drinking Water	PWS 3550615	N/A	VDH	N/A	12/8/99	N/A	Fentress	Potable Water Permit
Wastewater	VPA 01003	N/A	VDEQ	7170023744	6/27/11	6/27/21	Fentress	VA Pollution Abatement Permit
Storm water	VAR040114	N/A	VDEQ	N/A	7/1/13	6/30/18	Hampton Roads Region	Virginia Storm water Management Program General Permit
Air	N/A	60294	VDEQ	51-810-00004	8/27/09	N/A	NAS Oceana	Stationary Source Permit
Air	N/A	60294	VDEQ	51-810-00004	1/27/14	1/26/19	NAS Oceana	Title V Facility Wide Permit
Waste	278	N/A	VDEQ	N/A	9/1/79	N/A	NAS Oceana	Sanitary Solid Waste Landfill Permit
Safe Drinking Water	PWS 3810430	N/A	VDH	N/A	5/14/93	N/A	Oceana	Potable Water Permit
Storm water	VA 0005266	N/A	VDEQ	N/A	12/1/14	11/30/19	Oceana	Individual VPDES Industrial Storm Water Permit
Wastewater	0100	N/A	HRSD	N/A	3/1/13	2/29/16	Oceana	Industrial Wastewater Discharge Permit

APPENDIX D

LIST OF ACRONYMS

ACRONYM LIST

ACM – Asbestos Containing Material
APM – Asbestos Program Manager
AST – Aboveground Storage Tank
BMP – Best Management Practice
CBU - Construction Battalion Unit
CDC - Child Development Center
CEA – Classification Exception Area
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CHRIMP - Consolidated Hazardous Material Reutilization and Inventory Management Program
CNRMA - Commander Navy Region Mid-Atlantic
CNIC - Commander Naval Installations Command
CO - Commanding Officer
CWS - Community Water System
DMM – Discarded Military Munitions
DRMO - Defense Reutilization and Marketing Office
NAVFAC MIDLANT – Naval Facilities Engineering Command Mid-Atlantic
ECE – Environmental Compliance Evaluation
EMS - Environmental Management System
EPA - Environmental Protection Agency
EPS – Environmental Protection Specialist
EPCRA – Environmental Protection and Community Right-to-Know Act
EQA – Environmental Quality Assessment
FEAD – Facilities Engineering Acquisition Division (Public Works Division)
FSC - Facilities Support Contracts
FRP – Facility Response Plan
HM – Hazardous Materials
HW - Hazardous Waste
IAD – Internal Assessment Documentation
IAP – Internal Assessment Plan
ICP – Integrated Contingency Plan
ICRMP – Integrated Cultural Resources Management Plan
INRMP - Integrated Natural Resources Management Plan
IH - Industrial Hygiene
IR – Installation Restoration
LBP - Lead Based Paint
LEPC – Local Emergency Planning Commission
LEPS – Lead Environmental Protection Specialist
MM – Media Manager
MSDS - Material Safety Data Sheet
MEC – Munitions and Explosives of Concern
MWR - Morale, Welfare, and Recreation
NEPA – National Environmental Policy Act
NESHAP – National Emission Standards for Hazardous Air Pollutants
OBDA - Over Bank Disposal Area

ACRONYM LIST

ODS - Ozone Depleting Substance
OU – Operable Unit
P2ADS - Pollution Prevention Annual Data Summaries
POC - Point of Contact
PPV - Public/Private Venture
PWD - Public Works Department
QAE - Quality Assurance Evaluator
QRP - Qualified Recycling Program
RCRA – Resource Conservation & Recovery Act
ROD – Record of Decision
SAA – Satellite Accumulation Area
SASDA - Spent Acid Storage and Disposal Area
SERC – State Emergency Response Commission
SPCC – Spill Prevention, Control, and Countermeasure
SWMP - Solid Waste Management Plan
SWPPP – Storm Water Pollution Prevention Plan
TSCA - Toxic Substances Control Act
TSDF – Treatment, Storage, and Disposal Facility
UST – Underground Storage Tank
UWAA – Universal Waste Accumulation Area
VDCR – Virginia Department of Conservation and Recreation
VDEQ – Virginia Department of Environmental Quality
VPDES – Virginia Pollutant Discharge Elimination System
XO – Executive Officer

Appendix G

Flora and Fauna Lists

Enclosure 1 **Flora of NASO and NALFF**
Enclosure 2 **Fauna of NASO and NALFF**
Enclosure 3 **Potential Essential Fish Habitat (EFH) Species for NASO**
Enclosure 4 **Species of Greatest Conservation Need for the Mid-Atlantic Coastal Plain**
Enclosure 5 **Virginia Natural Heritage Resources List of Rare Plants**
Enclosure 6 **Virginia Natural Heritage List of Rare Animals**

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Enclosure 1. Flora of NASO and NALFF

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Trees												
Acer negundo	Box elder	N	X		X	X						
Acer rubrum	Red maple	N	X		X	X			2012-2013			X
Acer saccharinum	Silver maple	N				X						
Ailanthus altissima	Tree-of-heaven	I	X	X		X			2012-2013			X
Albizia julibrissin	Silk tree	I	X		X	X						
Amelanchier canadensis	Canadian serviceberry	N			X	X						
Asimina triloba	Pawpaw	N	X		X	X						
Betula nigra	River birch	N	X		X							
Broussonetia papyrifera	Paper mulberry	I	X			X						
Carpinus caroliniana	American hornbeam	N	X			X						
Carya aquatica	Water hickory	N	X		X							
Carya cordiformis	Bitternut hickory	N	X									
Castanea mollissima	Chinese chestnut	I	X			X						
Celtis laevigata	Sugarberry	N	X			X						
Celtis occidentalis	Common hackberry	N	X		X							
Chamaecyparis thyoides	Atlantic white cedar	N	X									
Chionanthus virginicus	Fringetree	N	X									
Cornus florida	Flowering dogwood	N	X									
Diospyros virginiana	Persimmon	N	X	X					2012-2013		X	
Fagus grandifolia	American beach	N	X			X			2012-2013		X	

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Fraxinus pennsylvanica	Green ash	N	X			X						
Ilex cassine	Dahoon	N	X		X							
Ilex opaca	American holly	N	X		X	X						
Juglans nigra	Black walnut	N	X									
Juniperus virginiana	Eastern red cedar	N	X	X		X						
Kalmia latifolia	Mountain laurel	N							2012-2013			X
Liriodendron tulipifera	Tuliptree	N							2012-2013			X
Liquidambar styraciflua	Sweet gum	N	X		X	X			2012-2013			X
Liriodendron tulipifera	Yellow poplar	N	X			X						
Magnolia virginiana	Sweet bay	N	X		X							
Morus alba	White mulberry	I							2012-2013			X
Nyssa aquatica	Water tupelo	N	X		X							
Nyssa sylvatica	Black gum	N	X		X	X						
Ostrya virginiana	Hophornbeam	N	X		X							
Oxydendrum arboreum	Sourwood	N	X									
Paulownia tomentosa	Princess tree	I	X			X			2012-2013			X
Persea borbonia	Red bay	N	X		X							
Phyllostachus aurea	Golden bamboo	I							2012-2013			X
Pinus echinata	Shortleaf pine	N	X			X						
Pinus palustris	Longleaf pine	N	X					G5, S1	2012-2013	X		
Pinus taeda	Loblolly pine	N	X		X	X			2012-2013	X		
Pinus virginiana	Virginia pine	N	X									
Platanus occidentalis	American sycamore	N	X			X						

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Populus alba	White poplar	I										
Populus deltoides	Eastern cottonwood	N	X			X						
Prunus serotina	Black cherry	N	X			X			2012-2013			X
Pyrus calleryana	Callery pear	I							2012-2013	X		
Quercus alba	White oak	N	X		X	X			2012-2013			X
Quercus falcata	Southern red oak	N	X			X						
Quercus laurifolia	Laurel oak	N	X			X						
Quercus lyrata	Overcup oak	N	X									
Quercus michauxii	Swamp chestnut oak	N	X		X				2012-2013	X		
Quercus nigra	Water oak	N	X		X	X						
Quercus pagodifolia	Cherrybark oak	N	X		X							
Quercus phellos	Willow oak	N	X		X	X						
Quercus rubra	Northern red oak	N	X			X			2012-2013			X
Quercus stellata	Post oak	N	X									
Quercus velutina	Black oak	N	X									
Quercus virginiana	Live oak	N	X			X						
Salix nigra	Black willow	N	X		X	X						
Taxodium distichum	Bald cypress	N	X		X	X			2012-2013	X		
Ulmus alata	Winged elm	N	X		X							
Ulmus americana	American elm	N	X		X							
Ulmus pumila	Siberian elm	I				X						
Ulmus rubra	Slippery elm	N	X									
Shrubs and Woody Vines												
Ampelopsis brevipedunculata	Porcelain berry	I							2012-2013			X
Baccharis halimifolia	Eastern baccharis	N	X		X							

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Berchemia scandens	Alabama supplejack	N	X		X							
Callicarpa americana	American beautyberry	N	X									
Campsis radicans	Trumpet creeper	N	X		X	X						
Cephalanthus occidentalis	Common buttonbush	N							2012-2013	X		
Clethra alnifolia	Coastal sweet pepper-bush	N			X							
Elaeagnus pungens	Thorny elaeagnus	I							2012-2013			X
Elaeagnus umbellate	Autumn olive	I							2012-2013	X		
Eubotrys racemosa	Swamp doghobble	N	X		X							
Euonymus americanus	Bursting-heart	N	X		X	X						
Gelsemium sempervirens	Evening trumpetflower	N	X		X	X						
Hedera helix	English ivy	I							2012-2013			X
Humulus japonicas	Japanese hops	I							2012-2013	X		
Ilex glabra	Inkberry	N	X		X							
Ilex verticillata	Common winterberry	N	X		X							
Ligustrum japonica	Japanese privet	I							2012-2013	X		
Ligustrum obtusifolium	Border privet	I							2012-2013	X		
Ligsustrum sinense	Chinese privet	I							2012-2013			X
Ligustrum vulgare	European privet	I	X		X	X						
Lonicera japonica	Japanese honeysuckle	I	X			X			2012-2013			X
Lonicera sempervirens	Trumpet honeysuckle	N	X			X						
Lyonia ligustrina	Maleberry	N	X		X							

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Mikania scandens	Climbing hempvine	N	X		X							
Morella cerifera	Wax myrtle	N	X			X			2012-2013			X
Myriophullum aquaticum	Parrot feather milfoil	I							2012-2013	X		
Parthenocissus quinquefolia	Virginia creeper	N	X		X	X						
Passiflora incarnata	Purple passionflower	N				X						
Photinia pyrifolia	Red chokeberry	N	X		X							
Pueraria montana	Kudzu vine	I							2012-2013	X		
Rhododendron periclymenoides	Pink azalea	N	X									
Rhododendron viscosum	Swamp azelea	N	X		X							
Rhus copallinum	Winged sumac	N	X	X		X						
Rosa multiflora	Multiflora rose	I							2012-2013			X
Rosa palustris	Swamp rose	N	X		X							
Rubus allegheniensis	Allegheny blackberry	N							2012-2013	X		
Sambucus canadensis	American black elderberry	N	X		X							
Smilax glauca	Cat greenbrier	N	X	X	X							
Smilax laurifolia	Laurel greenbrier	N	X	X	X							
Smilax rotundifolia	Roundleaf greenbrier	N	X	X	X							
Smilax spp.	Greenbrier	N							2012-2013			X
Stewartia malacodendron	Silky camellia	N									X	
Toxicodendron radicans	Eastern poison ivy	N	X	X	X	X						
Vaccinium corymbosum	Highbush blueberry	N	X		X							

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Viburnum nudum	Possumhaw	N	X		X							
Viburnum sp.									2012-2013			X
Vinca major	Bigleaf Periwinkle	I							2012-2013	X		
Vinca minor	Common periwinkle	I							2012-2013			X
Vitis labrusca	Fox grape	N	X	X								
Vitis rotundifolia	Muscadine	N	X	X	X							
Wisteria sinensis	Chinese wisteria	I							2012-2013			X
Forbs/Herbs												
Achillea millefolium	Common yarrow	N/I		X		X						
Agalinis fasciculat	Beach false foxglove	N		X		X						
Agrostemma githago	Common corncockle	I		X		X						
Allium canadense	Meadow garlic	N		X		X						
Allium vineale	Wild garlic	I		X		X			2012-2013	X		
Alternanthera philoxeroides	Alligator weed	I							2012-2013			X
Amaranthus retroflexus	Red-root amaranth	I		X		X						
Ambrosia artemisiifolia	Annual ragweed	N/I	X	X		X						
Andropogon gerardii	Big bluestem	N		X								
Andropogon glomeratus	Bushy bluestem	N		X	X							
Andropogon virginicus	Broomsedge bluestem	N		X		X			2012-2013	X		
Anthemis cotula	Stinking chamomile	I		X		X						
Apocynum cannabinum	Indian hemp	N	X		X							

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Arctium minus	Lesser burdock	I	X			X						
Arundinaria gigantea	Giant cane	N	X	X	X				2012-2013			X
Asclepias syriaca	Common milkweed	N			X							
Asplenium platyneuron	Ebony spleenwort	N	X									
Athyrium filix-femina spp. *asplenioides*	Asplenium lady fern	N										
Barbarea vulgaris	Garden yellow rocket	I		X	X							
Boehmeria cylindrica	Smallspike false nettle	N	X		X							
Brassica nigra	Black mustard	I		X								
Bromus sp.	Brome	N/I							2012-2013	X		
Capsella bursa-pastoris	Sheperd's purse	I		X		X						
Cardamine hirsuta	Hairy bitter cress	I				X						
Carex complanata	Hirsute sedge	N		X								
Carex lurida	Shallow sedge	N			X							
Carex sp.	Sedge	N							2012-2013	X		
Cenchrus spinifex	Coastal sandbur	N		X		X						
Centaurea cyanus	Garden cornflower	I		X		X						
Cerastium vulgatum	Mouse-ear chickweed	I		X		X						
Chamaecrista fasciculata	Partridgepea	N		X		X						
Chamaesyce maculata	Spotted sandmat	N	X									
Chenopodium album	Lambsquarters	N/I		X		X						
Cicuta maculata	Spotted water hemlock	N			X							

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Cirsium arvense	Canada thistle	I		X		X						
Cirsium vulgare	Bull thistle	I			X							
Commelina communis	Common dayflower	I							2012-2013			X
Commelina virginica	Virginia dayflower	N			X	X						
Conoclinium coelestinum	Blue mistflower	N	X			X						
Coreopsis lanceolata	Lanceleaf tickseed	N		X		X						
Crotalaria sagittalis	Arrowleaf rattlebox	N			X							
Croton capitatus	Hogwort	N		X								
Ctenium aromaticum	Toothache grass	N		X								
Cuscuta spp.	Dodder	N/I		X	X	X						
Cynodon dactylon	Bermuda grass	I		X		X						
Cyperus esculentus	Yellow nutsedge	N/I				X						
Cyperus rotundus	Nutgrass	I			X							
Cyperus virens	Green flatsedge	N		X	X							
Cypripedium acaule	Moccasin flower	N	X									
Dactylis glomerata	Orchard grass	I		X		X						
Daucus carota	Queen Anne's lace	I		X		X						
Decodon verticillatus	Swamp loosestrife	N			X	X						
Desmodium ciliare	Hairy small-leaf ticktrefoil	N	X	X								
Dichanthelium dichotomum	Cypress panicgrass	N				X						
Digitaria ischaemum	Smooth crabgrass	I				X						
Digitaria sanguinalis	Hairy crabgrass	I		X		X						

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Diodia teres	Poor Joe	N		X		X						
Diodia virginiana	Virginia buttonweed	N			X	X			2012-2013	X		
Drosera intermedia	Spoonleaf sundew	N							2001	X		
Dryopteris celsa	Log fern	N			X							
Dryopteris intermedia	Intermediate wood fern	N	X									
Duchesnea indica	Indian strawberry	I				X						
Echinochloa crus-galli	Barnyard grass	I		X		X						
Echinochloa walteri	Coast cockspur grass	N			X							
Eleocharis baldwinii	Baldwin's spikerush	N						G4G5, S2	2012-2013	X		
Eleocharis microcarpa	Small-fruit spikerush	N			X				2012-2013	X		
Eleocharis vivipara	Viviparous spikerush	N						G5, S1	2012-2013	X		
Eleusine indica	Indian goosegrass	I		X		X						
Elymus repens	Quackgrass	I		X		X						
Epifagus virginiana	Beech-drops	N	X			X						
Erigeron annuus	Eastern daisy fleabane	N	X			X						
Erigeron strigosus	Prairie fleabane	N	X		X							
Eryngium yuccifolium	Button eryngo	N		X		X						
Eupatoriadelphus maculatus	Spotted joe-pye weed	N			X							
Eupatorium album	White thoroughwort	N		X								
Eupatorium capillifolium	Dogfennel	N		X					2012-2013	X		
Eupatorium hyssopifolium	Hyssopleaf thoroughwort	N		X		X						

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Eupatorium rotundifolium	Roundleaf thoroughwort	N		X								
Euphorbia corollata	Flowering spurge	N	X									
Geranium carolinianum	Carolina geranium	N		X		X						
Glechoma hederacea	Ground ivy	I	X	X		X			2012-2013			X
Goodyera pubescens	Downy rattlesnake plantain	N	X									
Helenium amarum	Sneezeweed	N	X	X	X							
Helianthus angustifolius	Swamp sunflower	N			X							
Heterantherea multiflora	Mud plaintain	N						G4, S1	2012-2013	X		
Hibiscus moscheutos	Crimsoneyed rose mallow	N			X							
Hydrocotyle umbellata	Manyflower marshpennywort	N			X							
Hypericum hypericoides	St. Andrew's cross	N	X			X						
Hypericum mutilum	Dwarf St. Johnswort	N			X	X						
Ilex vomitoria	Yaupon	N							2001	X		
Impatiens capensis	Jewel-weed	N			X							
Ipomoea hederacea	Ivy-leaf morning glory	I		X		X						
Ipomoea purpurea	Common morning glory	I		X		X						
Juncus biflorus	Bog rush	N			X							
Juncus diffusissimus	Slimpod rush	N							2012-2013	X		
Juncus effusus	Common rush	N			X				2012-2013	X		
Juncus repens	Lesser creeping rush	N			X							
Juncus scirpoides	Needlepod rush	N			X							

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Juncus tenuis	Poverty rush	N			X							
Kummerowia striata	Japanese clover	I		X		X						
Lactuca serriola	Prickly lettuce	I		X		X						
Lamium amplexicaule	Henbit deadnettle	I		X		X						
Lechea maritima var. *maritima*	Beach pinweed	N							2001	X		
Lepidium virginicum	Poor-man's peppergrass	I		X		X						
Lespedeza bicolor	Shrubby bushclover	I							2012-2013	X		
Lespedeza cuneata	Chinese lespedeza	I							2012-2013			X
Liatris acidota	Sharp blazing star	N			X							
Liriope spicata	Creeping liriope	I							2012-2013	X		
Listera australis	Southern twayblade	N	X						1989	X		
Lobelia cardinalis	Cardinal flower	N			X							
Ludwigia alternifolia	Seedbox	N	X		X	X						
Ludwigia brevipes	Long beach seedbox							G2G3, S2	2012-2013	X		
Ludwigia palustri	Marsh seedbox	N			X							
Medicago lupulina	Black medic	I	X	X	X	X						
Microstegium vimineum	Japanases stilt grass	I							2012-2013			X
Mimosa sp.	Sensitive plant	N/I							2012-2013			X
Miscanthus sinensis	Chinese silvergrass	I							2012-2013	X		
Mitchella repens	Partridge berry	N										
Mollugo verticillata	Green carpet-weed	N	X	X		X						
Muhlenbergia expansa	Cut-over muhly	N			X							
Muhlenbergia schreberi	Nimble-will	N	X	X	X							

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Murdannia keisak	Asian spiderwort	I							2012-2013	X		
Onoclea sensibilis	Sensitive fern	N	X		X							
Osmunda cinnamomea	Cinnamon fern	N	X		X							
Osmunda regalis	Royal fern	N	X		X							
Oxalis stricta	Common yellow oxalis	N	X	X		X						
Panicum anceps	Beaked panic grass	N	X		X							
Panicum dichotomiflorum	Fall panic grass	N	X	X	X	X						
Panicum virgatum	Switchgrass	N	X	X	X							
Paspalum dilatatum	Dallisgrass	I			X							
Paspalum floridanum	Florida paspalum	N			X							
Phoradendron leucarpum	Oak mistletoe	N	X									
Phragmites australis	Common reed	I							2012-2013			X
Phytolacca americana	American pokeweed	N		X		X						
Pityopsis graminifolia	Narrowleaf silkgrass	N				X						
Plantago aristata	Largebracted plantain	N		X		X						
Plantago lanceolata	Narrowleaf plantain	I		X		X						
Plantago major	Common plantain	I			X							
Plantago spp.	Plantains	N/I							2012-2013	X		
Poa annua	Annual bluegrass	I		X		X						
Polygonum convolvulus	Black bindweed	I		X		X						
Polygonum erectum	Erect knotweed	N		X		X						

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Polygonum hydropiperoides	Swamp smartweed	N			X	X						
Polygonum pensylvanicum	Pennsylvania smartweed	N			X	X						
Polygonum persicaria	Spotted lady's thumb	I			X							
Polygonum sp.	Knotweed	N/I							2012-2013	X		
Portulaca oleracea	Little hogweed	I		X		X						
Proserpinaca palustris	Marsh mermaid-weed	N			X				2012-2013	X		
Prunella vulgaris	Common selfheal	N	X	X		X						
Pteridium aquilinum	Western bracken fern	N	X	X	X							
Rhexia mariana	Maryland meadow-beauty	N			X							
Rhynchosia difformis	Doubleform snoutbean	N		X		X						
Rhynchospora globularis	Globe beaksedge	N			X							
Rudbeckia hirta	Black-eyed Susan	N		X		X						
Rumex crispus	Curly dock	I		X		X						
Rumex obtusifolius	Bitter dock	I		X	X							
Rumex sp.	Dock	I							2012-2013	X		
Saccharum giganteum	Sugarcane plumegrass	N							2012-2013	X		
Saururus cernuus	Lizard's tail	N			X							
Schedonorus arundinaceus	Tall fescue	I	X	X		X			2012-2013	X		
Scirpus cyperinus	Wool grass	N			X							
Schizachyrium scoparium	Little bluestem	N							2012-2013	X		
Scutellaria integrifolia	Helmet flower	N			X							

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Setaria pumila	Yellow foxtail	I		X		X			2012-2013	X		
Setaria viridis	Green bristle grass	I		X		X			2012-2013	X		
Sida spinosa	Prickly fanpetals	N		X								
Sinapis arvensis var. *arvensis*	Wild mustard	I				X						
Sisyrinchium angustifolium	Narrow blue-eyed grass	N		X		X						
Solanum carolinense	Carolina horse nettle	N		X		X						
Solidago spp.	Goldenrod	N		X		X						
Sonchus arvensis	Field sow thistle	I		X		X						
Sorghastrum nutans	Indian grass	N		X								
Sorghum halepense	Johnson grass	I		X		X			2012-2013			X
Sporobolus junceus	Pineywoods dropseed	N	X									
Sporobolus poiretii	Smutgrass	N		X		X						
Stellaria media	Common chickweed	I		X		X						
Symphyotrichum spp.	Aster	N							2012-2013	X		
Taraxacum officinale	Common dandelion	N/I		X		X						
Thelypteris noveboracensis	New York fern	N	X									
Thelypteris palustris	Eastern marsh fern	N	X		X							
Thlaspi arvense	Field penny-cress	I		X		X						
Tipularia discolor	Crippled cranefly	N	X									
Triadenum virginicum	Virginia marsh St. Johnswort	N	X		X							
Trifolium repens	White clover	I		X		X						
Typha angustifolia	Narrow-leaf cattail	N/I			X							
Typha sp.	Cattail	N/I							2012-2013	X		

Flora of NASO and NALFF												
Scientific Name	**Common Name**	**Origin[1]**	**Forests**	**Early Successional**	**Freshwater Wetlands**	**Developed Areas**	**Status**	**Rank[2]**	**Date of Last Observation**	**Installation**		
										NASO	**NALFF**	**BOTH**
Utricularia purpurea	Eastern purple bladderwort	N			X							
Vernonia noveboracensis	New York ironweed	N			X							
Vicia sativa	Garden vetch	I				X						
Woodwardia areolata	Netted chain-fern	N	X		X							
Woodwardia virginica	Virginia chain-fern	N	X		X							
Xanthium strumarium	Rough cocklebur	N			X							

[1] N = Native to the region, I = Introduced to the region

[2] G2 = Imperiled, G3 = Vulnerable, S2 = Imperiled

Sources: NAVFAC Mid-Atlantic 2014a, NAVFAC Mid-Atlantic 2014b, NAVFAC Mid-Atlantic 2013b, Navy 2008b, and NatureServe 2007

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Enclosure 2. Fauna of NASO and NALFF

Mammals Known to Occur at NASO and NALFF									
Species	**Common Name**	**Origin**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
Order Marsupialia	**Marsupials**								
Didelphis virginiana	Virginia opossum					2012-2013		X	
Order Insectivora	**Insectivores**								
Blarina carolinensis	Southern short-tailed shrew					2012-2013			X
Cryptotis parva	Least shrew								
Scalopus aquaticus	Eastern mole								
Sorex longirostris longirostris	Southeastern shrew					2012-2013		X	
Order Chiroptera	**Bats**								
Corynorhinus rafinesquii macrotis	Rafinesque's big-eared bat			E	G3G4T?, S2	2012-2013		X	
Epesicus fuscus	Big brown bat					2012-2013			X
Lasionycteris noctivagans	Silver-haired bat				G5, SUB/S4N				
Lasiurus borealis	Eastern red bat					2012-2013		X	
Lasiurus cinereus	Hoary bat				G5, SUB/S3N	2002			
Myotis austroriparus	Southeastern myotis				G3G4, S2	2012-2013			X
Myotis lucifugus	Little brown myotis					2001	X		
Nyctieius humeralis	Evening bat					2012-2013		X	
Perimyotis subflavus	Tri-colored bat				G3, S3	2012-2013			X
Order Rodentia	**Rodents**								
Castor canadensis	North American beaver								X
Microtus pennsylvanicus	Meadow vole					2012-2013	X		
Microtus pinetorum	Pine vole								
Mus musculus	House mouse					2012-2013		X	

Mammals Known to Occur at NASO and NALFF									
Species	**Common Name**	**Origin**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
Myocastor coypus	Nutria								
Ondatra zibethica	Common muskrat								
Oryzomis palustris	Marsh rice rat								
Peromyscus leucopus	White-footed mouse					2001	X		
Rattus norvegicus	Norway rat								
Reithrodontomys humulis	Eastern harvest mouse					2012-2013	X		
Sciurus carolinensis	Eastern gray squirrel								
Sigmodon hispidus	Hispid cotton rat								
Synaptomys cooperi helaletes	Southern bog lemming				G5T3, S3	2013	X		
Order Lagomorpha	**Lagomorphs**								
Sylvilagus floridana	Eastern cottontail rabbit								
Order Carnivora	**Carnivores**								
Canis latrans	Coyote					2013			
Lontra canadensis	North American river otter								X
Lynx rufus	Bobcat								
Procyon lotor	Common raccoon								
Urocyon cinereoargenteus	Gray fox								
Ursus americanus	Black bear					2012-2013		X	
Vulpes vulpes	Red fox								
Order Artiodactyla	**Ungulates**								
Odocoileus virginianus	Whitetail deer					2012-2013			X

Mammals Known to Occur at NASO and NALFF									
Species	**Common Name**	**Origin**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**

[1] SE = State Endangered

[2] G3 = Vulnerable, G4 = Apparently Secure, G5 = Secure, G_T_ = Signifies the rank of a subspecies (e.g., G5T1 would apply to subspecies if the species is demonstrably secure globally (G5) but the subspecies warrants a rank of T1, critically imperiled), T? = Rank of subspecies is uncertain, S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, S4 = Apparently Secure, SU = Possibly rare, but status uncertain and more data needed, S_B/S_N = Breeding and nonbreeding status of an animal in Virginia, when they differ

Sources: Roble 2013, USDA APHIS WS 2012, Navy 2008a, and Derge and Belden 2002

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Order Accipitriformes										
Accipiter cooperii	Cooper's hawk		Uncommon resident	Forest						
Accipiter striatus	Sharp-shinned hawk		Common resident	Forest						
Buteo jamaicensis	Red-tailed hawk		Common resident	Throughout		G5, S3B/S3N	2013			X
Buteo lineatus	Red-shouldered hawk		Common resident	Forest						
Buteo platypterus	Broad-winged hawk		Spring and summer resident	Forest						
Cathartes aura	Turkey vulture		Common resident	Throughout			2015			X
Circus cyaneus	Northern harrier		Common winter resident	Open field						
Coragyps atratus	Black vulture					G5, S1S2B/S3N	2015			X
Haliaeetus leucocephalus	Bald eagle				BCC	G5, S3S4B/S3S4N	2013			X
Order Anseriformes										
Aix sponsa	Wood duck		Resident							
Anas americana	American wigeon						2001	X		
Anas platyrhynchos	Mallard		Resident				2001	X		
Aythya collaris	Ring-necked duck						2001	X		
Branta bernicla	Brant		Winter resident	Pond, open field						
Branta canadensis	Canada goose		Resident	Pond, open field			2001	X		
Chen caerulescens	Snow goose									
Cygnus columbianus	Tundra swan									

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Lophodytes cucullatus	Hooded merganser						2001	X		
Order Apodiformes										
Archilochus colubris	Ruby-throated hummingbird		Common summer resident	Forest						
Chaetura pelagica	Chimney swift		Spring and summer resident	Rural and urban areas						
Order Caprimulgiformes										
Antrostomus carolinensis	Chuck-will's-widow		Spring and summer resident	Forest	BCC	G5	2001	X		
Chordeiles minor	Common nighthawk									
Gallinago delicata	Wilson’s snipe									
Order Charadriiformes										
Actitis macularius	Spotted sandpiper					G5, S2B	2001			X
Bartramia longicauda	Upland sandpiper				BCC, ST	G5, S1B				
Calidris minutilla	Least sandpiper									
Charadrius vociferous	Killdeer		Common resident	Open land						
Chroicocephalus philadelphia	Bonaparte’s gull						2001	X		
Larus argentatus	Herring gull		Abundant resident	Wetland, throughout			2001	X		
Larus delawarensis	Ring-billed gull		Abundant summer resident	Wetland						
Leucophaeus atricilla	Laughing gull		Common resident	Seacoasts, bays, estuaries						
Pluvialis squatarola	Black-bellied plover									

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Scolopax minor	American woodcock		Uncommon resident	Wetland forest						
Tringa melanoleuca	Greater yellowlegs		Spring and early summer resident	Lakes, ponds, marshes						
Order Ciconiiformes										
Ardea alba	Great egret		Summer resident	Marsh			2001			X
Ardea herodias	Great blue heron		Resident	Marsh, wetland		G5, S2S3B/S3N	2001	X		
Bubulcus ibis	Cattle egret		Uncommon summer resident	Open field		G5, S3B/S5N	2013			X
Butroides virescens	Green-backed heron		Summer resident	Marsh, wetland			2001	X		
Order Columbiformes										
Columba livia	Rock pigeon		Common non-native resident	Throughout						
Zenaida macroura	Mourning dove		Common resident	Throughout			2001			X
Order Coraciiformes										
Ceryle alcyon	Belted kingfisher		Common summer resident	Open edge, marsh, wetland						
Order Cuculiformes										
Coccyzus americanus	Yellow-billed cuckoo		Common summer resident	Forest			2001			X
Coccyzus erythropthalmus	Black-billed cuckoo		Spring and summer resident	Forest edge and open woodlands						
Order Falconiformes										
Falco sparverius	American kestrel		Common resident	Open field	BCC	G5	2013			X

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Pandion haliaetus	Osprey		Common summer resident	Seacoasts, bays, estuaries						
Order Galliformes										
Colinus virginianus	Northern bobwhite		Abundant resident	Open field, young woods			2001			X
Meleagris gallopavo	Wild turkey									
Order Gruiformes										
Fulica americana	American coot		Spring and summer resident	Lakes, ponds, marshes		G5, S1B/S5N				
Order Passeriformes										
Agelaius phoeniceus	Red-winged blackbird		Common resident	Marsh			2001			X
Ammodramus savannarum	Grasshopper sparrow									
Bombycilla cedrorum	Cedar waxwing									
Cardinalis cardinalis	Northern cardinal		Common resident	Throughout			2001			X
Carduelis tristis	American goldfinch		Common resident	Old field						
Carpodacus mexicanus	House finch		Common resident	Throughout						
Catharus fuscescens	Veery									
Catharus minimus	Gray-cheeked thrush									
Catharus ustulatus	Swainson’s thrush					G5, S1B				

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Contopus virens	Eastern wood-pewee									
Corvus brachyrhynchos	American crow		Abundant resident	Throughout			2001			X
Corvus ossifragus	Fish crow		Common resident	Marsh			2001	X		
Cyanocitta cristata	Blue jay		Abundant resident	Throughout			2001			X
Dumetella carolinensis	Gray catbird		Common resident	Throughout						
Empidonax virescens	Acadian flycatcher		Common summer resident	Forest, clearing			2001	X		
Eremophila alpestris	Horned lark									
Geothlypis trichas	Common yellowthroat		Common resident	Brush, open land			2001			X
Helmitheros vermivorum	Worm-eating warbler				BCC	G5				
Hirundo rustica	Barn swallow		Abundant summer resident	Barn, bridge, building			2001			X
Hylocichla mustelina	Wood thrush		Common resident	Forest			2001			X
Icteria virens	Yellow-breasted chat		Uncommon summer resident	Forest edge			2001	X		
Icteria spurius	Orchard oriole		Common spring and summer resident	Farms and open woodlands						
Junco hyemalis	Dark-eyed junco		Abundant winter resident	Throughout						
Melospiza melodia	Song sparrow		Common resident	Open field						
Mimus polyglottos	Northern mockingbird		Common resident	Throughout						

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Mniotilta varia	Black-and-white warbler									
Molothrus ater	Brown-headed cowbird		Common resident	Throughout						
Myiarchus crinitus	Great crested flycatcher		Common summer resident	Forest			2001			X
Oporornis formosus	Kentucky warbler		Uncommon summer migrant	Wetland and upland forest	BCC	G5				
Parkesia noveboracensis	Northern waterthrush					G5, S1B				
Parus bicolor	Tufted titmouse		Common resident	Forest, open areas			2001			X
Passer domesticus	House sparrow		Abundant resident	Throughout						
Passerculus sandwichensis	Savannah sparrow					G5, S3S4B/S4N				
Passerina caerulea	Blue grosbeck									
Passerina cyanea	Indigo bunting		Common summer resident	Open field			2001			X
Pipilo erythrophthalmus	Eastern towhee		Common spring and summer resident	Forest			2001			X
Piranga olivacea	Scarlet tanager		Common summer resident	Forest						
Piranga rubra	Summer tanager		Uncommon summer resident	Forest						
Poecile carolinensis	Carolina chickadee		Common resident	Forest			2001	X		
Polioptila caerulea	Blue-gray gnatcatcher		Common summer resident	Forest						
Pooecetes gramineus	Vesper sparrow									

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Progne subis	Purple martin		Common summer resident	Open area						
Protonotaria citrea	Prothonotary warbler		Uncommon summer resident	Forest	BCC	G5	2001			X
Quiscalus quiscula	Common grackle		Common resident	Throughout						
Seiurus aurocapillus	Ovenbird		Common summer resident	Forest			2001			X
Seiurus motacilla	Louisiana waterthrush		Uncommon summer migrant	Wetland and upland forest						
Setophaga caerulescens	Black-throated blue warbler									
Steophaga coronata	Yellow-rumped warbler		Common winter migrant	Forest			2001	X		
Setophaga discolor	Prairie warbler									
Setophaga dominica	Yellow-throated warbler									
Setophaga petechia	Yellow warbler									
Setophaga pinus	Pine warbler		Common summer resident	Pine forest			2001	X		
Setophaga ruticilla	American redstart		Spring and summer resident	Forest						
Sialis sialis	Eastern bluebird		Common resident	Open field, woods edge			2001	X		
Sitta canadensis	Red-breasted nuthatch		Uncommon winter resident	Forest		G5, S2B/S4N				
Sitta carolinensis	White-breasted nuthatch		Uncommon winter resident	Forest						
Spizella passerina	Chipping sparrow									
Spizella pusilla	Field sparrow		Common resident	Open field			2001	X		

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Sturnella magna	Eastern meadowlark		Uncommon resident	Old field			2001			X
Sturnus vulgaris	European starling		Abundant non-native resident	Throughout						
Tachycineta bicolor	Tree swallow									
Thryothorus ludovicianus	Carolina wren		Common resident	Forest			2001			X
Toxostoma rufum	Brown thrasher		Common resident	Forest			2001	X		
Troglodytes aedon	House wren									
Turdus migratorius	American robin		Abundant resident	Throughout			2001			X
Tyrannus tyrannus	Eastern kingbird		Common resident	Open field						
Vireo flavifrons	Yellow-throated vireo		Uncommon summer resident	Forested wetland			2001	X		
Vireo griseus	White-eyed vireo		Common summer resident	Forest			2001	X		
Vireo olivaceous	Red-eyed vireo		Common summer resident	Forest						
Wilsonia citrina	Hooded warbler		Uncommon summer resident	Forest						
Zonotrichia albicollis	White-throated sparrow		Common winter resident	Throughout			2001	X		
Order Pelecaniformes										
Eudocimus albus	White ibis					G5, S1B				
Nycticorax nycticorax	Black-crowned night-heron					G5, S3B/S3N	2001	X		
Plegadis falcinellus	Glossy ibis					G5, S2B/S1N				

Birds Known to Occur at NASO and NALFF										
Scientific Name	**Common Name**	**Origin**	**Occurrence**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
								NASO	**NALFF**	**BOTH**
Order Piciformes										
Colaptes auratus	Northern flicker		Common resident	Forest			2001			X
Dryocopus pileatus	Pileated woodpecker		Uncommon resident	Mature forest			2001			X
Melanerpes carolinus	Red-bellied woodpecker		Common resident	Forest			2001	X		
Picoides pubescens	Downy woodpecker		Common resident	Forest			2001	X		
Picoides villosus	Hairy woodpecker		Common resident	Forest			2001	X		
Order Podicipediformes										
Podilymbus podiceps	Pied-billed grebe		Winter resident	Open water		G5, S1S2B/S4N				
Order Strigiformes										
Bubo virginianus	Great horned owl		Common resident	Forest			2001	X		
Otus asio	Eastern screech owl		Common resident	Forest						
Strix varia	Barred owl		Common resident	Wetland forest						
Order Suliformes										
Phalacrocorax auritus	Double-crested cormorant						2001	X		

Notes: Common and scientific names were verified using the Cornell University Lab of Ornithology All About Birds Database (Cornell University 2013).

[1] BCC = Birds of Conservation Concern (USFWS 2008). The Installation is located in Bird Conservation Regions 27 (Southeastern Coastal Plain) and 30 (New England/Mid-Atlantic Coast).

[2] G5 = Secure, S1 = Critically Imperiled, S2 = Imperiled, S3 = Vulnerable, S4 = Apparently Secure, S5 = Secure, S_B = Breeding status of an animal in Virginia; these species typically inhabit Virginia only during the breeding season, S_B/S_N = Breeding and nonbreeding status of an animal in Virginia, when they differ

Sources: Cornell University 2013, Roble 2013, USDA APHIS WS 2013, Wright 2013b, Institute for Bird Population 2012, USDA APHIS WS 2012, Navy 2008a, USFWS 2008, Derge and Belden 2002, Navy 2001a, VDCR-DNH 1990a, and VDCR-DNH 1990b

Herpetofauna Known to Occur at NASO and NALFF									
Scientific Name	**Common Name**	**Origin**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
AMPHIBIANS									
Salamanders									
Plethodon chlorobryonis	Atlantic Coast slimy salamander					2012-2013			X
Plethodon cinereus	Eastern red-backed salamander					2012-2013	(2001)	X	
Plethodon glutinosus	Northern slimy salamander					2001	X		
Pseudotriton montanus montanus	Eastern mud salamander								
Frogs and Toads									
Acris crepitans	Eastern cricket frog					2012-2013	X		
Acris gryllus	Southern cricket frog					2001	X		
Anaxyrus fowleri	Fowler's toad					2012-2013	(2001)	X	
Anaxyrus terrestris	Southern toad					2012-2013			X
Gastrophryne carolinensis	Eastern narrow-mouthed toad					2012-2013	X		
Hyla chrysocelis	Cope's gray treefrog					2012-2013	X		
Hyla cinerea	Green treefrog					2012-2013	X	(2001)	
Hyla femoralis	Pine woods treefrog					2012-2013	X	(2001)	
Hyla squirella	Squirrel treefrog					2012-2013	X	(2001)	
Lithobates catesbeianus	American bullfrog					2012-2013	X	(2001)	
Lithobates clamitans melanota	Northern green frog					2012-2013	X	(2001)	
Lithobates sphenocephalus utricularius	Southern leopard frog					2012-2013	X	(2001)	
Pseudacris crucifer	Spring peeper					2001	X		
REPTILES									
Turtles									
Chelydra serpentina serpentina	Common snapping turtle					2012-2013	X		
Chrysemys picta picta	Eastern painted turtle					2012-2013			X

Herpetofauna Known to Occur at NASO and NALFF									
Scientific Name	**Common Name**	**Origin**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
Clemmys guttata	Spotted turtle					2001		X	
Kinosternon subrubrum subrubrum	Eastern mud turtle					2012-2013	X		
Malaclemys terrapin terrapin	Northern diamondback terrapin				G4, S4				
Pseudemys rubriventris	Northern red-bellied cooter					2012-2013	X		
Terrapene carolina carolina	Eastern box turtle					2012-2013	(2001)	X	
Trachemys scripta scripta	Yellow-bellied slider					2012-2013	X		
Lizards									
Plestiodon fasciatus	Five-lined skink					2012-2013			X
Plestiodon inexpectatus	Southeastern five-lined skink					2012-2013			X
Plestiodon laticeps	Broad-headed skink					2012-2013		X	
Sceloporus undulatus	Eastern fence lizard								
Sceloporus undulatus hyacinthinus	Northern fence lizard								
Scincella lateralis	Little brown skink					2012-2013	X		
Snakes									
Agkistrodon contortrix mokasen	Northern copperhead								
Agkistrodon piscivorus piscivorus	Eastern cottonmouth								
Carphophis amoenus amoenus	Eastern worm snake								
Coluber constrictor constrictor	Northern black racer								
Crotalus horridus atricaudatus	Timber (canebrake) rattlesnake, Coastal Plain population			SE	G4, S1	2013	X		
Diadophis punctatus punctatus	Southern ringed-neck snake					2012-2013	X		
Lampropeltis getula	Eastern kingsnake					2012-2013	X		
Pantherophis alleghaniensis	Eastern rat snake								

Herpetofauna Known to Occur at NASO and NALFF									
Scientific Name	**Common Name**	**Origin**	**Habitat**	**Status[1]**	**Rank[2]**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
Nerodia erythrogaster	Plain-bellied watersnake					2012-2013	X		
Nerodia sipedon sipedon	Northern water snake								
Nerodia taxispilota	Brown watersnake					2001	X		
Opheodrys aestivus aestivus	Northern rough green snake								
Thamnophis sirtalis sirtalis	Common garter snake					2012-2013		X	
Virginia valeriae valeriae	Eastern smooth earth snake								

[1] SE = State Endangered

[2] S1 = Critically Imperiled, S4 = Apparently Secure, G4 = Apparently Secure

Sources: NAVFAC Mid-Atlantic 2013a, Roble 2013, Navy 2008a, and Derge and Belden 2002

Fish Known or Expected to Occur at NASO and NALFF									
Scientific Name	**Common Name**	**Origin[1]**	**Habitat**	**Status[2]**	**Rank**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
Shellfish									
Callinectes sapidus	Blue crab	N	S						
Corbicula spp. or *Pisidum* spp.	Clam spp.		S			2012	X		
Crangon septemspinosa	Sand shrimp	N	S						
Crassostrea virginica	Eastern oyster	N	S						
Family Limulidae	Horseshoe crab		S			2012	X		
Geukensea demissa	Atlantic ribbed mussel	N	S						
Infraorder Astacidea	Crayfish		S			2012	X		
Mercenaria mercenaria	Northern quahog	N	S						
Mya arenaria	Softshell clam	N	S						
Mytilus edulis	Blue mussel	N	S						
Palaemonetes pugio	Daggerblade grass shrimp	N	S						
Penaeus aztecus	Brown shrimp	N	S						
Unionid spp.	Mussel spp.		S			2012	X		
Finfish									
Acipenser brevirostrum	Shortnose sturgeon	N	F/S	FE					
Acipenser oxyrinchus oxyrinchus	Atlantic sturgeon	N	S	FE (Chesapeake Distinct Population Segment)					
Alosa aestivalis	Blueback herring	N	F/S			2014			
Alosa pseudoharengus	Alewife	N	F/S						
Ameiurus nebulosus	Brown bullhead	N	F			2012	X		
Ameiurus spp.	Bullhead spp.					2012	X		
Anchoa mitchelli	Bay anchovy	N	S						
*Anguilla rostrata**	American eel	N	F/S	UR		2014			X

Fish Known or Expected to Occur at NASO and NALFF									
Scientific Name	**Common Name**	**Origin[1]**	**Habitat**	**Status[2]**	**Rank**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
*Aphredoderus sayanus**	Pirate perch	N	F						
Archosargus probatocephalus	Sheepshead	N	S						
Brevoortia tyrannus	Atlantic menhaden	N	S						
*Centrarchus macropterus**	Flier	N	F						
Centropristis striata	Black sea bass	N	S	EFH					
Chaetodipterus faber	Spadefish	N	S						
Cynoscion nebulosus	Spotted seatrout	N	S						
Cynoscion regalis	Weakfish	N	S						
Cyprinodon variegatus	Sheepshead minnow	N	F/S						
*Cyprinus carpio**	Common carp	I	F/S						
Dasyatis sabina	Atlantic stingray	N	F/S						
Dorosoma cepedianum	Gizzard shad	N	F/S						
Enneacanthus gloriosus	Bluespotted sunfish	N	F			2012	X		
*Esox americanus**	Redfin pickerel	N	F						
Fundulus heteroclitus	Mummichog	N	S						
Fundulus majalis	Striped killifish	N	S						
Gambusia affinis	Mosquitofish	N	F/S			2012-2013	X		
*Gambusia holbrooki**	Mosquitofish	N	F/S			2001	X		
Lagodon rhomboides	Pinfish	N	S						
Leiostomus xanthurus	Spot	N	S						
Lepomis cyanellus	Green sunfish	N	F			2012	X		
Lepomis gibbosus	Pumpkinseed	N	F			2012	X		
Lepomis gulosus	Warmouth	N	F			2012	X		
*Lepomis macrochirus**	Bluegill	N	F						
*Lepomis microlophus**	Redear sunfish	I	F/S						
Lepomis spp.	Sunfish spp.					2012	X		
Menidia menidia	Atlantic silverside	N	S						

Fish Known or Expected to Occur at NASO and NALFF									
Scientific Name	**Common Name**	**Origin[1]**	**Habitat**	**Status[2]**	**Rank**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
Micropogonias undulatus	Atlantic croaker	N	S						
*Micropterus salmoides**	Largemouth bass	N	F			2012-2013	X		
*Morone americana**	White perch	N	F						
Morone saxatilis	Striped bass	N	F/S						
Mugil cephalus	Striped mullet	N	S						
*Notemigonus crysoleucas**	Golden shiner	N	F						
Opsanus tau	Oyster toadfish	N	S						
Orthopristis chrysoptera	Pigfish	N	S						
Paralichthys dentatus	Summer flounder	N	S	EFH					
Peprilus triacanthus	Butterfish	N	S						
Pomatomus saltatrix	Bluefish	N	S						
*Pomoxis nigromaculatus**	Black crappie	N	F						
Pomoxis spp.	Crappie spp.		F			2012	X		
Prionotus carolinus	Northern searobin	N	S						
Raja eglanteria	Clearnose skate	N	S						
Rhinoptera bonasus	Cownose ray	N	S						
Sciaenops ocellatus	Red drum	N	S	EFH					
Scophthalmus aquosus	Windowpane flounder	N	S	EFH					
Selene vomer	Lookdown	N	S						
Sphoeroides maculatus	Northern pufferfish	N	S						
Stenotomus chrysops	Scup	N	S	EFH					
Strongylura marina	Atlantic needlefish	N	F/S						
Syngnathus fuscus	Northern pipefish	N	S						
Synodus foetens	Inshore lizardfish	N	S						
Tautoga onitis	Tautog	N	S						
Trinectes maculatus	Hogchoker	N	F/S						
*Umbra pygmaea**	Mudminnow	N	F						

Fish Known or Expected to Occur at NASO and NALFF									
Scientific Name	**Common Name**	**Origin[1]**	**Habitat**	**Status[2]**	**Rank**	**Date of Last Observation**	**Installation**		
							NASO	**NALFF**	**BOTH**
Urophycis regia	Spotted hake	N	S						

*Species recorded at NASO or NALFF

[1] N = Native, I = Introduced to Virginia, F = Freshwater, S = Saltwater

[2] EFH = Essential Fish Habitat designated for this species (NOAA NMFS n.d.), FE = federally listed as endangered, UR = under federal review for listing

Sources: Tetra Tech, Inc. 2014, Roble 2013, NatureServe 2007, Swihart et al. 1994, USFWS 1990, and NOAA NMFS n.d.

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Enclosure 3. Potential Essential Fish Habitat (EFH) Species for NASO

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Summary of Essential Fish Habitat (EFH) Designations

10° x 10° Square Coordinates:

Boundary	North	East	South	West
Coordinate	36° 50.0° N	75° 50.0° W	36° 40.0° N	76° 00.0° W

Square Description (i.e. habitat, landmarks, coastline markers): Waters within the Atlantic Ocean within the square affecting North Bay, Shipps Bay, and southern Virginia Beach. These waters affect the following: Muddy Creek, Porpoise Pt., and northern Long I., and affect Virginia Beach from Rudee Inlet on the north, south past Sandbridge Beach, VA., to east of half way down Long I., just north of the Wash Flats.

Species	Eggs	Larvae	Juveniles	Adults
Atlantic cod (Gadus morhua)				
haddock (Melanogrammus aeglefinus)				
pollock (Pollachius virens)				
whiting (Merluccius bilinearis)				
red hake (Urophycis chuss)	X	X	X	
witch flounder (Glyptocephalus cynoglossus)	X			
winter flounder (Pseudopleuronectes americanus)				
yellowtail flounder (Limanda ferruginea)				
windowpane flounder (Scophthalmus aquosus)	X		X	
American plaice (Hippoglossoides platessoides)				
ocean pout (Macrozoarces americanus)				
Atlantic halibut (Hippoglossus hippoglossus)				
Atlantic sea scallop (Placopecten magellanicus)				
Atlantic sea herring (Clupea harengus)				X
monkfish (Lophius americanus)				

bluefish (Pomatomus saltatrix)			X	X
long finned squid (Loligo pealeii)	n/a	n/a		
short finned squid (Illex illecebrosus)	n/a	n/a		
Atlantic butterfish (Peprilus triacanthus)				
Atlantic mackerel (Scomber scombrus)				
summer flounder (Paralichthys dentatus)			X	X
scup (Stenotomus chrysops)	n/a	n/a	X	X
black sea bass (Centropristis striata)	n/a		X	X
surf clam (Spisula solidissima)	n/a	n/a		
ocean quahog (Artica islandica)	n/a	n/a		
spiny dogfish (Squalus acanthias)	n/a	n/a	X	
tilefish (Lopholatilus chamaeleonticeps)				
king mackerel (Scomberomorus cavalla)	X	X	X	X
Spanish mackerel (Scomberomorus maculatus)	X	X	X	X
cobia (Rachycentron canadum)	X	X	X	X
red drum (Sciaenops occelatus)	X	X	X	X
sand tiger shark (Carcharias taurus)		X		X
Atl. sharpnose shark (Rhizoprionodon terraenovae)				X
dusky shark (Carcharhinus obscurus)		X	X	
sandbar shark (Carcharhinus plumbeus)		X	X	X
sandbar shark (Carcharhinus plumbeus)		HAPC	HAPC	HAPC
scalloped hammerhead shark (Sphyrna lewini)			X	
tiger shark (Galeocerdo cuvieri)		X	X	X

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Enclosure 4. Species of Greatest Conservation Need for the Mid-Atlantic Coastal Plain

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4.3. The Species of Greatest Conservation Need: Coastal Plain

Of the 235 species of greatest conservation need that occur in the Coastal Plain, 23 (10%) are in Tier I, 35 (15%) are in Tier II, 39 (17%) are in Tier III, and 138 (59%) are in Tier IV (Table 4.2).

Table 4.23. The species of greatest conservation need in Virginia's Coastal Plain.

Common Name	Scientific Name
Tier I	
Fishes	
Shortnose sturgeon	*Acipenser brevirostrum*
Blackbanded sunfish	*Enneacanthus chaetodon*
Bridle shiner	*Notropis bifrenatus*
Roanoke logperch	*Percina rex*
Amphibians	
None	
Reptiles	
Loggerhead turtle[1]	*Caretta caretta*
Wood turtle	*Glyptemys insculpta*
Chicken turtle	*Deirochelys reticularia*
Birds	
Bachman's sparrow	*Aimophila aestivalis*
Henslow's sparrow	*Ammodramus henslowii*
Piping plover	*Charadrius melodus*
Wilson's plover	*Charadrius wilsonia*
Wayne's black-throated green warbler	*Dendroica virens waynei*
Peregrine falcon	*Falco peregrinus*
Loggerhead shrike	*Lanius ludovicianus*
Black rail	*Laterallus jamaicensis*
Red-cockaded woodpecker	*Picoides borealis*
Gull-billed tern	*Sterna nilotica*
Mammals	
Eastern big-eared bat	*Corynorhinus rafinesquii macrotis*
Terrestrial Insects	
Arogos skipper	*Atrytone arogos arogos*
American burying beetle	*Nicrophorus americanus*
Other Terrestrial Invertebrates	
None	
Aquatic Mollusks	
None	
Crustaceans	

Common Name	Scientific Name
Phreatic isopod	*Caecidotea phreatica*
Lancaster County amphipod	*Crangonyx baculispina*
Northern Virginia well amphipod	*Stygobromus phreaticus*
Aquatic Insects	
None	
Other Aquatic Invertebrates	
None	
Tier II	
Fishes	
Atlantic sturgeon	*Acipenser oxyrhynchus*
Roanoke bass	*Ambloplites cavifrons*
Amphibians	
Mabee's salamander	*Ambystoma mabeei*
Tiger salamander	*Ambystoma tigrinum*
Oak toad	*Bufo quercicus*
Barking treefrog	*Hyla gratiosa*
Reptiles	
Canebrake rattlesnake	*Crotalus horridus*
Northern diamond-backed terrapin	*Malaclemys terrapin*
Eastern glass lizard	*Ophisaurus ventralis*
Birds	
Saltmarsh sharp-tailed sparrow	*Ammodramus caudacutus*
American black duck	*Anas rubripes*
American bittern	*Botaurus lentiginosus*
Cerulean warbler	*Dendroica cerulea*
Little blue heron	*Egretta caerulea*
American oystercatcher	*Haematopus palliatus*
Bald eagle	*Haliaeetus leucocephalus*
Swainson's warbler	*Limnothlypis swainsonii*
Yellow-crowned night-heron	*Nyctanassa violacea*
King rail	*Rallus elegans*
Black skimmer	*Rynchops niger*
Least tern	*Sterna antillarum*
Royal tern	*Sterna maxima*
Mammals	
Delmarva fox squirrel	*Sciurus niger cinereus*
Terrestrial Insects	
Precious underwing	*Catocala pretiosa pretiosa*
Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*

Common Name	Scientific Name
Rare skipper	*Problema bulenta*
Other Terrestrial Invertebrates	
Snowhill ambersnail	*Catinella hubrichti*
Hanging Rock threetooth	*Triodopsis pendula*
Aquatic Mollusks	
Dwarf wedgemussel	*Alasmidonta heterodon*
Green floater	*Lasmigona subviridis*
Crustaceans	
Dismal Swamp isopod	*Caecidotea attenuatus*
Rock Creek groundwater amphipod	*Stygobromus kenki*
Aquatic Insects	
Spieth's great speckled olive mayfly	*Siphloplecton costalense*
Other Aquatic Invertebrates	
Holsinger's groundwater planarian	*Sphalloplana holsingeri*
Bigger's groundwater planarian	*Sphalloplana subtilis*
Tier III	
Fishes	
Steelcolor shiner	*Cyprinella whipplei*
Amphibians	
Dwarf waterdog	*Necturus punctatus*
Carpenter frog	*Rana virgatipes*
Lesser siren	*Siren intermedia*
Reptiles	
Spotted turtle	*Clemmys guttata*
Glossy crayfish snake	*Regina rigida rigida*
Eastern box turtle	*Terrapene carolina*
Birds	
Nelson's sharp-tailed sparrow (winter)	*Ammodramus nelsoni*
Redhead (winter)	*Aythya americana*
Brant (winter)	*Branta bernicla*
Northern harrier	*Circus cyaneus*
Sedge wren (winter)	*Cistothorus platensis*
Tricolored heron	*Egretta tricolor*
Least bittern	*Ixobrychus exilis*
Black-crowned night-heron	*Nycticorax nycticorax*
Glossy ibis	*Plegadis falcinellus*
Common tern	*Sterna hirundo*
Barn owl	*Tyto alba pratincola*

Common Name	Scientific Name
Mammals	
Pungo white-footed mouse	*Peromyscus leucopus easti*
Southeastern fox squirrel	*Sciurus niger niger*
Terrestrial Insects	
Dusky roadside-skipper	*Amblyscirtes alternata*
Little metalmark	*Calephelis virginiensis*
Hessel's hairstreak	*Callophrys hesseli*
Dismal Swamp green stink bug	*Chlorochroa dismalia*
Dukes' skipper	*Euphyes dukesi*
Palatka skipper	*Euphyes pilatka*
Brimley's assassin bug	*Pnirontis brimleyi*
Sandpit alydid bug	*Stachyocnemus apicalis*
Other Terrestrial Invertebrates	
A millipede	*Pseudopolydesmus paludicolous*
Aquatic Mollusks	
Yellow lance	*Elliptio lanceolata*
Yellow lampmussel	*Lampsilis cariosa*
Chesapeake ambersnail	*Oxyloma subeffusum*
Crustaceans	
Chowanoke crayfish	*Orconectes virginiensis*
Tidewater interstitial amphipod	*Stygobromus araeus*
Tidewater amphipod	*Stygobromus indentatus*
Aquatic Insects	
Swamp forestfly	*Prostoia hallasi*
Coppery emerald	*Somatochlora georgiana*
Other Aquatic Invertebrates	
None	
Tier IV	
Fishes	
Mud sunfish	*Acantharcus pomotis*
Alewife	*Alosa pseudoharengus*
American shad	*Alosa sapidissima*
American eel	*Anguilla rostrata*
Swampfish	*Chologaster cornuta*
Banded sunfish	*Enneacanthus obesus*
Lake chubsucker	*Erimyzon sucetta*
Lined topminnow	*Fundulus lineolatus*
Least brook lamprey	*Lampetra aepyptera*
American brook lamprey	*Lampetra appendix*

Common Name	Scientific Name
Ironcolor shiner	*Notropis chalybaeus*
Logperch	*Percina caprodes*
Trout-perch	*Percopsis omiscomaycus*
Amphibians	
New Jersey chorus frog	*Pseudacris feriarum kalmi*
Striped southern chorus frog	*Pseudacris nigrita nigrita*
Little grass frog	*Pseudacris ocularis*
Eastern mud salamander	*Pseudotriton montanus*
Eastern spadefoot	*Scaphiopus holbrookii*
Greater siren	*Siren lacertina*
Many-lined salamander	*Stereochilus marginatus*
Reptiles	
Scarletsnake	*Cemophora coccinea*
Mudsnake	*Farancia abacura*
Rainbow snake	*Farancia erytrogramma*
Eastern hog-nosed snake	*Heterodon platirhinos*
Eastern slender glass lizard	*Ophisaurus attenuatus*
Queen snake	*Regina septemvittata*
Southeastern crowned snake	*Tantilla coronata*
Common ribbonsnake	*Thamnophis sauritus*
Yellowbellied slider	*Trachemys scripta scripta*
Birds	
Seaside sparrow	*Ammodramus maritimus*
Grasshopper sparrow	*Ammodramus savannarum*
Greater scaup (winter)	*Aythya marila*
Green heron	*Butorides striatus*
Dunlin (winter)	*Calidris alpina*
Red knot (winter)	*Calidris canutus*
Purple sandpiper (winter)	*Calidris maritima*
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*
Bicknell's thrush (migrant)	*Catharus bicknelli*
Chimney swift	*Chaetura pelagica*
Marsh wren	*Cistothorus palustris*
Yellow-billed cuckoo	*Coccyzus americanus*
Northern bobwhite	*Colinus virginianus*
Eastern wood-pewee	*Contopus virens*
Yellow rail (migrant)	*Coturnicops noveboracensis*
Prairie warbler	*Dendroica discolor*
Yellow warbler	*Dendroica petechia*
Gray catbird	*Dumetella carolinensis*
Willow flycatcher	*Empidonax traillii*
Rusty blackbird (winter)	*Euphagus carolinus*
Worm-eating warbler	*Helmitheros vermivorus*

Common Name	Scientific Name
Wood thrush	*Hylocichla mustelina*
Yellow-breasted chat	*Icteria virens*
Short-billed dowitcher (migrant)	*Limnodromus griseus*
Marbled godwit (migrant)	*Limosa fedoa*
Hudsonian godwit (migrant)	*Limosa haemastica*
Black-and-white warbler	*Mniotilta varia*
Whimbrel (migrant)	*Numenius phaeopus*
Kentucky warbler	*Oporornis formosus*
Northern parula	*Parula americana*
Rose-breasted grosbeak	*Pheuctitus ludovicianus*
Eastern towhee	*Pipilo erythrophthalmus*
Scarlet tanager	*Piranga olivacea*
Black-bellied plover (winter)	*Pluvialis squatarola*
Horned grebe (winter)	*Podiceps auritus*
Prothonotary warbler	*Protonotaria citrea*
Virginia rail	*Rallus limicola*
Clapper rail	*Rallus longirostris*
American woodcock	*Scolopax minor*
Ovenbird	*Seiurus aurocapillus*
Louisiana waterthrush	*Seiurus motacilla*
Brown-headed nuthatch	*Sitta pusilla*
Field sparrow	*Spizella pusilla*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Roseate tern (migrant)	*Sterna dougallii*
Forster's tern	*Sterna forsteri*
Eastern meadowlark	*Sturnella magna*
Brown thrasher	*Toxostoma rufum*
Eastern kingbird	*Tyrannus tyrannus*
Yellow-throated vireo	*Vireo flavifrons*
Mammals	
Least weasel	*Mustela nivalis*
Southeastern myotis	*Myotis austroriparius*
Cotton mouse	*Peromyscus gossypinus*
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*
Appalachian cottontail	*Sylvilagus obscurus*
Marsh rabbit	*Sylvilagus palustris*
Southern bog lemming	*Synaptomys cooperi*
Terrestrial Insects	
Barrens dagger moth	*Acronicta albarufa*
A cane moth	*Argillophora furcilla*
Frosted elfin	*Callophrys irus*
Orange-bellied tiger beetle	*Cicindela abdominalis*
Spectral tiger beetle	*Cicindela lepida*
A tiger beetle	*Cicindela limbalis*
Pink-streak moth	*Faronta rubripennis*

Common Name	Scientific Name
A cane moth	*Franclemontia interrogans*
A shield bug	*Galgupha denudata*
Buchholz's gray moth	*Hypomecis buchholzaria*
Lemmer's pinion moth	*Lithophane lemmeri*
Bronze copper	*Lycaena hyllus*
Yucca giant-skipper	*Megathymus yuccae*
A noctuid moth	*Meropleon titan*
A turtle bug	*Oncozygia clavicornis*
Long dash	*Polites mystic*
Southern Ptichodis moth	*Ptichodis bistrigata*
Yellow-edged Pygarctia moth	*Pygarctia abdominalis*
Other Terrestrial Invertebrates	
Slim snaggletooth	*Gastrocopta pellucida*
Fine-ribbed striate	*Striatura milium*
Pinhole threetooth	*Triodopsis messana*
Palmetto vertigo	*Vertigo oralis*
Swamp vertigo	*Vertigo teskeyae*
Aquatic Mollusks	
Triangle floater	*Alasmidonta undulata*
Alewife floater	*Anodonta implicata*
Carolina lance mussel	*Elliptio angustata*
Carolina slabshell mussel	*Elliptio congaraea*
Northern lance mussel	*Elliptio fisheriana*
Oblong ancylid	*Ferrissia parallelus*
Tidewater mucket	*Leptodea ochracea*
Eastern pondmussel	*Ligumia nasuta*
Ridged lioplax	*Lioplax subcarinata*
Sharp sprite	*Promenetus exacuous*
Creeper	*Strophitus undulatus*
Florida pondhorn	*Uniomerus caroliniana*
Crustaceans	
Ohio River shrimp	*Macrobrachium ohione*
Aquatic Insects	
Blackwater bluet	*Enallagma weewa*
Robust baskettail	*Epitheca spinosa*
Drake's water scorpion	*Ranatra drakei*
Treetop emerald	*Somatochlora provocans*
Laura's clubtail	*Stylurus laurae*
Other Aquatic Invertebrates	
None	

[1] Loggerhead turtle *Caretta caretta* is included in Section 4.4, since its habitat within Virginia is terrestrial (nesting beaches).

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Enclosure 5 Virginia Natural Heritage Resources List of Rare Plants

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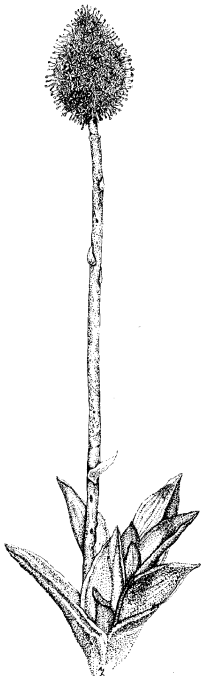
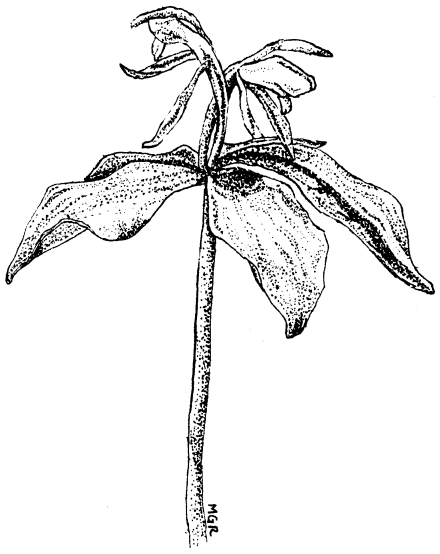
COMMONWEALTH of VIRGINIA

Natural Heritage Resources of Virginia: Rare Plants

November 2016

Compiled by:
John F. Townsend, Botanist





VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION
DIVISION OF NATURAL HERITAGE
600 EAST MAIN STREET, 24TH FLOOR
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Cover illustrations (l. to r.) of Swamp Pink (*Helonias bullata*), dwarf burhead (*Echinodorus tenellus*), and small whorled pogonia (*Isotria medeoloides*) by Megan Rollins

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DCR
Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

November 2016. 59 pages plus appendices

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INTRODUCTION

The Virginia Department of Conservation and Recreation's Division of Natural Heritage (DCR-DNH) was established to protect Virginia's Natural Heritage Resources. These Resources are defined in the Virginia Natural Area Preserves Act of 1989 (Section 10.1-209 through 217, *Code of Virginia*), as the habitat of rare, threatened, and endangered plant and animal species; exemplary natural communities, habitats, and ecosystems; and other natural features of the Commonwealth. DCR-DNH is the state's only comprehensive program for conservation of our natural heritage and includes an intensive statewide biological inventory, field surveys, electronic and manual database management, environmental review capabilities, and natural area protection and stewardship. Through such a comprehensive operation, the Division identifies Natural Heritage Resources which are in need of conservation attention while creating an efficient means of evaluating the impacts of economic growth.

To achieve this protection, DCR-DNH maintains lists of the most significant elements of our natural diversity. These lists focus the Division's inventory on the Natural Heritage Resources most likely to be lost without conservation action in the near future. Most importantly, these lists are not only useful for DCR-DNH, but can be used by other agencies, organizations, and individuals to guide protection and development decision-making. In formulating these lists, the Division uses information from previous studies, museum records, the observations and opinions of experts, DCR-DNH staff scientists, and field inventories.

The first list included in this report is the Rare Vascular Plant List. This list contains information on the legal and biological status of Virginia's rarest known native vascular plant taxa, **628** in all. This list includes all plants believed to be sufficiently rare or threatened to merit an inventory of their status and locations.

The second list included in this report is the Vascular Plant Watchlist. This list contains information on the legal and biological status of **230** additional taxa that are decidedly uncommon in Virginia but not scarce enough to merit inclusion on the Rare Vascular Plant List. Plants on this list are monitored to determine general population trends. If a species or variety on this list is found to be rare or threatened, it is placed on the Rare Vascular Plant List.

The third list included in this report is the Review List (Taxa of Uncertain Status). These taxa lack numerical ranks, indicating that they are poorly known from a taxonomic and distributional standpoint. Although some of these taxa may prove to be conservation targets, more field and herbarium data are needed to assess their distinctiveness and degree of rarity in Virginia. There are **72** taxa in this category.

The fourth list included in this report is the Rare Non-Vascular Plant List. This list contains information on the legal and biological status of **95** taxa thought to be rare in the state of Virginia. The lichens, liverworts, and mosses listed herein represent an attempt at designating imperiled species within this often-neglected group. The list is currently small compared to the vascular plant lists because the taxonomy and distributions of non-vascular plants are generally poorly known in Virginia at this time (with some exceptions).

Natural Heritage Resource lists are necessarily dynamic and are revised annually, with updates occurring as data become available. Such revisions assure the most current knowledge of the status of Virginia's plants. Taxa are added to the list when it is determined that they have become rare or threatened to such an extent that their continued existence in Virginia is in jeopardy. Plants are deleted from the list when data indicate they are common and do not warrant priority conservation efforts.

If you have information which could refine this list, please contact DCR-DNH staff botanist John Townsend at (804) 225-4855 (email: john.townsend@dcr.virginia.gov) or by mailing the Rare Species Sighting Form found at the end of this document.

All plants which are officially protected by federal or state endangered species acts are included in these lists. The Office of Plant Protection within the Virginia Department of Agriculture and Consumer Services (VDACS) has regulatory responsibility for the listing and protection of Virginia's endangered and threatened plants and insects under the Virginia Endangered Plant and Insect Species Act, as amended (Section 3.1 -1020 through 1030, *Code of Virginia*). The Act provides for the official listing and recovery of endangered and threatened plant and insect species in Virginia. The Act also establishes a permit system for collection of listed species. As of 2013, there were 26 state-listed plant species. A memorandum of agreement between DCR-DNH and VDACS facilitates data transfer between agencies and allows for DCR-DNH to nominate species for listing by VDACS.

Federally listed species are protected by the Endangered Species Act of 1973, as amended. The U.S. Department of the Interior's Fish and Wildlife Service administers the Act, listing and protecting federally endangered and threatened species. As of 2015, there were 16 plant species federally listed as endangered or threatened which occur or formerly occurred in Virginia.

The Virginia Department of Conservation and Recreation, Virginia Department of Agriculture and Consumer Services, and U. S. Fish and Wildlife Service work cooperatively to insure the continued survival of Virginia's diverse flora and other elements of natural diversity. The Division of Natural Heritage also works closely with other state and federal agencies, local governments, conservation organizations, and other organizations and individuals to seek adequate protection of Virginia's natural heritage.

FORMAT OF LISTS

Lists for each category (vascular plant lists, liverwort list, etc.) are alphabetized by scientific name. Each list has an identical format which presents six fields: scientific name, common name, global rank, state rank, federal status, and state status. To help interpret the list, a brief explanation of each field may be found on the following page.

Column 1. Scientific name:
Nomenclature for vascular plants almost exclusively follows Weakley, A.S., J.C. Ludwig, and J.F. Townsend, 2012. *Flora of Virginia*. Bland Crowder, ed. Foundation of the Flora of Virginia Project, Inc., Richmond. Fort Worth: Botanical Research Institute of Texas Press. A line is provided below the scientific name to provide synonyms when other names are used in popular botanical references.

Nomenclature for lichens follows Esslinger, T.L. 2014. A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. North Dakota State University: http://www.ndsu.edu/pubweb/~esslinge/chcklst/chcklst7.htm (First Posted 1 December 1997, Most Recent Version (#19) 23 March 2014), Fargo, North Dakota.

Nomenclature for liverworts follows the Field Museum taxonomy module, located at:
http://emuweb.fieldmuseum.org/botany/taxonomic.php?_ga=1.125124173.613149090.1423754725

Nomenclature for mosses follows volumes 27 and 28 of Flora of North America, North of Mexico (Bryophytes, Part 1 and Part 2).

Column 2. Common name:
A common name is provided for the convenience of the user. Common names for plants follow the *Flora of Virginia*.

Column 3. Global rank:
Global ranks are assigned by a consensus of the network of natural heritage programs, scientific experts, and The Nature Conservancy to designate a rarity rank based on the range-wide status of a species or variety. This system was developed by The Nature Conservancy and is widely used by other agencies and organizations as the best available scientific and objective assessment of a taxon's rarity and level of threat to its existence. The ranks are assigned after considering a suite of factors, including number of occurrences, number of individuals, and severity of threats.

G1 = **Critically Imperiled** - At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2 = **Imperiled** - At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

G3 = **Vulnerable** - At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

G4 = **Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors.

G5 = **Secure** – Common, widespread and abundant.

GH = **Possibly Extinct** - Missing; known from only historical occurrences but still some hope of rediscovery.

GX = **Presumed Extinct** - Not located despite intensive searches and virtually no likelihood of rediscovery.

GU = **Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and the question mark qualifier is added (e.g., G2?) to express uncertainty, or a range rank (e.g., G2G3) is used to delineate the range of uncertainty.

G_? = **Inexact Numeric Rank** - Denotes inexact numeric rank (e.g., G3?).

G_Q = **Questionable taxonomy** - Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower conservation priority (e.g., G3Q).

G_T_ = **Infraspecific Taxa** - Signifies the rank of a subspecies or variety. For example, the rank G5T1 would be assigned to a very rare and localized variety of an otherwise widespread and common taxon.

GNR = **Unranked** – Global rank not yet assessed.

GNA = **Not applicable** – A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Column 4. State rank:
State ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Virginia. For example, whereas a plant which is endemic to Virginia (found nowhere else) will have the same global and state ranks, a plant which may be common in the northeastern United States, but only known from a few occurrences in Virginia will have different global and state ranks. By comparing the global and state ranks, the status, rarity, and the urgency of conservation needs can be ascertained.

S1 = Critically Imperiled - At very high risk of extirpation from the state due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

S2 = Imperiled - At high risk of extirpation from the state due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

S3 = **Vulnerable** - At moderate risk of extirpation from the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

S4 = Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 = Secure – Common, widespread and abundant.

SH = Possibly Extirpated - Known only from historical occurrences but still some hope of rediscovery.

SX = **Presumed Extirpated** - Not located despite intensive searches and virtually no likelihood of rediscovery.

SU = **Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

S_? = **Inexact Numeric Rank** - Denotes inexact numeric rank (e.g., S3?).

SNR = **Unranked** – State conservation status not yet assessed.

SNA = **Not Applicable** - A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

Column 5. Federal Status:
Federal Status is determined by the U. S. Fish and Wildlife Service. This includes all species and varieties which are listed as endangered or threatened by the U. S. government and receive protection under the federal Endangered Species Act. The list also notes those taxa which are proposed for listing or are candidates for listing.

LE = **Listed Endangered** - A taxon is threatened with extinction throughout all or a significant portion of its range.

LT = **Listed Threatened** - A taxon is likely to become endangered in the foreseeable future.

PE = **Proposed Endangered** - A taxon is proposed for listing as endangered.

PT = **Proposed Threatened** - A taxon is proposed for listing as threatened.

C = **Candidate** - There is enough available information to propose the taxon for listing, but listing is "precluded by other pending proposals of higher priority". The U.S. Fish and Wildlife Service is "directed to make prompt use of the emergency listing if the well-being of any such species is at significant risk."

_* = An * following the status denotes that the species or variety is possibly extinct.

Column 6. State Status:
State status indicates those plants which are listed as state endangered or threatened under the authority of the Virginia Department of Agriculture and Consumer Services.

LE = **Listed Endangered**

LT = **Listed Threatened**

PE = **Proposed Endangered**

PT = **Proposed Threatened**

C = **Candidate for listing as threatened or endangered**

ACKNOWLEDGEMENTS

If not for the hard work of many biologists, these plant lists could not accurately reflect our current understanding of the Virginia flora. On the staff of the Division of Natural Heritage, Allen Belden, Gary Fleming, Chris Ludwig, Nancy Van Alstine, Karen Patterson, Kristin Taverna, Irvine Wilson, and Darren Loomis have provided many comments to refine the content of the lists. In addition to Heritage staff, members of the Virginia Botanical Associates have contributed greatly to our understanding of the Virginia flora via the continuously updated Digital Atlas of the Virginia Flora and through numerous personal communications.

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GENERA INDEX

If you can't find:	**Look under:**
Agave	*Manfreda*
Agropyron	*Elymus*
Allium	*Nothoscordum*
Arabis	*Boechera*
Arabis	*Turritis*
Arenaria	*Honckenya*
Arenaria	*Minuartia*
Arenaria	*Moehringia*
Armoracea	*Neobeckia*
Asarum	*Hexastylis*
Aster	*Eurybia*
Aster	*Symphyotrichum*
Botrychium	*Sceptridium*
Bumelia	*Sideroxylon*
Cacalia	*Arnoglossum*
Cacalia	*Hasteola*
Cacalia	*Neobeckia*
Calamintha	*Clinopodium*
Carduus	*Cirsium*
Cassia	*Chamaecrista*
Centunculus	*Anagallis*
Callisia	*Cuthbertia*
Cleistes	*Cleistesopsis*
Convolvulus	*Calystegia*
Croton	*Crotonopsis*
Cynoctonum	*Mitreola*
Dentaria	*Cardamine*
Dichromena	*Rhynchospora*
Diplachne	*Leptochloa*
Disporum	*Prosartes*
Dracocephalum	*Physostegia*
Erianthus	*Saccharum*
Eupatorium	*Eutrochium*
Euphorbia	*Chamaesyse*
Fleischmannia	*Eupatorium*
Gentiana	*Gentianopsis*
Gerardia	*Agalinis*
Gerardia	*Aureolaria*
Gillenia	*Porteranthus*
Gnaphalium	*Pseudognaphalium*
Habenaria	*Platanthera*
Haplopappus	*Croptilon*
Hedyotis	*Houstonia*
Hedyotis	*Oldenlandia*
Helianthemum	*Crocanthemum*
Heterotheca	*Chrysopsis*
Hierochloe	*Anthoxanthum*
Houstonia	*Hedyotis*
Hypericum	*Triadenum*
Isopyrum	*Enemion*
Jussiaea	*Ludwigia*
Leptoloma	*Digitaria*
Lipocarpha	*Hemicarpha*
Lippia	*Phyla*
Lophotocarpus	*Sagittaria*
Lotus	*Acmispon*
Lycopodiella	*Peudolycopodiella*
Lycopodium	*Lycopodiella*
Lycopodium	*Peudolycopodiella*
Lycopodium	*Huperzia*
Manisuris	*Coelorachis*
Osmunda	*Osmundastrum*
Panicum	*Coleataenia*
Panicum	*Dichanthelium*
Panicum	*Phanopyrum*
Panicum	*Steinchisma*
Peplis	*Didiplas*
Potentilla	*Drymocallis*
Potentilla	*Sibbaldia*
Prenanthes	*Nabalus*
Psilocarya	*Rhynchospora*
Psoralea	*Onobrychis*
Psoralea	*Orbexilum*
Psoralea	*Pediomelum*
Ptilimnium	*Harperella*
Pyrola	*Orthilia*
Satureja	*Clinopodium*
Saxifraga	*Micranthes*
Schrankia	*Mimosa*
Schoenoplectus	*Bolboscoenus*
Scirpus	*Isolepis*
Scirpus	*Schoenoplectus*
Senecio	*Packera*
Seymeria	*Dasistoma*
Smilacina	*Maianthemum*
Solidago	*Euthamia*
Solidago	*Oligoneuron*
Sphaeralcea	*Malvastrum*
Thelypteris	*Parathelypteris*
Tomanthera	*Agalinis*
Tradescantia	*Cuthbertia*
Triodia	*Tridens*
Tofieldia	*Triantha*
Trichomanes	*Crepidomanes*
Trichomanes	*Vandenboschia*
Uniola	*Chasmanthium*
Verbena	*Stylodon*
Xanthoxylum	*Zanthoxylum*
Zigadenus	*Stenanthium*

PART ONE:

RARE VASCULAR PLANT LIST

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Abies balsamea* (L.) P. Mill**	**Balsam fir**	**G5**	**S1**		
***Abies fraseri* (Pursh) Poir.**	**Fraser fir**	**G2**	**S1**		
***Acmispon helleri* (Britt.) A.A. Heller**	**Carolina Prairie-trefoil**	**G3**	**S1**		
syn: *Lotus helleri* Britton					
***Actaea rubifolia* (Kearney) Kartesz**	**Appalachian Black Cohosh**	**G3**	**S1**		
syn: *Cimicifuga rubifolia* Kearney					
***Adiantum capillus-veneris* L.**	**Venus'-hair Fern**	**G5**	**SH**		
***Aeschynomene virginica* (L.) B.S.P.**	**Sensitive Joint-vetch**	**G2**	**S2**	**LT**	**LT**
***Agalinis auriculata* (Michx.) Blake**	**Earleaf False Foxglove**	**G3**	**S1**		
syn: *Tomanthera auriculata* (Michx.) Raf.					
***Aletris aurea* Walt.**	**Golden Colicroot**	**G5**	**S1**		
***Allium allegheniense* Small**	**Allegheny Onion**	**G3?**	**S1**		
Under *A. cernuum* Roth in Fernald (1950) and Radford *et al.* (1968)					
***Allium oxyphilum* Wherry**	**Shale Barren Nodding Onion**	**G2**	**S1**		
***Alnus incana* (L.) Moench ssp. *rugosa* (Du Roi) Clausen**	**Speckled Alder**	**G5T5**	**S2**		
syn: *A. rugosa* (Du Roi) Spreng.					
***Amaranthus pumilus* Raf.**	**Sea-beach Amaranth**	**G2**	**S1**	**LT**	**LT**
***Amelanchier nantucketensis* Bickn.**	**Nantucket Shadbush**	**G3Q**	**S1**		
***Amphicarpum amphicarpon* (Pursh) Nash**	**Pine-barrens Peanut Grass**	**G4**	**S1**		
***Anagallis minima* (L.) Krause**	**Chaffweed**	**G5**	**SH**		
syn: *Centunculus minimus L.*					
***Anaphalis margaritacea* (L.) Benth. & Hook. f.**	**Pearly Everlasting**	**G5**	**S1**		
***Andropogon mohrii* (Hack.) Hack. ex Vasey**	**Mohr's Bluestem**	**G4?**	**SH**		
***Anemone berlandieri* Pritz.**	**Eastern Prairie Anemone**	**G4?**	**S1**		
***Anemone canadensis* L.**	**Canada Anemone**	**G5**	**SH**		
***Anthoxanthum hirtum* (Shrank) Y. Schouten & Veldkamp**	**Holy Grass**	**G5**	**S1**		
syn: *Hierochloe odorata* (L.) Beauv. ssp. *odorata*					
***Arabis patens* Sullivant**	**Spreading Rock Cress**	**G3**	**S1**		
***Arabis pycnocarpa* M. Hopkins var. *adpressipilis* M. Hopkins**	**Hairy Rock Cress**	**G5T4Q**	**S1S2**		
syn: *Arabis hirsuta* (L.) Scop. var. *adpressipilis* (M. Hopkins) Rollins					
***Aralia hispida* Vent.**	**Bristly Sarsaparilla**	**G5**	**S2**		
***Arctostaphylos uva-ursi* (L.) Spreng.**	**Bearberry**	**G5**	**S1**		
Arenaria lanuginosa* (Michx.) Rohrb. var. *lanuginosa	**Spreading Sandwort**	**G5T5**	**SH**		
***Arethusa bulbosa* L.**	**Dragon's-mouth**	**G5**	**SH**		

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***Arnoglossum reniforme* (Hooker) H.E. Robins.** syn: *Arnoglossum muhlenbergii* (Schultz-Bip.) H.E. Robinson	**Great Indian-plantain**	**G4**	**S2**		
***Asclepias longifolia* Michx.**	**Long-leaf Milkweed**	**G4G5**	**S1**		
***Asclepias purpurascens* L.**	**Purple Milkweed**	**G5?**	**S2**		
***Asclepias rubra* L.**	**Red Milkweed**	**G4G5**	**S2**		
***Asclepias tuberosa* L. var. *rolfsii* (Britt. ex Vail) Woods.**	**Sandhills Butterfly-weed**	**G5?TNR**	**S1**		
***Asplenium bradleyi* D.C. Eaton**	**Bradley's Spleenwort**	**G4**	**S2**		
Astragalus distortus* Torr. & Gray var. *distortus	**Ozark Milkvetch**	**G5T5?**	**SH**		
***Astragalus neglectus* (Torr. & Gray) Sheldon**	**Cooper's Milkvetch**	**G4**	**S2**		
***Atriplex glabriuscula* Edmondston**	**Maritime Orach**	**G4**	**SH**		
***Bacopa caroliniana* (Walt.) B.L. Robins.**	**Blue Water-hyssop**	**G4G5**	**SH**		
***Bacopa innominata* (G.Maza) Alain** Virginia material formerly named *B. stragula* Fern.	**Tropical Water-hyssop**	**G3G5**	**S2**		
***Bacopa rotundifolia* (Michx.) Wettst.** Virginia material formerly named *B. simulans* Fern.	**Round-leaf Water-hyssop**	**G5**	**SH**		
***Baptisia albescens* Small** Treated as *B. alba* (L.) R. Brown in Fernald (1950)	**Narrow-pod White Wild Indigo**	**G4**	**S1**		
***Baptisia cinerea* (Raf.) Fern. & Schub.**	**Gray-hairy Wild Indigo**	**G3G4**	**SH**		
***Bartonia verna* (Michx.) Raf. Ex Bart.**	**Spring Bartonia**	**G5?**	**S1**		
***Betula papyrifera* Marshall** Virginia material has traditionally been treated as *Betula cordifolia* but most populations closely resemble *B. papyrifera.* They are under study.	**Paper Birch**	**G5**	**S2**		
***Betula lenta* L. var. *uber* Ashe** *syn: Betula uber* (Ashe) Fern.	**Virginia Roundleaf Birch**	**G5T1Q**	**S1**	**LT**	**LE**
***Betula populifolia* Marsh.**	**Gray Birch**	**G5**	**S1**		
***Boechera dentata* (Raf.) Al-Shehbaz & Zarruchi** syn: *Arabis shortii* (Fern.) Gleason	**Short's Rock Cress**	**G5**	**S1**		
***Boechera serotina* (Steele) Windham & Al-Shehbaz** syn: *Arabis serotina* Steele	**Shale Barren Rock Cress**	**G2**	**S2**	**LE**	**LT**
***Bolboschoenus fluviatilis* (Torr.) J. Sojak** syn: *Schoenoplectus fluviatilis* (Torr.) M.T. Strong	**River Bulrush**	**G5**	**S2**		
***Boltonia asteroides* (L.) L'Her var. *glastifolia* (Hill) Fern.**	**Eastern Doll's-daisy**	**G5TNR**	**S2**		
***Boltonia montana* J.F. Townsend & V. Karaman-Castro**	**Valley Doll's-daisy**	**G1G2**	**S1**		**LE**

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***Botrychium lanceolatum* (Gmel.) Angstr. var. *angustisegmentum* Pease & Moore**	**Triangle Grape Fern**	**G5T4**	**SH**		
Botrychium simplex* E. Hitchc. var. *simplex	**Dwarf Gape Fern**	**G5T5**	**S1**		
***Bromus ciliatus* L.**	**Fringed Brome Grass**	**G5**	**S1**		
***Bromus kalmii* Gray**	**Arctic Brome**	**G5**	**S1**		
***Buchnera americana* L.**	**American Bluehearts**	**G5?**	**S1S2**		
***Buckleya distichophylla* (Nutt.) Torr.**	**Piratebush**	**G3**	**S2**		
***Burmannia biflora* L.**	**Violet Burmannia**	**G4G5**	**SH**		
***Cabomba caroliniana* Gray**	**Carolina Fanwort**	**G3G5**	**S1S2**		
***Calamovilfa brevipilis* (Torr.) Scribn.**	**Pine Barren Sandreed**	**G4**	**S1**		
***Calopogon pallidus* Chapman**	**Pale Grass-pink**	**G4G5**	**S1**		
***Calopogon tuberosus* (L.) B.S.P.**	**Tuberous Grass-pink**	**G5**	**S1S2**		
***Calycanthus floridus* L.**	**Sweet-shrub**	**G5**	**S1**		
***Calystegia catesbeiana* Pursh**	**Catesby's False Bindweed**	**G3**	**S1**		
***Camassia scilloides* (Raf.) Cory**	**Wild Hyacinth**	**G4G5**	**S1**		
***Campanula rotundifolia* L.**	**Harebell**	**G5**	**S1**		
***Cardamine clematitis* Shuttlw. ex Gray**	**Mountain Bittercress**	**G3**	**S1**		
***Cardamine dissecta* (Leavenworth) Al-Shehbaz**	**Fork-leaf Toothwort**	**G4?**	**S1**		
***Cardamine flagellifera* O.E. Schulz**	**Blue Ridge Bittercress**	**G3**	**S1**		
***Cardamine micranthera* Rollins**	**Small-anthered Bittercress**	**G2**	**S2**	**LE**	**LE**
***Cardamine pratensis* L.** Only native Virginia populations are monitored	**Cuckoo-flower**	**G5**	**S1**		
***Carex aestivaliformis* Mackenz.** syn: *Carex x aestivaliformis* Mackenz.	**Small-fruited Summer Sedge**	**GNA**	**S1**		
***Carex aquatilis* Wahlenb**	**Aquatic sedge**	**G5**	**S1**		
***Carex arctata* Boott ex Hook.**	**Black Sedge**	**G5**	**S1**		
***Carex atherodes* Spreng.**	**Awned Sedge**	**G5**	**S1**		
***Carex barrattii* Schwein. & Torr.**	**Barratt's Sedge**	**G4**	**S2**		
***Carex bebbii* Olney ex Fern.**	**Bebb's Sedge**	**G5**	**S1**		
***Carex buxbaumii* Wahlenb.**	**Brown Bog Sedge**	**G5**	**S2**		
***Carex conoidea* Schkuhr ex Willd.**	**Field Sedge**	**G5**	**S1S2**		
***Carex crawei* Dewey**	**Crawe's Sedge**	**G5**	**S2**		
***Carex cristatella* Britt.**	**Crested Sedge**	**G5**	**S1**		
***Carex crus-corvi* Shuttlw. ex Kunze**	**Crowfoot Sedge**	**G5**	**S2**		
***Carex davisii* Schwein. & Torr.**	**Davis's Sedge**	**G4**	**S1**		
***Carex decomposita* Muhl.**	**Cypress-knee Sedge**	**G3G4**	**S1**		
***Carex flava* L.**	**Yellow Sedge**	**G5**	**S1**		
***Carex interior* Bailey**	**Inland Sedge**	**G5**	**S1S2**		
***Carex juniperorum* Catling, Reznicek, & Crins**	**Juniper Sedge**	**G3**	**S1**		**LE**
***Carex lacustris* Willd.**	**Lake-shore Sedge**	**G5**	**S1**		
***Carex lasiocarpa* Ehrh var. *americana* Fern.** Does not include *C. lanuginosa* Michx.	**Slender Sedge**	**G5T5**	**S1**		
***Carex lupuliformis* Sartwell ex Dewey**	**False Hop sedge**	**G4**	**S1S2**		

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***Carex manhartii* Bryson**	**Blue Ridge Purple Sedge**	**G3G4**	**S1**		
***Carex ormostachya* Wieg.**	**Necklace Spike Sedge**	**G4**	**S1**		
***Carex pallescens* L.**	**Pale Sedge**	**G5**	**S1**		
***Carex polymorpha* Muhl.**	**Variable Sedge**	**G3**	**S2**		
***Carex prairea* Dewey ex Wood**	**Prairie Sedge**	**G5**	**S1**		
***Carex reniformis* (Bailey) Small**	**Kidney Sedge**	**G4?**	**S1**		
***Carex roanensis* F.J. Herm**	**Roan Mountain Sedge**	**G2G3**	**S2**		
***Carex schweinitzii* Dewey ex Schwein.**	**Schweinitz's Sedge**	**G3G4**	**S1**		
***Carex silicea* Olney**	**Sea-beach Sedge**	**G5**	**S1**		
***Carex* sp. 2 *sp. nov*.** Mountain species in Section *Acrocystis*	**A sedge**	**GNR**	**S1**		
***Carex sterilis* Willd.**	**Sterile Sedge**	**G4G5**	**S1**		
***Carex straminea* Willd. ex Schkuhr** Does not include *C. hormathodes* Fern.	**Straw Sedge**	**G5**	**S1**		
***Carex utriculata* Boott** Treated as *C. rostrata* Stokes in Fernald (1950)	**Beaked Sedge**	**G5**	**S1**		
***Carex vesicaria* L.**	**Inflated Sedge**	**G5**	**S1S2**		
***Carex vestita* Willd.**	**Velvet Sedge**	**G5**	**S2**		
***Carphephorus bellidifolius* (Michx.) Torr. & Gray**	**Sandy-woods Chaffhead**	**G4**	**S1S2**		
***Carphephorus tomentosus* (Michx.) Torr. & Gray**	**Woolly Chaffhead**	**G4**	**S1**		
***Carya carolinae-septentrionalis* (Ashe) Engl. & Graebn.**	**Carolina Shagbark Hickory**	**G5?**	**S1**		
Cerastium velutinum* Raf. var. *velutinum syn: *Cerastium arvense* L. ssp. *velutinum* (Raf.) Ugborogho.	**Field Chickweed**	**G5T4?**	**S1S2**		
***Cheilanthes alabamensis* (Buckl.) Kunze**	**Alabama Lip Fern**	**G4G5**	**S1**		
***Cheilanthes castanea* Maxon**	**Chestnut Lip Fern**	**G5?**	**S2**		
***Cheilanthes feei* T. Moore**	**Slender Lip Fern**	**G5**	**S1**		
***Chelone cuthbertii* Small**	**Cuthbert's Turtlehead**	**G3**	**S2**		
***Chelone obliqua* L.**	**Red Turtlehead**	**G4**	**S1**		
***Chenopodium foggii* H.A. Wahl**	**Fogg's Goosefoot**	**G2G3**	**S1?**		
***Chrysopsis gossypina* (Michx.) Ell.**	**Cottony Golden-aster**	**G5**	**S1**		
***Cicuta bulbifera* L.**	**Bulb-bearing Water-hemlock**	**G5**	**SH**		
***Cirsium altissimum* (L.) Hill**	**Tall Thistle**	**G5**	**S1**		
***Cirsium carolinianum* (Walt.) Fern. & Schub.**	**Carolina Thistle**	**G5**	**S1**		
***Cirsium nuttallii* DC.**	**Nuttall's Thistle**	**G5**	**SH**		
***Cirsium repandum* Michx.**	**Sandhill Thistle**	**G5**	**SH**		
***Cirsium virginianum* (L.) Michx.**	**Virginia Thistle**	**G3**	**S2**		
***Cladium jamaicense* Crantz**	**Sawgrass**	**G5T5**	**S1S2**		
***Cleistesiopsis bifaria* (Fern.) Pansarin & F. Barros**	**Small Spreading Pogonia**	**G4?**	**S2**		
***Cleistesiopsis divaricata* (L.) Pansarin & F. Barros**	**Large Spreading Pogonia**	**G4**	**S1**		

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***Clematis addisonii* Britt.**	**Addison's Leatherflower**	**G1?**	**S2**		
***Clematis catesbyana* Pursh** Under *C. virginiana* L. in Radford et al. (1968)	**Satin-curls**	**G4G5**	**S1**		
Clematis occidentalis* (Hornem.) DC. var. *occidentalis syn: *C. verticillatus* DC.	**Purple Clematis**	**G5T5**	**S1**		
***Clematis viticaulis* Steele**	**Millboro Leatherflower**	**G1**	**S1S2**		**LT**
***Clinopodium arkansanum* (Nutt.) House** often confused with *Calamintha glabella* (Michx.) Benth. syn: *Satureja arkansana* (Nutt.) Briquet	**Limestone Calamint**	**G5**	**SH**		
***Cocculus carolinus* (L.) A. DC.** Only native Virginia populations are monitored	**Carolina Coralbead**	**G5**	**S1**		
***Coelorachis rugosa* (Nutt.) Nash** syn: *Manisuris rugosa* (Nutt.) Kuntze	**Wrinkled Jointgrass**	**G5**	**S1**		
***Collinsia verna* Nutt.**	**Eastern Blue-eyed Mary**	**G5**	**S1**		
***Collinsonia verticillata* Baldw.**	**Whorled Horsebalm**	**G3G4**	**S1**		
***Conioselinum chinense* (L.) B.S.P.**	**Hemlock Parsley**	**G5**	**S1**		
***Corallorhiza bentleyi* Freudenstein**	**Bentley's Coralroot**	**G2**	**S2**		**LE**
***Corallorhiza maculata* (Raf.) Raf. var. *occidentalis* (Lindl.) Cockerell**	**Western Spotted Coralroot**	**G5T3T5**	**SH**		
***Corallorhiza trifida* Châtelain**	**Early Coralroot**	**G5**	**S1**		
***Coreopsis delphiniifolia* Lam.**	**Larkspur Coreopsis**	**G3?Q**	**S1**		
***Coreopsis falcata* Boynton**	**Pool Coreopsis**	**G4G5**	**S1**		
***Coreopsis linifolia* Nutt** syn: *C. oniscicarpa Fern.*	**Savanna Coreopsis**	**G4Q**	**S1**		
***Cornus canadensis* L.**	**Bunchberry**	**G5**	**S1**		
***Cornus obliqua* (Raf.) J.S. Wilson**	**Silky Dogwood**	**G5**	**S1**		
***Cornus rugosa* Lam.**	**Round-leaf Dogwood**	**G5**	**S1**		
***Crataegus calpodendron* (Ehrh.) Medik.**	**Pear Hawthorn**	**G5**	**S1**		
Crataegus mollis* Scheele var. *mollis	**Downy Hawthorn**	**G5T5**	**S1**		
***Crataegus succulenta* Schrad. ex Link var. *neofluvialis* (Ashe) Palmer**	**New River Hawthorn**	**G4G5TNR**	**SH**		
Crataegus succulenta* Schrad. ex Link var. *succulenta	**Fleshy Hawthorn**	**G5T5**	**S1**		
***Crocanthemum bicknellii* Fern. (Barnhart)**	**Plains Frostweed**	**G5**	**S1**		
***Crocanthemum propinquum* Bickn. (Bickn.)**	**Low Frostweed**	**G4**	**S1**		
***Crotalaria purshii* DC.**	**Pursh's Rattlebox**	**G5**	**S1**		
***Crotalaria rotundifolia* Walt. ex J.F. Gmel. var. *vulgaris* Windler** syn: *C. angulata* P. Mill.	**Low Rattlebox**	**G5TNR**	**SH**		
***Ctenium aromaticum* (Walt.) Wood**	**Toothache Grass**	**G5**	**S1**		
***Cuscuta cephalanthi* Engelm.**	**Buttonbush Dodder**	**G5**	**S1**		
***Cuscuta coryli* Engelm.**	**Hazel Dodder**	**G5?**	**S2**		

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***Cuscuta indecora* Choisy**	**Big-seed Alfalfa Dodder**	**G5**	**S1**		
***Cuscuta polygonorum* Engelm.**	**Smartweed Dodder**	**G5**	**S1**		
***Cuscuta rostrata* Shuttlw. ex Engelm. & Gray**	**Beaked Dodder**	**G4**	**S1S2**		
***Cuthbertia graminea* Small** syn: *Tradescantia rosea* Vent. var. *graminea* (Small) E.S. Anderson & Woods syn: *Callisia graminea* (Small) G. Tucker	**Grasslike Roselings**	**G5**	**S1**		
***Cyperus acuminatus* Torr. & Hook. ex Torr.**	**Short-point flatsedge**	**G5**	**S1**		
***Cyperus dentatus* Torr.**	**Toothed Flatsedge**	**G4**	**S1**		
***Cyperus diandrus* Torr.**	**Umbrella Flatsedge**	**G5**	**S1**		
***Cyperus granitophilus* McVaugh**	**Granite Flatsedge**	**G3G4Q**	**S1**		
***Cyperus houghtonii* Torr.**	**Houghton's Flatsedge**	**G4?**	**SH**		
***Cyperus odoratus* L. var. *engelmannii* (Steud.) R. Carter**	**Slender Sand Sedge**	**G5T4Q**	**S1**		
***Cyperus plukenetii* Fern.**	**Plukenet's Flatsedge**	**G5**	**S2**		
***Cypripedium candidum* Muhl. ex Willd.**	**Small White Lady's-slipper**	**G4**	**S1**		
***Cypripedium kentuckiense* C.F. Reed**	**Kentucky Lady's-slipper**	**G3**	**S1**		
***Cypripedium reginae* Walt.**	**Showy Lady's-slipper**	**G4G5**	**S1**		
***Cystopteris tennesseensis* Shaver**	**Tennessee Bladder Fern**	**G5**	**S1**		
***Dasistoma macrophyllum* (Nutt.) Raf.**	**Mullein Foxglove**	**G4**	**S1**		
***Deschampsia cespitosa* (L.) Beauv.**	**Tufted Hairgrass**	**G5**	**S1**		
***Desmodium canadense* (L.) DC.**	**Showy Tick-trefoil**	**G5**	**S1**		
Desmodium cuspidatum* (Muhl. *ex* Willd.) DC. ex Loud. var. *cuspidatum	**Toothed Tick-trefoil**	**G5T5?**	**S2**		
***Desmodium ochroleucum* M.A. Curtis ex Canby**	**Cream-flowered Tick-trefoil**	**G2**	**SH**		
***Desmodium sessilifolium* (Torr.) Torr. & Gray**	**Sessile-leaf Tick-trefoil**	**G5**	**S2**		
***Desmodium strictum* (Pursh) DC.**	**Pineland Tick-trefoil**	**G4**	**S2**		
***Desmodium tenuifolium* Torr. & Gray**	**Slim-leaf Tick-trefoil**	**G4**	**S1**		
***Diamorpha smallii* Britt. ex Small** syn: *Sedum smallii* (Britton ex Small) Ahles	**Small's Stonecrop**	**G4**	**S1**		
***Dichanthelium caerulescens* (Hack. ex Hitchc.) Correll** syn: *Panicum caerulescens* Hack ex A.S. Hitchc. Under *D. dichotomum* (L.) Gould var. *dichotomum* in Kartesz (1999)	**Blue Panic Grass**	**G2G3**	**S1**		
***Dichanthelium consanguineum* (Kunth) Gould & C. A. Clark** syn: *Panicum consanguineum* Kunth	**Blood Panic Grass**	**G5**	**S1S2**		
***Dichanthelium cryptanthum* (Ashe) LeBlond** syn: *Panicum scabriusculum* (Ell.) Gould & Clark var. *cryptanthum* (Ashe) Gleason	**Hidden-flowered Panic Grass**	**G3G4Q**	**S1**		

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***Dichanthelium curtifolium* (Nash) LeBlond** syn: *Dichanthelium ensifolium* (Baldw. ex Ell.) Gould ssp. *curtifolium* (Nash) Freckmann & LeLong	**Short-leaved Witchgrass**	**GNR**	**S1**		
Dichanthelium ovale* (Ell.) Gould & C. A. Clark var. *ovale syn: *Panicum ovale* Ell. var. *ovale*	**Oval-flowered Panic Grass**	**G5T5**	**S1?**		
Dichanthelium strigosum* (Muhl. ex Ell.) Freckmann var. *strigosum syn: *Panicum strigosum* Muhl. ex Ell. var. *strigosum*	**Rough-hair Panic Grass**	**G5T5**	**SH**		
***Didiplis diandra* (Nutt. ex DC.) Wood** syn: *Peplis diandra* Nutt. ex DC.	**Water-purslane**	**G5**	**S1**		
***Digitaria cognata* (J.A. Schultes) Pilger** syn: *Leptoloma cognata* (J.A. Schultes) Chase	**Fall Witch Grass**	**G5**	**S1**		
***Digitaria serotina* (Walt.) Michx.**	**Dwarf Crabgrass**	**G5?**	**S1**		
***Drymocallis arguta* (Pursh) Rydberg** syn: *Potentilla arguta* Pursh	**Tall Cinquefoil**	**G5**	**S1**		
Dryopteris clintoniana (D.C. Eaton) Dowell	**Clinton's Wood Fern**	**G5**	**SH**		
***Echinacea laevigata* (C.L. Boynt. & Beadle) Blake**	**Smooth Coneflower**	**G2G3**	**S2**	**LE**	**LT**
***Echinocystis lobata* (Michx.) Torr. & Gray**	**Wild Cucumber**	**G5**	**SH**		
***Echinodorus tenellus* (Mart.) Buch.** syn: *Echinodorus parvulus* Engelm.	**Dwarf Burhead**	**G5?**	**S1**		
***Elatine minima* (Nutt.) Fisch. & C.A. Mey.**	**Small Waterwort**	**G5**	**S1**		
***Eleocharis baldwinii* (Torr.) Chapman**	**Baldwin's Spikerush**	**G4G5**	**S1**		
***Eleocharis bifida* S.G. Smith**	**Glades Spikerush**	**G3G4**	**S1**		
Eleocharis compressa* Sullivant var. *compressa	**Flattened Spikerush**	**G4TNR**	**S2**		
***Eleocharis elliptica* Kunth**	**Elliptic Spikerush**	**G5**	**S1**		
***Eleocharis equisetoides* (Ell.) Torr.**	**Horsetail Spikerush**	**G4**	**S1**		
***Eleocharis intermedia* J.A. Schultes**	**Matted Spikerush**	**G5**	**S1**		
***Eleocharis melanocarpa* Torr.**	**Black-fruited Spikerush**	**G4**	**S2**		
***Eleocharis radicans* (A. Dietr.) Kunth**	**Rooted Spikerush**	**G5**	**SH**		
***Eleocharis robbinsii* Oakes**	**Robbins' Spikerush**	**G4G5**	**S1**		
***Eleocharis tricostata* Torr.**	**Three-angled Spikerush**	**G4**	**S1**		
***Eleocharis uniglumis* (Link) Schultes** formerly listed as *Eleocharis halophila*	**One-scale Spikerush**	**G5**	**S1**		
***Eleocharis vivipara* Link**	**Viviparous Spikerush**	**G5**	**S1**		
***Eleocharis wolfii* (Gray) Gray ex Britt.**	**Wolf's Spikerush**	**G3G5**	**S1**		
Elymus canadensis* L. var. *canadensis	**Nodding Wild Rye**	**G5TNR**	**S1**		
Elymus trachycaulus* (Link) Gould ex Shinners ssp. *trachycaulus syn: *Agropyron trachycaulum* (Link) Malte ex H.F. Lewis	**Slender Wheatgrass**	**G5T5**	**S1**		
***Enemion biternatum* Raf.** syn: *Isopyrum biternatum* (Raf.) Torr. & Gray	**False Rue-anemone**	**G5**	**S1**		

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Epilobium ciliatum* Raf. ssp. *ciliatum	**American Willow-herb**	**G5T5**	**S1**		
***Epilobium leptophyllum* Raf.**	**Bog Willow-herb**	**G5**	**S2S3**		
***Equisetum fluviatile* L.**	**Water Horsetail**	**G5**	**S1**		
***Equisetum sylvaticum* L.**	**Woodland Horsetail**	**G5**	**S1**		
***Erigeron vernus* (L.) Torr. & Gray**	**White-top Fleabane**	**G5**	**S2**		
***Eriocaulon aquaticum* (Hill) Druce**	**Seven-angled Pipewort**	**G5**	**S1**		
Eriocaulon decangulare* L. var. *decangulare	**Ten-angled Pipewort**	**G5T5?**	**S2**		
***Eriocaulon parkeri* B.L. Robins.**	**Parker's Pipewort**	**G3**	**S2**		
***Eryngium integrifolium* Walt.**	**Blue-flower Eryngo**	**G5**	**S1**		
Eryngium yuccifolium* Michx. var. *yuccifolium	**Northern Rattlesnake-master**	**G5T5**	**S2**		
Erysimum capitatum* (Dougl. ex Hook.) Greene var. *capitatum	**Western Wallflower**	**G5T5**	**S2**		
All Virginia *E. capitatum* is var. *capitatum*					
***Erythronium albidum* Nutt.**	**White Trout Lily**	**G5**	**S2**		
***Eupatorium linearifolium* Walter**	**Narrow-leaf Bushy Thoroughwort**	**G5**	**SH**		
***Eupatorium maritimum* E.E. Schilling**	**A Eupatorium**	**G2?**	**S1**		
Newly named taxon, formerly lumped with *Eupatorium anomalum* Nash					
***Euphorbia bombensis* Jacquin**	**Southern Seaside Spurge**	**G4G5**	**S2**		
syn: *Chamaesyce bombensis* (Jacquin) Dugand					
***Euphorbia exserta* (Small) Coker**	**Maroon Sandhills Spurge**	**G4?**	**S1**		
***Euphorbia purpurea* (Raf.) Fern.**	**Glade Spurge**	**G3**	**S2**		
***Eurybia radula* (Ait.) Nesom**	**Low Rough Aster**	**G5**	**S1**		
syn: *Aster radula Ait.*					
***Eurybia surculosa* (Michx) Nesom**	**Creeping Aster**	**G4G5**	**S1S2**		
syn: *Aster surculosus Michx.*					
Eutrochium maculatum* (L.) E.E. Lamont var. *maculatum	**Spotted Joe-pye-weed**	**G5T5**	**S1**		
syn: *Eupatorium maculatum* L. var. *maculatum*					
***Filipendula rubra* (Hill) B.L. Robins.**	**Queen-of-the-Prairie**	**G4G5**	**S2**		
***Fimbristylis perpusilla* Harper *ex* Small & Britt.**	**Harper's Fimbry**	**G2**	**S1**		**LE**
Fimbristylis puberula* (Michx.) Vahl var. *puberula	**Hairy Fimbry**	**G5T5**	**S1**		
Under *F. spadicea* (L.) Vahl. in Radford et al. (1968)					
Under *F. caroliniana* (Lam.) Fern. in Fernald (1950)					
All Virginia *F. puberula* is var. *puberula*					
***Fleischmannia incarnata* (Walt.) King & H.E. Robins.**	**Pink Thoroughwort**	**G5**	**S2**		
syn: *Eupatorium incarnatum* Walter					

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***Fragaria vesca* L. var. *americana* (Porter) Staudt** All native *F. vesca* is var. *americana*	**Woodland Strawberry**	**G5T5**	**S1**		
***Fuirena breviseta* (Coville) Coville** Under *F. squarrosa* Michx. in Radford et al. (1968)	**Short-bristled Umbrella-sedge**	**G5**	**SH**		
***Gaylussacia brachycera* (Michx.) Gray**	**Box Huckleberry**	**G3**	**S1**		
***Gentiana autumnalis* L.**	**Pine Barren Gentian**	**G3**	**S1**		
***Gentianella quinquefolia* (L.) Small var. *occidentalis* Gray**	**Western Stiff Gentian**	**G5T4T5**	**S1**		
***Gentianopsis crinita* (Froel.) Ma**	**Greater Fringed Gentian**	**G5**	**S1**		
***Geum aleppicum* Jacq.**	**Yellow Avens**	**G5**	**SH**		
***Geum laciniatum* Murr.**	**Rough Avens**	**G5**	**S1**		
***Gillenia stipulata* (Muhl. ex Willd.) Nutt.** syn: *Porteranthus stipulatus* (Muhl. ex Willd.) Britt.	**American ipecac**	**G5**	**S1**		
Glyceria grandis* S. Wats. var. *grandis	**American Mannagrass**	**G5T5**	**S1**		
***Glyceria laxa* (Scribn.) Scribn.**	**Northern Mannagrass**	**G5**	**S1**		
***Gnaphalium uliginosum* L.**	**Low Cudweed**	**G5**	**S1**		
***Goodyera repens* (L.) R. Br. ex Ait. f.**	**Dwarf Rattlesnake-plantain**	**G5**	**S1**		
***Gratiola ramosa* Walt.**	**Branched Hedge-hyssop**	**G4G5**	**S1**		
***Harperella nodosa* Rose** syn: *Ptilimnium nodosum* (Rose) Mathias	**Harperella**	**G2**	**S1**	**LE**	**LE**
***Helenium brevifolium* (Nutt.) Wood**	**Short-leaf Sneezeweed**	**G4**	**S2**		
***Helenium virginicum* Blake**	**Virginia Sneezeweed**	**G3**	**S2**	**LT**	**LE**
Helianthus occidentalis* Riddell ssp. *occidentalis	**Western Sunflower**	**G5T5**	**S1**		
Heliotropium curassavicum* L. var. *curassivicum	**Seaside Heliotrope**	**G5T5**	**S1**		
***Helonias bullata* L.**	**Swamp-pink**	**G3**	**S2S3**	**LT**	**LE**
***Heteranthera multiflora* (Griseb.) Horn**	**Mud Plantain**	**G4**	**S1**		
***Heuchera alba* Rydb.**	**White Alumroot**	**G2Q**	**S1**		
***Heuchera caroliniana* (Rosendahl, Butters & Lakela) E. Wells**	**Carolina Alumroot**	**G3**	**S1**		
***Hexastylis contracta* Blomquist**	**Mountain Heartleaf**	**G3**	**S1**		
***Honckenya peploides* (L.) Ehrh. ssp. *robusta* (Fern.) Hulten** syn: *Honkenya peploides* (L.) Ehrh. syn: *Arenaria peploides* L. var. *robusta* Fern.	**Sea-beach Sandwort**	**G5T5**	**SH**		
Hordeum jubatum* L. ssp. *jubatum Only native Virginia occurrences are monitored	**Foxtail Barley**	**G5T5**	**S1**		

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***Houstonia canadensis* Willd. ex Roemer & J.A. Schultes** syn: *Hedyotis canadensis* (Willd. ex Roemer & J.A. Schultes) Fosberg	**Canada Bluets**	**G4G5**	**S2**		
***Houstonia montana* Small** syn: *Houstonia purpurea* L. var. *montana* (Small) Terrell	**Roan Mountain Bluet**	**G2**	**S1**	**LE**	
Houstonia nigricans* (Lam.) Fernald var. *nigricans syn: *Hedyotis nigricans* (Lam.) Fosberg	**Glade Bluets**	**G5T5**	**S1**		
***Huperzia appressa* (Desvaux) A. Löve & D. Löve** syn: *Huperzia appalachiana* Beitel & Mickel Includes apparent hybrids between *H. appressa* and *H. lucidula*	**Appalachian Fir Clubmoss**	**G5**	**S2**		
***Huperzia porophila* (Lloyd & Underwood) Holub** syn: *Lycopodium porophilum* Lloyd & Underwood	**Rock Clubmoss**	**G4**	**S1**		
***Hydrocotyle bonariensis* Comm. ex Lam.**	**Coastal Water-pennywort**	**G5**	**S2**		
***Hypericum adpressum* Raf. ex W. Bart.**	**Bog St. John's-wort**	**G3**	**S1**		
***Hypericum boreale* (Britt.) Bickn.**	**Northern St. John's-wort**	**G5**	**S2**		
***Hypericum densiflorum* Pursh var. *interior* (Small) Sorrie & Weakley**	**Interior Bushy St. John's-wort**	**G5TNR**	**S1**		
***Hypericum denticulatum* Walt.** Does not include *H. virgatum* (=*H. denticulatum var. acutifolium* Ell.)	**Coppery St. John's-wort**	**G5**	**S1**		
***Hypericum ellipticum* Hook.**	**Pale St. John's-wort**	**G5**	**S1**		
***Hypericum fraseri* Spach** syn: *Triadenum fraseri* (Spach) Gleason	**Fraser's Marsh St. John's-wort**	**G5**	**S2**		
***Hypericum lloydii* (Svenson) P. Adams**	**Sandhill St.-John's-wort**	**G4?**	**SH**		
***Hypericum setosum* L.**	**Hairy St. John's-wort**	**G4G5**	**S1S2**		
***Hypericum tubulosum* Walt.** syn: *Triadenum tubulosum* (Walt.) Gleason	**Lesser Marsh St. John's-wort**	**G4?**	**S2**		
***Hypoxis sessilis* L.** Includes *H. longii* Fern.	**Glossy-seed Yellow Stargrass**	**G4**	**SH**		
***Ilex collina* Alexander** syn: *Nemopanthus collinus* (Alexander) R. Clark	**Long-stalked Holly**	**G3**	**S1**		**LE**
***Ilex coriacea* (Pursh) Chapman**	**Big Gallberry**	**G5**	**S1**		
***Iliamna corei* Sherff**	**Peters Mountain Mallow**	**G1**	**S1**	**LE**	**LE**
***Iliamna remota* Greene**	**Kankakee Mallow**	**G1Q**	**S1**		

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***Isoetes appalachiana* Brunton & Britton**	**Appalachian Quillwort**	**G4**	**S1**		
***Isoetes hyemalis* Brunton**	**Winter Quillwort**	**G2G3**	**S2**		
***Isoetes lacustris* L.**	**Lake Quillwort**	**G5**	**SH**		
***Isoetes mattaponica* L.J. Musselman & W.C. Taylor**	**Mattaponi Quillwort**	**GNR**	**S2**		
***Isoetes melanopoda* Gay & Durieu *ex* Durieu**	**Black-footed Quillwort**	**G5**	**S1**		
***Isoetes piedmontana* (N.E. Pfeiffer) C.F. Reed**	**Piedmont Quillwort**	**G4**	**S1**		
***Isoetes virginica* N.E. Pfeiffer**	**Virginia Quillwort**	**G1**	**S1**		**LE**
***Isotria medeoloides* (Pursh) Raf.**	**Small Whorled Pogonia**	**G2?**	**S2**	**LT**	**LE**
***Iva imbricata* Walt.**	**Dune Marsh-elder**	**G5?**	**S1**		
***Juncus articulatus* L.**	**Jointed Rush**	**G5**	**S1**		
***Juncus balticus* Willd. var. *littoralis* Engelm.**	**Baltic Rush**	**G5T5**	**S1**		
***Juncus brachycephalus* (Engelm.) Buch.**	**Small-headed Rush**	**G5**	**S2**		
***Juncus brevicaudatus* (Engelm.) Fern.**	**Narrow-panicled Rush**	**G5**	**S2**		
***Juncus caesariensis* Coville**	**New Jersey Rush**	**G2G3**	**S2**		**LT**
***Juncus elliottii* Chapman**	**Bog Rush**	**G4G5**	**S1**		
***Juncus megacephalus* M.A. Curtis**	**Big-headed Rush**	**G4G5**	**S2**		
***Juncus nodosus* L.**	**Knotted Rush**	**G5**	**S1**		
***Juncus pelocarpus* E. Mey.**	**Brown-fruited Rush**	**G5**	**S2**		
***Juncus torreyi* Coville**	**Torrey's Rush**	**G5**	**S1**		
***Juncus trifidus* L.**	**Highland Rush**	**G5**	**S1**		
***Juniperus communis* L. var. *depressa* Pursh** Some Virginia populations may in fact be the European *J. communis* var. *communis*. They are under study	**Ground Juniper**	**G5T5**	**S1**		
***Kalmia angustifolia* L.**	**Sheep Laurel**	**G5**	**S2**		
***Kalmia carolina* Small** syn: *Kalmia anugustifolia* L. var. *caroliniana* (Small) Fernald	**Carolina Laurel**	**G4**	**S2**		
***Lachnanthes caroliniana* (Lam.) Dandy**	**Redroot**	**G4**	**SH**		
***Lachnocaulon anceps* (Walt.) Morong**	**Common Bog-buttons**	**G5**	**S1**		
***Lathyrus palustris* L.**	**Marsh Pea**	**G5**	**S1**		
Lechea intermedia* Leggett ex Britt. var. *intermedia	**Round-fruit Pinweed**	**G5T4T5**	**SH**		
***Leersia hexandra* Sw.**	**Southern Cutgrass**	**G5**	**SH**		
***Lemna trisulca* L.**	**Star Duckweed**	**G5**	**S1**		
***Leucospora multifida*(Michx.) Nutt.**	**Narrow-leaf Paleseed**	**G5**	**S1**		
***Leucothoe fontanesiana* (Steud.) Sleumer** syn: *L. axillaris* (Lam.) D. Don var. *editorum* (Fern. & Shub.) Ahles	**Highland Dog-hobble**	**G5**	**S1S2**		
***Lilaeopsis carolinensis* Coult. & Rose**	**Carolina Lilaeopsis**	**G3G5**	**S1**		
***Lilium catesbaei* Walt.**	**Pine Lily**	**G4**	**S1**		
***Lilium grayi* S. Wats.** Includes low-elevation (< 1200 m.) occurrences, which are likely intergrades between *L. grayi* and *L. canadense*	**Gray's Lily**	**G3**	**S2**		

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***Lilium pyrophilum* M.W. Skinner & Sorrie**	**Sandhills Bog Lily**	**G2**	**S1**		
***Limosella australis* R. Br.** syn: *L. subulata* Ives	**Mudwort**	**G4G5**	**SH**		
***Liparis loeselii* (L.) L.C. Rich.**	**Bog Twayblade**	**G5**	**S2**		
***Lipocarpha maculata* (Michx.) Torr.**	**American Halfchaff Sedge**	**G5**	**S1**		
***Lipocarpha micrantha* (Vahl) G. Tucker** syn: *Hemicarpha micrantha* (Vahl) Pax	**Small-flower Halfchaff Sedge**	**G5**	**S2**		
***Lithospermum caroliniense* (Walt. ex J.F. Gmel.) MacM.**	**Golden Puccoon**	**G4G5**	**S1**		
***Lithospermum virginianum* L.** syn: *Onosmodium virginianum* (L.) DC.	**Virginia False Gromwell**	**G4**	**S2**		
***Litsea aestivalis* (L.) Fern.**	**Pondspice**	**G3?**	**S1**		
***Lobelia elongata* Small**	**Long-leaf Lobelia**	**G4G5**	**S1**		
***Ludwigia alata* Ell.**	**Winged Seedbox**	**G3G5**	**S1**		
***Ludwigia brevipes* (B.H. Long ex Britt., A. Braun & Small) Eames**	**Long Beach Seedbox**	**G2G3**	**S2**		
***Ludwigia hirtella* Raf.**	**Rafinesque's Seedbox**	**G5**	**S2**		
***Ludwigia pilosa* Walt.**	**Hairy Seedbox**	**G5**	**S1**		
***Ludwigia ravenii* Peng**	**Raven's Seedbox**	**G1G2**	**S1**		
***Ludwigia virgata* Michx.**	**Savanna Seedbox**	**G5**	**SH**		
***Lycopodiella inundata* (L.) Holub** syn: *Lycopodium inundatum* L.	**Northern Bog Clubmoss**	**G5**	**S1**		
***Lysimachia hybrida* Michx.**	**Lowland Loosestrife**	**G5**	**S2**		
***Lysimachia quadriflora* Sims**	**Prairie Loosestrife**	**G5?**	**S1**		
***Lysimachia radicans* Hook.**	**Trailing Loosestrife**	**G4G5**	**SH**		
***Lythrum alatum* Pursh**	**Winged Loosestrife**	**G5**	**S2**		
***Lythrum lanceolatum* Ell.** syn: *Lythrum alatum* Pursh var. *lanceolatum* (Ell.) Torr. & Gray ex Rothrock	**Lance-leaf Loosestrife**	**G5**	**SH**		
***Magnolia macrophylla* Michx.**	**Bigleaf Magnolia**	**G5**	**S1**		
***Maianthemum stellatum* (L.) Link**	**Starry Solomon's-plume**	**G5**	**S1S2**		
***Malvastrum angustum* A. Gray** *syn: Malvastrum hispidum* (Pursh) Hochreutiner	**Hispid False Mallow**	**G3G5**	**S1**		
***Manfreda virginica* (L.) Salisb. ex Rose** syn: *Agave virginica* L.	**Rattlesnake-master**	**G5**	**S2**		
***Marshallia legrandii* Weakley**	**Tall Barbara's-buttons**	**G1**	**S1**		
Marshallia obovata* (Walt.) Beadle & F.E. Boynt. var. *obovata	**Piedmont Barbara's-buttons**	**G4G5T3T5**	**S1**		
***Matelea decipiens* (Alexander) Woods.**	**Old-field Milkvine**	**G5**	**S1**		
***Matteuccia struthiopteris* (L.) Todaro var. *pensylvanica* (Willd.) C.V. Morton**	**Ostrich Fern**	**G5T5**	**S1**		
***Melica nitens* (Scribn.) Nutt. ex Piper**	**Three-flower Melic**	**G5**	**S1**		

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***Menyanthes trifoliata* L.**	**Buckbean**	**G5**	**S1**		
***Micranthemum micranthemoides* (Nutt.) Wettst.**	**Nuttall's Micranthemum**	**GH**	**SH**		
***Micranthemum umbrosum* (J.F. Gmel.) Blake**	**Shade Mudflower**	**G5**	**S2**		
***Micranthes careyana* (A. Gray) Small** syn: *Saxifraga careyana* Gray	**Carey's Saxifrage**	**G3**	**S1**		
***Mimosa microphylla* Dryander** syn: *Schrankia microphylla* (Dry.) J.F. MacBr.	**Little-leaf Sensitive-brier**	**G5**	**S1**		
***Mimulus moschatus* Dougl. ex Lindl.**	**Muskflower**	**G5**	**SH**		
***Minuartia caroliniana* (Walt.) Mattf.**	**Carolina Sandwort**	**G5**	**SH**		
***Minuartia groenlandica* (Retz.) Ostenf.**	**Mountain Sandwort**	**G5**	**S1**		
***Mitreola petiolata* (J.F. Gmel.) Torr. & Gray** syn: *Cynoctonum mitreola* (L.) Britt.	**Lax Hornpod**	**G5**	**S1**		
***Mitreola sessilifolia* (J.F. Gmel) G. Don** syn: *Cynoctonum sessilifolium* J.F. Gmel.	**Swamp Hornpod**	**G4G5**	**S1**		
***Moehringia lateriflora* (L.) Fenzl** syn: *Arenaria lateriflora* L.	**Grove Sandwort**	**G5**	**S1**		
***Monarda fistulosa* L. var. *brevis* Fosberg & Artz**	**Smoke Hole Bergamot**	**G5T1T2**	**SH**		
***Morella pumila* (Michx.) Small**	**Dwarf Wax Myrtle**	**G5**	**S1**		
***Muhlenbergia bushii* Pohl** Includes *M. brachyphylla* Bush	**Bush's Muhly**	**G5**	**S1**		
***Muhlenbergia cuspidata* (Torr. ex Hook.) Rydb.**	**Plains Muhly**	**G5**	**S2**		
***Muhlenbergia expansa* (Poir.) Trin.** *syn: M. capillaris* (Lam.) Trin. var. *trichopodes* (Ell.) Vasey	**Cut-over Muhly**	**G5**	**SH**		
***Muhlenbergia glabriflora* Scribn.**	**Inland Muhly**	**G4?**	**SH**		
***Muhlenbergia glomerata* (Willd.) Trin.**	**Marsh Muhly**	**G5**	**S2**		
***Myriophyllum humile* (Raf.) Morong**	**Low Water-milfoil**	**G5**	**S1**		
***Myriophyllum laxum* Shuttlw. ex Chapm.**	**Loose Water-milfoil**	**G3**	**SH**		
***Nabalus autumnalis* (Walt.) Weakley** syn: *Prenanthes autumnalis* Walt.	**Slender Rattlesnake-root**	**G4G5**	**S1**		
***Napaea dioica* L.**	**Glade Mallow**	**G4**	**SH**		
***Nestronia umbellula* Raf.**	**Nestronia**	**G4**	**S1**		
***Nuphar sagittifolia* (Walt.) Pursh** syn: *Nuphar lutea* (L.) Sm. ssp. *sagittifolia* (Walt.) E.O. Beal	**Narrow-leaved Spatterdock**	**G2**	**S1**		**LT**
***Nymphoides aquatica* (J.F. Gmel.) Kuntze**	**Big Floating Heart**	**G5**	**S1**		
***Oenothera riparia* Nuttall** syn: *O. tetragona* Roth ssp. *glauca* (Michaux) Munz var. *riparia* (Nuttall) Munz included in *O. fruticosa* L. by Radford et al. (1968)	**Riverbank Evening-primrose**	**G2G3**	**S1S2**		

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***Oldenlandia boscii* (DC.) Chapman** syn: *Hedyotis boscii* DC.	**Bosc's Bluets**	**G5**	**S1**		
***Ophioglossum petiolatum* Hook.**	**Long-stem Adder's-tongue**	**G5**	**S1**		
***Ophioglossum pusillum* Raf.** syn: *O. vulgatum* L. var. *pseudopodium* (Blake) Farw.	**Northern Adder's-tongue**	**G5**	**SH**		
***Orbexilum onobrychis* (Nutt.) Rydb.** syn: *Psoralea onobrychis* Nutt.	**Lance-leaf Scurfpea**	**G5**	**SH**		
***Orthilia secunda* (L.) House** syn: *Pyrola secunda* L.	**One-sided Shinleaf**	**G5**	**SH**		
***Oryzopsis asperifolia* Michx.**	**Rough-leaved Ricegrass**	**G5**	**S1**		
***Osmanthus americanus* (L.) Benth. & Hook f. ex Gray**	**Wild Olive**	**G5**	**S1**		
***Osmundastrum cinnamomeum* (L.) C. Presl var. *glandulosum* (Waters) McAvoy**	**Glandular Cinnamon Fern**	**G5TNR**	**S1**		
***Oxypolis ternata* (Nutt.) A. Heller**	**Savanna Cowbane**	**G3**	**SH**		
***Packera millefolium* (Torr. & Gray) Weber & Löve**	**Yarrow-leaved Ragwort**	**G3**	**S2**		
***Panicum hemitomon* J.A. Schultes**	**Maidencane**	**G5?**	**S2**		
***Parathelypteris simulata* (Davenport) Holttum** syn: *Thelypteris simulata* (Davenport) Nieuwland	**Bog Fern**	**G4G5**	**S1S2**		
***Parnassia grandifolia* DC.**	**Large-leaved Grass-of-Parnassus**	**G3**	**S2**		
Paronychia virginica* Spreng. var. *virginica	**Yellow Nailwort**	**G4T1Q**	**S1**		
***Paspalum bifidum* (Bertol.) Nash**	**Pitchfork Paspalum**	**G5**	**SH**		
***Paspalum dissectum* (L.) L.**	**Walter's Paspalum**	**G4?**	**S2**		
***Paspalum distichum* L.**	**Joint Paspalum**	**G5**	**S1**		
***Paspalum praecox* Walt.**	**Early Paspalum**	**G4**	**S1**		
***Paxistima canbyi* Gray** syn: *Pachistima canbyi*	**Canby's Mountain-lover**	**G2**	**S2**		
***Pediomelum canescens* (Michx.) Rydb.** syn: *Psoralea canescens* Michx.	**Buckroot**	**G3G4**	**S1**		
***Penstemon australis* Small**	**Southern Beard-tongue**	**G5**	**S1?**		
***Penstemon calycosus* Small**	**Calico Beard-tongue**	**G5**	**SH**		
***Phacelia covillei* S. Watson ex A. Gray**	**Coville's Phacelia**	**G3**	**S1**		
***Phacelia fimbriata* Michx.**	**Fringed Phacelia**	**G4**	**S2**		
***Phalaris caroliniana* Walt.**	**Carolina Canary Grass**	**G5?**	**SH**		
***Phanopyrum gymnocarpon* (Ell.) Nash** syn: *Panicum gymnocarpum* Ell.	**Savanna Panic Grass**	**G5**	**S1**		
***Phemeranthus piedmontanus* S. Ware**	**Piedmont Fameflower**	**G1**	**S1**		
***Phlox amplifolia* Britt.**	**Large-leaf Phlox**	**G3G5**	**S1**		
***Phlox buckleyi* Wherry**	**Sword-leaf Phlox**	**G2**	**S2**		

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***Phlox pilosa* L.**	**Downy Phlox**	**G5**	**S1**		
***Phyla nodiflora* (L.) Greene** syn: *Lippia nodiflora* (L.) Michx.	**Sawtooth Frogfruit**	**G5**	**S1**		
***Pinus palustris* P. Mill.**	**Longleaf Pine**	**G5**	**S1**		
***Pityopsis graminifolia* (Michx.) Nutt. var. *tenuifolia* (Torr.) Semple & Bowers**	**Narrowleaf Silk-Grass**	**G5T5?**	**S1**		
***Plantago cordata* Lam.**	**King-root**	**G4**	**SH**		
***Plantago maritima* L. var. *juncoides* (Lam.) Gray**	**Seaside Plantain**	**G5T5**	**S1**		
***Platanthera blephariglottis* (Willd.) Lindl.** Conflicting opinions on whether Virginia material is var. *blephariglottis* or var. *conspicua*	**Small White Fringed Orchid**	**G4G5**	**S2**		
***Platanthera grandiflora* (Bigelow) Lindl.**	**Large Purple Fringed Orchid**	**G5**	**S2**		
***Platanthera leucophaea* (Nutt.) Lindl.**	**Prairie Fringed Orchid**	**G2G3**	**SH**	**LT**	**LT**
***Platanthera peramoena* (Gray) Gray**	**Purple Fringeless Orchid**	**G5**	**S1**		
***Platanthera shriveri* P.M. Brown**	**Shriver's Frilly Orchid**	**G1**	**S1**		
***Poa languida* Hitchcock**	**Drooping Bluegrass**	**G3G4Q**	**S1**		
***Poa paludigena* Fern. & Wieg.**	**Bog Bluegrass**	**G3**	**S2**		
***Poa palustris* L.**	**Fowl Bluegrass**	**G5**	**S1S2**		
***Poa saltuensis* Fern. & Wieg.**	**Weak Bluegrass**	**G5**	**S2**		
Polanisia dodecandra* (L.) DC. var. *dodecandra	**Common Clammy-weed**	**G5T5?**	**S2**		
***Polygala ramosa* Ell.**	**Low Pine Barren Milkwort**	**G5**	**SH**		
Polygonella polygama* (Vent.) Engelm. & Gray var. *polygama	**October-flower**	**G4TNR**	**S1**		
***Polygonum glaucum* Nutt.**	**Sea-beach Knotweed**	**G3**	**S2**		
***Populus tremuloides* Michx.**	**Quaking Aspen**	**G5**	**S1**		
***Portulaca smallii* P. Wilson**	**Small's Purslane**	**G3**	**S1**		
***Potamogeton amplifolius* Tuckerman**	**Bigleaf Pondweed**	**G5**	**S1**		
***Potamogeton bicupulatus* Fern.**	**Snailseed Pondweed**	**G4**	**S1**		
***Potamogeton friesii* Rupr.**	**Fries' Pondweed**	**G5**	**SH**		
***Potamogeton hillii* Morong**	**Hill's Pondweed**	**G3**	**S1**		
***Potamogeton oakesianus* J.W. Robbins**	**Oakes' Pondweed**	**G5**	**S1**		
***Potamogeton robbinsii* Oakes**	**Flatleaf Pondweed**	**G5**	**SH**		
***Potamogeton spirillus* Tuckerman**	**Spiral Pondweed**	**G5**	**SH**		
***Potamogeton strictifolius* Benn.**	**Straightleaf Pondweed**	**G5**	**SH**		
***Potamogeton tennesseensis* Fern.**	**Tennessee Pondweed**	**G2G3**	**S1**		
***Potamogeton zosteriformis* Fern.**	**Flatstem Pondweed**	**G5**	**S1**		
***Prunus maritima* Marshall**	**Beach Plum**	**G4**	**S1?**		
***Prunus nigra* Ait.**	**Canada Plum**	**G4G5**	**S1?**		

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***Prunus susquehanae* Hort. ex Willd.**	**Susquehanna Sand Cherry**	**G4**	**S1**		
syn: *Prunus pumila* L. var. *susquehanae* (Hort. ex Willd.) Jaeger					
***Pseudognaphalium helleri* (Britt.) A. Anderb.**	**Heller's Cudweed**	**G3G4**	**S1**		
***Pseudognaphalium macounii* (Greene) Kartesz**	**Clammy Everlasting**	**G5**	**S1**		
syn: *Gnaphalium viscosum* Kunth					
***Pseudognaphalium micradenium* (Weatherby) Nesom**	**Small Rabbit Tobacco**	**G3?**	**S1**		
***Pseudolycopodiella caroliniana* (L.) Holub**	**Carolina Bog Clubmoss**	**G4**	**SH**		
syn: *Lydopodium carolinianum* L.					
syn: *Lycopodiella caroliniana* (L.) Pichi Sermolli					
***Puccinellia fasciculata* (Torr.) Bickn.**	**Eastern Alkali Grass**	**G3G5**	**SH**		
***Pycnanthemum clinopodioides* Torr. & Gray**	**Basil Mountain-mint**	**G1G2**	**S1**		
***Pycnanthemum setosum* Nutt.**	**Awned Mountain-mint**	**G4**	**S1**		
***Pycnanthemum torreyi* Benth.**	**Torrey's Mountain-mint**	**G2**	**S2**		
***Pyrola chlorantha* Sw.**	**Green Pyrola**	**G5**	**SH**		
syn: *P. virens* Schreb.					
***Pyrola elliptica* Nutt.**	**Shinleaf**	**G5**	**S1**		
Pyxidanthera barbulata* Michx. var. *barbulata	**Common Pyxie-moss**	**G4TNR**	**S1**		
***Quercus hemisphaerica* Bartr. ex Willd.**	**Sand Laurel Oak**	**G5**	**S1**		
Under *Q. laurifolia* Michx. in Radford et al. (1968)					
***Quercus incana* Bartr.**	**Bluejack Oak**	**G5**	**S2**		
***Quercus macrocarpa* Michx.**	**Bur Oak**	**G5**	**S1**		
***Quercus prinoides* Willd.**	**Dwarf Chinquapin Oak**	**G5**	**S1**		
***Ranunculus ambigens* S. Wats.**	**Water-plantain Crowfoot**	**G4**	**S1**		
***Ranunculus flabellaris* Raf.**	**Yellow Water Crowfoot**	**G5**	**S2**		
***Ranunculus hederaceus* L.**	**Ivy-leaved Water Crowfoot**	**G5**	**SH**		
***Ranunculus laxicaulis* (Torr. & Gray) Darby**	**Mississippi Buttercup**	**G5?**	**SH**		
***Ranunculus longirostris* Godr.**	**Long-beaked Buttercup**	**G5**	**SH**		
syn: *Ranunculus aquatalis* L. var. *diffusus* Withering					
***Rhamnus alnifolia* L'Her.**	**Alder-leaved Buckthorn**	**G5**	**S1**		
***Rhamnus lanceolata* Pursh var. *glabrata* Gleason**	**Western Lance-leaf Buckthorn**	**G5T4T5**	**S1**		
***Rhexia petiolata* Walt.**	**Fringed Meadow Beauty**	**G5?**	**S1**		
***Rhododendron arborescens* (Pursh) Torr.**	**Sweet Azalea**	**G4G5**	**S2**		
***Rhus michauxii* Sarg.**	**Michaux's Sumac**	**G2G3**	**S1**	**LE**	**LT**

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***Rhynchospora alba* (L.) Vahl**	**Northern White Beaksedge**	**G5**	**S2**		
***Rhynchospora capillacea* Torr.**	**Needle Beaksedge**	**G4**	**S1**		
***Rhynchospora cephalantha* Gray var. *attenuata* Gale**	**Small Bunched Beaksedge**	**G5T3?**	**S1**		
***Rhynchospora colorata* (L.) H. Pfieffer**	**Narrow-leaf Whitetop Sedge**	**G5**	**S1**		
syn: *Dichromena colorata* (L.) Hitchc.					
***Rhynchospora debilis* Gale**	**Savanna Beaksedge**	**G4?**	**S1**		
***Rhynchospora distans* (Michx.) Chapm.**	**Fasciculate Beaksedge**	**G4?**	**S1**		
***Rhynchospora fascicularis* (Michx.) Vahl**	**Fasciculate Beaksedge**	**G3G5**	**S2**		
***Rhynchospora filifolia* Gray**	**Thread-leaved Beaksedge**	**G5**	**SH**		
***Rhynchospora grayi* Kunth**	**Gray's Beaksedge**	**G4**	**SH**		
***Rhynchospora harveyi* W. Boott**	**Harvey's Beaksedge**	**G4**	**S1**		
***Rhynchospora miliacea* (Lam.) Gray**	**Millet Beaksedge**	**G5**	**SH**		
***Rhynchospora nitens* (Vahl) Gray**	**Short-beaked Beaksedge**	**G4?**	**SH**		
syn: *Psilocarya nitens* (Vahl) Wood					
***Rhynchospora oligantha* Gray**	**Feather-bristled Beaksedge**	**G4**	**S1**		
***Rhynchospora pallida* M.A. Curtis**	**Pale Beaksedge**	**G3**	**SX**		
***Rhynchospora scirpoides* (Torr.) Gray**	**Long-beaked Beaksedge**	**G4**	**S1**		
syn: *Psilocarya scirpoides* Torr.					
***Rhynchospora stenophylla* Chapman**	**Coastal Bog Beaksedge**	**G4**	**S1**		
***Rhynchospora wrightiana* Boeckl.**	**Wright's Beaksedge**	**G5**	**S1**		
***Ribes americanum* P. Mill.**	**Wild Black Currant**	**G5**	**S1**		
***Rorippa aquatica* (Eat.) E.J. Palmer & Steyermark**	**Lake Cress**	**G4?**	**SH**		
syn: *Neobeckia aquatica* (Eaton) Greene					
***Rorippa sessiliflora* (Nutt.) A.S. Hitchc.**	**Stalkless Yellow Cress**	**G5**	**S2**		
***Rosa setigera* Michx.**	**Climbing Prairie Rose**	**G5**	**S1**		
***Rosa virginiana* Miller**	**Virginia Rose**	**G5**	**SH**		
***Rubus dalibarda* L.**	**Dewdrop**	**G5**	**S1**		
syn: *Dalibarda repens* L.					
***Rubus idaeus* L. var. *strigosus* (Michx.) Focke**	**Red Raspberry**	**G5T5**	**S2**		
***Rudbeckia heliopsidis* Torr. & Gray**	**Sun-facing Coneflower**	**G2**	**S1**		
***Rudbeckia laciniata* L. var. *bipinnata* Perdue**	**Northeastern cutleaf coneflower**	**G5TNR**	**S1**		
***Rudbeckia triloba* L. var. *beadlei* (Small) Fern.**	**Pinnate-lobed Coneflower**	**G5T3**	**S1**		
syn: *Rudbeckia triloba* L. var. *pinnatiloba*					

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***Sabatia campanulata* (L.) Torr.**	**Slender Marsh-pink**	**G5**	**S2**		
***Sabatia difformis* (L.) Druce**	**Lance-leaved Rose-gentian**	**G4G5**	**S1**		
***Saccharum coarctatum* (Fern.) R. Webster** syn: *Erianthus coarctatus* Fern. syn: *Erianthus coarctatus* var. *elliottianus* Fern.	**Compressed Plumegrass**	**G5?**	**S1**		
***Sagittaria brevirostra* Mackenzie & Bush**	**Short-beak arrowhead**	**G5**	**SH**		
***Sagittaria calycina* Engelm.**	**Long-lobe Arrowhead**	**G5**	**S1**		
***Sagittaria engelmanniana* J.G. Sm.**	**Engelmann's Arrowhead**	**G5?**	**SH**		
***Sagittaria rigida* Pursh**	**Sessile-fruited Arrowhead**	**G5**	**S1**		
***Sagittaria spatulata* (J.G. Smith) Buchenau** syn: *Sagittaria calycina* Engelm. var. *spongiosa* Engelm.	**Tidal Arrowhead**	**G4**	**S1**		
***Salix discolor* Muhl.**	**Pussy Willow**	**G5**	**S1**		
***Salix exigua* Nutt. var. *sericans* (Nees) Nesom**	**Sandbar Willow**	**G5TNR**	**S1**		
***Sanguisorba canadensis* L.**	**Canada Burnet**	**G5**	**S2**		
***Sarracenia flava* L.**	**Yellow Pitcher Plant**	**G5?**	**S1**		
***Sarracenia purpurea* L.**	**Purple Pitcher Plant**	**G5**	**S2**		
***Sceptridium jenmanii* Underwood (Lyon)** syn: *Botrychium jenmanii* Underwood	**Alabama Grape Fern**	**G3G4**	**SH**		
***Sceptridium multifidum* (S.G. Gmelin) M. Nishida** syn: *Botrychium multifidum* (Gmel.) Trev.	**Leathery Grape Fern**	**G5**	**S1**		
***Sceptridium oneidense* (Gilbert) Holub** syn: *Botrychium oneidense* (Gilbert) House	**Blunt-lobe Grape Fern**	**G4**	**S1**		
***Schizachne purpurascens* (Torr.) Swallen**	**Purple Oatgrass**	**G5**	**S1**		
Schoenoplectus acutus* (Muhl. *ex* Bigelow) Love & Love var. *acutus	**Hard-stem Bulrush**	**G5T5**	**S1**		
***Schoenoplectus etuberculatus* (Steud.) Sojak**	**Swamp Bulrush**	**G3G4**	**SH**		
***Schoenoplectus smithii* (Gray) Sojak**	**Smith's Bulrush**	**G5?**	**SH**		
***Schoenoplectus subterminalis* (Torr.) Sojak**	**Water Bulrush**	**G5**	**S1**		
***Schoenoplectus torreyi* (Olney) Palla**	**Torrey's Bulrush**	**G5?**	**S1**		
***Schwalbea americana* L.**	**Chaffseed**	**G2G3**	**SH**	**LE**	
***Scirpus ancistrochaetus* Schuyler**	**Northeastern Bulrush**	**G3**	**S2**	**LE**	**LE**
***Scirpus flaccidifolius* (Fern.) Schuyler**	**Reclining Bulrush**	**G2**	**S1S2**		**LT**
Scleria ciliata* Michx. var. *ciliata	**Hairy Nutrush**	**G5TNR**	**S1**		
***Scleria minor* W. Stone**	**Slender Nutrush**	**G4**	**S2**		
***Scleria verticillata* Muhl. ex Willd.**	**Whorled Nutrush**	**G5**	**S2**		
***Sclerolepis uniflora* (Walt.) B.S.P.**	**One-flowered Sclerolepis**	**G4**	**S1**		
***Scutellaria galericulata* L.** syn: *S. epilobiifolia* A. Hamilton	**Hooded Skullcap**	**G5**	**S1**		
***Scutellaria incana* Biehler**	**Hoary Skullcap**	**G5**	**S2**		
***Scutellaria parvula* Michx.**	**Dwarf Skullcap**	**G4**	**S1**		
***Sedum pulchellum* Michx.**	**Widow's-cross**	**G5**	**S1**		

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***Senecio suaveolens* (L.) Elliott** syn: *Hasteola suaveolens* (L.) Pojark.	**Sweet-scented Indian-plantain**	**G4**	**S2**		
***Seymeria cassioides* (J.F. Gmel.) Blake**	**Senna Seymeria**	**G5**	**S1S2**		
***Sibbaldia tridentata* (Ait.) Paule & Soják** syn: *Potentilla tridentata* Ait.	**Three-toothed Cinquefoil**	**G5**	**S2**		
Sida elliottii* Torr. & Gray var. *elliottii Virginia material is referrable to *Sida inflexa* Fern., but treated here as an anomalous form of *S. elliottii* var. *elloittii*.	**Elliott's Sida**	**G4G5TNR**	**S1**		
***Sida hermaphrodita* (L.) Rusby**	**Virginia Sida**	**G3**	**S1**		
***Silene nivea* (Nutt.) Muhl. ex Otth**	**Snowy Campion**	**G4?**	**S1**		
***Silene ovata* Pursh**	**Mountain Catchfly**	**G3**	**S1**		
***Silene rotundifolia* Nutt.**	**Round-leaf Catchfly**	**G4**	**S2**		
***Silphium terebinthinaceum* Jacq.**	**Prairie Rosin Weed**	**G4G5**	**S1**		
***Sisyrinchium albidum* Raf.**	**White Blue-eyed-grass**	**G5?**	**S2**		
***Smilax ecirrata* (Engelm. ex Kunth) S. Wats.** also spelled *ecirrhata*	**Upright Carrion-flower**	**G5**	**S1**		
***Solidago latissimifolia* P. Mill.** syn: *S. elliottii* Torr. & Gray	**Elliott's Goldenrod**	**G5**	**S2**		
***Solidago racemosa* Greene** syn: *S. simplex* Kunth ssp. *randii* (Porter) Ringius var. *racemosa* (Greene) Ringius syn: *S. simplex* Kunth var. *racemosa* (Greene) Ringius	**Sticky Goldenrod**	**G3?**	**S1**		
***Solidago randii* (Porter) Britt.** syn: *S. simplex* Kunth ssp. *randii* (Porter) Ringius var. *randii* syn: *S. simplex* Kunth var. *randii* (Porter) Ringius	**Rand's Goldenrod**	**G4**	**S2**		
***Solidago rigida* L. var. *glabrata* E.L. Braun** syn: *Oligoneuron rigidum* (L.) var. *glabratum* (E.L. Braun) Nesom	**Southeastern Stiff Goldenrod**	**G5T4**	**S1**		
Solidago rigida* L. var. *rigida syn: *Oligoneuron rigidum* (L.) Small var. *rigidum*	**Stiff Goldenrod**	**G5T5**	**S2**		
***Solidago rupestris* Raf.** Under *S. altissima* L. in Radford et al. (1968)	**Riverbank Goldenrod**	**G4?**	**S1**		
***Solidago salicina* Ell.** syn: *Solidago patula* Muhl. ex Willd. var. *strictula* Torr. & Gray	**Southern Rough-leaved Goldenrod**	**G5**	**SH**		
***Solidago stricta* Ait.** Includes *S. gracillima* Torr. & Gray, S. *perlonga* Fern.	**Southern Bog Goldenrod**	**G4?**	**S1**		

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***Solidago tortifolia* Ell.**	**Twisted-leaf Goldenrod**	**G4G5**	**S1**		
Solidago uliginosa* Nutt. var. *uliginosa All Virginia *S. uliginosa* is var. *uliginosa*	**Bog Goldenrod**	**G4G5T4T5**	**S2**		
***Sparganium emersum* Rehmann**	**Narrow-leaf Bur-reed**	**G5**	**S1**		
***Spartina pectinata* Link**	**Freshwater Cordgrass**	**G5**	**S2**		
***Spermacoce glabra* Michx.**	**Smooth False Buttonweed**	**G4G5**	**S1**		
***Spermolepis divaricata* (Walt.) Raf. ex Ser.**	**Rough-fruit Scale-seed**	**G5**	**S1?**		
***Sphenopholis filiformis* (Chapman) Scribn.**	**Long-leaf Wedgegrass**	**G4?**	**SH**		
***Spiraea virginiana* Britt.**	**Virginia Spiraea**	**G2**	**S1**	**LT**	**LE**
***Spiranthes eatonii* Ames ex P.M. Brown**	**Eaton's Ladies'-tresses**	**G2G4**	**S1**		
***Spiranthes lucida* (H.H. Eat.) Ames**	**Shining Ladies'-tresses**	**G5**	**S1S2**		
***Spiranthes magnicamporum* Sheviak**	**Great Plains Ladies'-tresses**	**G4**	**S1**		
***Spiranthes ochroleuca* (Rydb.) Rydb.**	**Yellow Nodding Ladies'-tresses**	**G4**	**S2**		
Sporobolus compositus* (Poir.) Merr. var. *compositus syn: *S. asper* (Beauv.) Kunth, All Virginia *S. compositus* is var. *compositus*	**Tall Dropseed**	**G5T5**	**S2**		
***Sporobolus heterolepis* (Gray) Gray**	**Prairie Dropseed**	**G5**	**S1**		
***Sporobolus junceus* (Beauv.) Kunth**	**Purple Dropseed**	**G5**	**S1**		
***Sporobolus neglectus* Nash**	**Small Dropseed**	**G5**	**S1**		
***Sporobolus ozarkanus* Fernald**	**Ozark Dropseed**	**G5?**	**S1**		
***Stachys appalachiana* D.B. Poindexter & J.B. Nelson**	**Appalachian Hedge-Nettle**	**GNR**	**S1**		
***Stachys arenicola* Britt.** Given as *S. palustris* L. in Harvill et al. (1992)	**Hairy Hedge-nettle**	**G4?**	**S1**		
***Stachys aspera* Michx.** syn: *S. hyssopifolia* Michx. var. *ambigua* Gray	**Rough Hedge-nettle**	**G4?**	**S2**		
***Stachys eplingii* J. Nelson**	**Epling's Hedge-nettle**	**G5**	**S1**		
***Stachys matthewsii* G.P. Fleming, J.B. Nelson, & J.F. Townsend**	**Yadkin Hedge-nettle**	**G1G2**	**S1**		
***Steinchisma hians* (Ell.) Nash** syn: *Panicum hians* Ell.	**Gaping Panic Grass**	**G5**	**S1**		
Stellaria alsine Grimm	**Bog Chickweed**	**G5**	**S1**		
***Stenanthium densum* (Desr.) Zomlefer & Judd**	**Dense-flowered Camas**	**G5**	**S1**		
***Stenanthium leimanthoides* (A. Gray) Zomlefer & Judd**	**Pinebarrens Death-camas**	**G4Q**	**S1**		
***Stewartia ovata* (Cav.) Weatherby**	**Mountain Camellia**	**G4**	**S2**		

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Stillingia sylvatica* Garden ex L. ssp. *sylvatica	**Queen's-delight**	**G5T5**	**S1**		
Stipulicida setacea* Michx. var. *setacea	**Pineland Scalypink**	**G4G5T4T5**	**S1**		
***Streptopus amplexifolius* (L.) DC.**	**White Mandarin**	**G5**	**S1**		
***Stylophorum diphyllum* (Michx.) Nutt.**	**Celandine Poppy**	**G5**	**S2**		
***Sullivantia sullivantii* (Torr. & Gray) Britt.**	**Sullivantia**	**G4**	**S1**		
Symphoricarpos albus* (L.) Blake var. *albus	**Common Snowberry**	**G5T5**	**S1**		
All native Virginia *S. albus* is var. *albus*, non-native material is *S. albus* var. *laevigatus* (Fern.) Blake					
***Symphyotrichum elliottii* (Torr. & Gray) Nesom**	**Elliott's Aster**	**G4**	**S1**		
syn: *Aster puniceus* L. var. *elliottii* (Torr. & Gray) A.G. Jones					
syn: *A. elliottii* Torr. & Gray					
***Symphyotrichum praealtum* (Poiret) Nesom var. *angustior* (Wiegand) Nesom**	**Willow-leaf Aster**	**G5T4**	**S1**		
syn: *Aster praealtus* Poir. var. *angustior* Wieg.					
***Symphyotrichum pratense* (Raf.) Nesom**	**Western Silvery Aster**	**G4?**	**S1**		
syn: *Aster pratensis* Raf.					
syn: *A. sericeus* Vent. var. *microphyllus* DC.					
***Symphyotrichum shortii* (Lindl.) Nesom**	**Short's Aster**	**G5**	**S1**		
syn: *Aster shortii* Lindl.					
***Synandra hispidula* (Michx.) Baill.**	**Gyandotte Beauty**	**G4**	**S2**		
***Taxodium ascendens* Brongn.**	**Pondcypress**	**G5**	**S1**		
Largest population contains trees transitional to *T. distichum*					
***Tetragonotheca helianthoides* L.**	**Squarehead**	**G5**	**S1**		
***Thalictrum macrostylum* Small & Heller**	**Small-leaved Meadow-rue**	**G3G4**	**S1**		
***Tillandsia usneoides* (L.) L.**	**Spanish-moss**	**G5**	**S1S2**		
***Toxicodendron rydbergii* (Small ex Rydb.) Greene**	**Western Poison Ivy**	**G5**	**S1**		
***Triantha glutinosa* (Michx.) Pers.**	**Sticky False Asphodel**	**G5**	**S1**		
syn: *Tofieldia glutinosa* (Michx.) Pers.					
***Triantha racemosa* (Walt.) B.S.P.**	**Coastal False Asphodel**	**G5**	**SH**		
syn: *Tofieldia racemosa* (Walt.) B.S.P.					
***Trichostema setaceum* Houtt.**	**Narrow-leaf Blue Curls**	**G5**	**S2**		
***Tridens chapmanii* (Small) Chase**	**Chapman's Purpletop**	**G3**	**SH**		
syn: *T. flavus* (L.) A.S. Hitchc. var. *chapmanii* (Small) Shinners					
***Trifolium calcaricum* Collins and Wieboldt**	**Running Glade Clover**	**G1**	**S1**		**LE**
***Trifolium reflexum* L.**	**Buffalo Clover**	**G3G4**	**S1**		
***Trillium cernuum* L.**	**Nodding Trillium**	**G5**	**S2**		
***Trillium flexipes* Raf.**	**Drooping Trillium**	**G5**	**SH**		
***Trillium nivale* Riddell**	**Snow Trillium**	**G4**	**S1**		

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Trillium pusillum* Michx. var. *virginianum* Fern.** Includes var. *moniticulum* Bodkin & Reveal	**Virginia Least Trillium**	**G3T2**	**S2**		
Triphora trianthophora* (Sw.) Rydb. ssp. *trianthophora	**Three Birds Orchid**	**G3G4T3T4**	**S1**		
***Trisetum spicatum* (L.) Richter**	**Narrow False Oats**	**G5**	**S1**		
***Turritis glabra* L.** syn: *Arabis glabra* (L.) Bernh.	**Tower Mustard**	**G5**	**S1**		
***Utricularia juncea* Vahl**	**Southern Bladderwort**	**G5**	**S1**		
***Utricularia olivacea* C. Wright ex Griseb.**	**Dwarf Bladderwort**	**G4**	**SH**		
***Utricularia purpurea* Walt.**	**Purple Bladderwort**	**G5**	**S2**		
***Utricularia striata* Le Conte ex Torr.** syn: *U. fibrosa* Walt.	**Fibrous Bladderwort**	**G4G5**	**S1**		
***Vaccinium crassifolium* Andr.**	**Creeping Blueberry**	**G4G5**	**S1**		
***Vaccinium macrocarpon* Ait.**	**Cranberry**	**G5**	**S2**		
***Vaccinium myrtilloides* Michx.**	**Velvetleaf Blueberry**	**G5**	**S1**		
***Valeriana pauciflora* Michx.**	**Pink Valerian**	**G4**	**S1**		
***Valerianella chenopodiifolia* (Pursh) A.P. de Candolle**	**Goosefoot Corn-salad**	**G4**	**SH**		
***Vandenboschia boschiana* (Sturm) Ebihara & K. Iwatsuki** syn: *Trichomanes boscianum* Sturm	**Appalachian Filmy Fern**	**G4**	**S1**		
***Verbena scabra* Vahl**	**Rough Vervain**	**G5**	**S1**		
***Veronica scutellata* L.**	**Marsh Speedwell**	**G5**	**S1**		
***Viburnum lentago* L.**	**Nannyberry**	**G5**	**S1**		
Vicia americana* Muhl. ex Willd. var. *americana	**American Vetch**	**G5T5**	**S1**		
***Viola* sp. nov.** Unnamed taxon of shale barrens and woodlands, similar in appearance to *Viola pedatifida* G. Don	**A Violet**	**GNR**	**S1**		
***Viola tripartita* Ell. var. *glaberrima* (DC.) R.M. Harper**	**Three-parted Violet**	**G5TNR**	**S1**		
Viola walteri* House var. *walteri	**Prostrate Blue Violet**	**G4G5TNR**	**S2**		
***Vitis palmata* Vahl**	**Red Grape**	**G4**	**S1**		
***Vitis rupestris* Scheele**	**Sand Grape**	**G3**	**S1**		
***Wisteria frutescens* (L.) Poir.**	**American Wisteria**	**G5**	**S1**		
***Wolffia columbiana* Karst.**	**Columbian Watermeal**	**G5**	**S1**		
***Xyris caroliniana* Walt.**	**Carolina Yellow-eyed Grass**	**G4G5**	**S1**		
***Xyris curtissii* Malme** syn: *X. difformis* Chapman var. *curtisii* (Malme) Kral	**Curtiss' Yellow-eyed Grass**	**G5**	**S1**		
***Xyris fimbriata* Ell.**	**Fringed Yellow-eyed Grass**	**G5**	**S1**		

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Xyris iridifolia* Chapman**	**Iris-leaf Yellow-eyed Grass**	**G4G5**	**S1**		
syn: *Xyris laxifolia* Mart. var. *iridifolia* (Chapman) Kral					
***Xyris platylepis* Chapman**	**Tall Yellow-eyed Grass**	**G5**	**S2**		
***Yucca aloifolia* L.**	**Spanish Dagger**	**G5**	**S1**		
***Yucca flaccida* Haworth**	**Weakleaf Yucca**	**G5**	**S1**		
***Zenobia pulverulenta* (Bartr. ex Willd.) Pollard**	**Dusty Zenobia**	**G4?**	**S1**		
***Zigadenus glaberrimus* Michx.**	**Large Death-camas**	**G5**	**S1**		
***Zornia bracteata* J.F. Gmel.**	**Viperina**	**G5?**	**S1**		

PART TWO:
VASCULAR PLANT WATCH LIST

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Acalypha deamii* (Weatherby) Ahles**	**Deam's Copperleaf**	**G4?**	**S3**		
***Aconitum reclinatum* Gray**	**White Monkshood**	**G3**	**S3**		
***Adlumia fungosa* (Ait.) Greene ex B.S.P.**	**Climbing Fumitory**	**G4**	**S3**		
***Agrostis scabra* Willd.**	**Rough Bentgrass**	**G5**	**S3?**		
***Amelanchier sanguinea* (Pursh) DC.**	**Roundleaf Serviceberry**	**G5**	**S3**		
Amsonia tabernaemontana* Walt. var. *tabernaemontana	**Eastern Blue-star**	**G5T5**	**S3**		
***Andropogon perangustatus* Nash**	**Narrow-leaved Bluestem**	**G4**	**S3**		
syn: A. *gyrans* Ashe var. *stenophyllus* (Hack.) C. Cambell					
***Andropogon virginicus* L. var. *decipiens* C. Campbell**	**Deceptive Bluestem**	**G5T4**	**S3**		
Under *A. virginicus* L. in Radford *et al.* (1968)					
Under *A. virginicus* L. var. *virginicus* in Fernald (1950)					
***Anemone quinquefolia* L. var. *minima* (DC.) Frodin**	**Dwarf Anemone**	**G5T3**	**S3**		
***Anticlea glauca* Kunth**	**White Death-camas**	**G4G5**	**S3**		
syn: *Zigadenus elegans* Pursh ssp. *glaucus* (Nutt.) Hulten					
***Aristida lanosa* Muhl. ex Ell.**	**Woolly Three-awn Grass**	**G5**	**S3**		
***Aristida tuberculosa* Nutt.**	**Sea-beach Needlegrass**	**G5**	**S3**		
Asclepias incarnata* L. var. *incarnata	**Swamp Milkweed**	**G5T5**	**S3**		
***Asclepias lanceolata* Walt.**	**Few-flower Milkweed**	**G5**	**S3**		
***Asimina parviflora* (Michx.) Dunal**	**Dwarf Pawpaw**	**G5**	**S3**		
***Bacopa monnieri* (L.) Pennell**	**Coastal Water-hyssop**	**G5?**	**S3**		
Baptisia australis* (L.) R. Br. ex Ait. f. var. *australis	**Blue Wild Indigo**	**G5T3T4**	**S3**		
Bartonia paniculata* (Michx.) Muhl. ssp. *paniculata	**Twining Bartonia**	**G5T5**	**S3**		
***Blephilia hirsuta* (Pursh) Benth.**	**Hairy Wood Mint**	**G5?**	**S3**		
***Bolboschoenus novae-angliae* (Britt.) S.G. Sm.**	**New England Bulrush**	**G5**	**S3**		
syn: *Schoenoplectus novae-angliae* (Britt.) M.T. Strong					
***Bulbostylis ciliatifolia* (Ell.) Fern.**	**Savanna Hairsedge**	**G3G5**	**S3?**		
***Bulbostylis coarctata* (Ell.) Fern.**	**Elliott's Hairsedge**	**G3G5**	**S3**		
syn: *Bulbostylis ciliatifolia* (Ell.) Fern. var. *coarctata* (Ell.) Kral					
***Callitriche palustris* L.**	**Vernal Water-starwort**	**G5**	**S3**		
syn: *C. verna* L.					
***Cardamine douglassii* Britt.**	**Purple Cress**	**G5**	**S3**		
***Carex austrodeflexa* P.D. McMillan, Sorrie, & van Eerden**	**Canebrake Sedge**	**G3G4**	**S3S4**		
***Carex canescens* L. var. *disjuncta* (Fern.) Toivonen**	**Silvery Sedge**	**G5T5**	**S3**		

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***Carex careyana* Torr. ex Dewey**	**Carey's Sedge**	**G4G5**	**S3**		
***Carex collinsii* Nutt.**	**Collins's Sedge**	**G4**	**S3**		
***Carex conjuncta* Boott**	**Soft Fox Sedge**	**G4G5**	**S3**		
***Carex floridana* Schwein.** syn: *Carex nigromarginata* Schwein. var. *floridana* (Schwein.) Kukenth.	**Florida Sedge**	**G5?**	**S3**		
***Carex fraseriana* Ker-Gawl.** syn: *Cymophyllus fraserianus* (Ker-Gawl.) Kartesz & Ghandi	**Fraser's Sedge**	**G4**	**S3**		
***Carex leptonervia* (Fern.) Fern.**	**Finely-nerved Sedge**	**G5**	**S3**		
***Carex lucorum* Willd. ex Link var. *austrolucorum* J. Rettig** syn: *C. pensylvanica* Lam. var. *distans* Peck	**Appalachian Woodland Sedge**	**G4T3T4**	**S3**		
***Carex meadii* Dewey**	**Mead's Sedge**	**G4G5**	**S3**		
Carex pedunculata* Muhl. ex Willd. var. *pedunculata	**Long-stalk Sedge**	**G5TNR**	**S3**		
***Carex pellita* Muhl. ex Willd.**	**Woolly Sedge**	**G5**	**S3S4**		
***Carex purpurifera* Mackenzie**	**Limestone Purple Sedge**	**G4?**	**S3**		
***Carex ruthii* Mackenzie**	**Ruth's Sedge**	**G3**	**S3**		
***Carex shortiana* Dewey**	**Short's Sedge**	**G5**	**S3**		
***Carex striata* Michx. var. *brevis* Bailey** syn: *C. walteriana* Bailey var. *brevis* (Bailey) Bailey	**Walter's Sedge**	**G4G5T4?**	**S3**		
***Carex suberecta* (Olney) Britt.**	**Prairie Straw Sedge**	**G4**	**S3**		
***Carex superata* Naczi, Reznicek, & B.A. Ford**	**Limestone Forest Sedge**	**G4?**	**S3**		
***Carex tetanica* Schkuhr**	**Rigid Sedge**	**G4G5**	**S3**		
Carex trisperma* Dewey var. *trisperma	**Three-seeded Sedge**	**G5T5**	**S3**		
***Carex venusta* Dewey**	**Dark Green Sedge**	**G4**	**S3?**		
***Castilleja coccinea* (L.) Spreng.**	**Eastern Indian Paintbrush**	**G5**	**S3**		
***Cenchrus incertus* M.A. Curtis** syn: *C. spinifex* Cav.	**Coastal Sandbur**	**GNR**	**S3**		
***Chaerophyllum procumbens* (L.) Crantz var. *shortii* Torr. & Gray**	**Short's Spreading Chervil**	**G5T3T4Q**	**S3?**		
***Chamaecrista fasciculata* (Michx.) Greene var. *macrosperma* (Fern.) C.F. Reed**	**Marsh Senna**	**G5T3**	**S3**		
***Chamaecyparis thyoides* (L.) B.S.P.**	**Atlantic White-cedar**	**G4**	**S3**		
***Chenopodium simplex* (Torr.) Raf.** Under *C. hybridum* L. in Fernald (1950), syn: *C. gigantospermum* Aellen	**Maple-leaf Goosefoot**	**G5**	**S3**		
***Chrysogon virginianum* L. var. *brevistolon* Nesom**	**Carolina Green-and-gold**	**G5TNR**	**S3**		
***Cinna latifolia* (Trev. ex Goepp.) Griseb.**	**Slender Wood Reedgrass**	**G5**	**S3**		

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***Clematis albicoma* Wherry**	**White-haired Leatherflower**	**G4**	**S3**		
***Clematis coactilis* (Fern.) Keener**	**Virginia White-haired Leatherflower**	**G3**	**S3**		
***Clematis crispa* L.**	**Marsh Swamp Leatherflower**	**G5**	**S3**		
***Coleataenia longifolia* (Torrey) Soreng ssp. *combsii* (Scribn. & C.R. Ball) Soreng** syn: *Panicum longifolium* Torrey var. *combsii* (Scribn. & Ball) Fern.	**Combs' Panic Grass**	**G5T5?**	**S3?**		
***Corallorrhiza wisteriana* Conrad**	**Spring Coralroot**	**G5**	**S3**		
***Croton monanthogynus* Michx.**	**Prairie Tea**	**G5**	**S3**		
***Cyperus haspan* L.**	**Sheathed Flatsedge**	**G5**	**S3**		
***Cyperus refractus* Engelm. ex Boeckl.**	**Reflexed Flatsedge**	**G5**	**S3**		
***Delphinium exaltatum* Ait.**	**Tall Larkspur**	**G3**	**S3**		
***Dendrolycopodium dendroideum* (Michx.) A. Haines** syn: *Lycopodium dendroideum* Michx.	**Prickly Tree-clubmoss**	**G5**	**S3**		
***Dendrolycopodium hickeyi* (W.H. Wagner, Beitel & Moran) A. Haines** syn: *Lycopodium hickeyi* W.H. Wagner, Beitel, & Moran	**Hickey's Tree-clubmoss**	**G5**	**S3?**		
***Descurainia pinnata* (Walt.) Britt. var. *brachycarpa* (Richards.) Detling**	**Western Tansy Mustard**	**G5T5**	**S3?**		
***Desmodium fernaldii* Schub.**	**Fernald's Tick-trefoil**	**G4**	**S3**		
***Desmodium lineatum* DC.**	**Sand Tick-trefoil**	**G5**	**S3**		
***Diarrhena americana* Beauv.**	**American Beakgrain**	**G4G5**	**S3**		
***Dichanthelium annulum* (Ashe) LeBlond**	**Ringed Panic Grass**	**G3G4**	**S3**		
***Dichanthelium fusiforme* (Hitchcock) Harvill** Under D. *aciculare* (Desv. ex Poir.) Gould & C.A. Clark in Kartesz (1999)	**Spindle-fruited Panic Grass**	**G5?**	**S3**		
***Dichanthelium portoricense* (Desv. ex Ham.) B.F. Hansen & Wunderlin ssp. *patulum* (Scribn. & Merr.) Freckmann & LeLong** syn: *Panicum lancearium* Trin.	**Hemlock Panic Grass**	**G5T5**	**S3**		
***Dichanthelium ravenelii* (Scribn. & Merr.) Gould** syn: *Pancium ravenelii* Scribn. & Merr.	**Ravenel's Panic Grass**	**G5**	**S3**		
***Dichanthelium scabriusculum* (Ell.) Gould & C.A. Clark** syn: *Panicum scabriusculum* Ell.	**Tall Swamp Panic Grass**	**G4**	**S3**		
***Dichanthelium wrightianum* (Scribn.) Freckmann** syn: *Panicum wrightianum* Scribn.	**Wright's Panic Grass**	**G4**	**S3**		
***Dicliptera brachiata* (Pursh) Spreng.**	**Branched Dicliptera**	**G5**	**S3**		
***Diphylleia cymosa* Michx.**	**Umbrella-leaf**	**G4**	**S3**		

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***Drosera brevifolia* Pursh** syn: *D. leucantha* Shinners	**Dwarf Sundew**	**G5**	**S3**		
***Drosera capillaris* Poir.**	**Pink Sundew**	**G5**	**S3**		
***Drosera intermedia* Hayne**	**Water Sundew**	**G5**	**S3**		
***Dryopteris campyloptera* Clarkson** syn: D. *spinulosa* (O.F. Muell.) Watt var. *americana* (Fisch.) Fern.	**Mountain Wood Fern**	**G5**	**S3**		
***Echinodorus cordifolius* (L.) Griseb.**	**Creeping Burhead**	**G5**	**S3**		
***Eleocharis albida* Torr.**	**White Spikerush**	**G4G5**	**S3**		
***Eleocharis palustris* (L.) Roemer & J.A. Schultes**	**Common Spikerush**	**G5**	**S3?**		
***Eleocharis rostellata* (Torr.) Torr.**	**Beaked Spikerush**	**G5**	**S3**		
***Erigenia bulbosa* (Michx.) Nutt.**	**Harbinger-of-spring**	**G5**	**S3**		
***Eriophorum virginicum* L.**	**Tawny Cottongrass**	**G5**	**S3**		
***Eurybia spectabilis* (Ait.) Nesom** *syn: Aster spectabilis* Ait. var. *spectabilis* and var. *suffultus* Fern. Under *A spectabilis* Ait. in Radford *et al.* (1968)	**Showy Aster**	**G5**	**S3**		
***Fallopia cilinodis* (Michx.) Holub** syn: *Polygonum cilinode* Michx.	**Fringed Bindweed**	**G5**	**S3**		
***Floerkea proserpinacoides* Willd.**	**False Mermaid**	**G5**	**S3**		
***Fraxinus nigra* Marsh.**	**Black Ash**	**G5**	**S3**		
***Fraxinus quadrangulata* Michx.**	**Blue Ash**	**G5**	**S3**		
***Galium boreale* L.**	**Northern Bedstraw**	**G5**	**S3**		
***Galium hispidulum* Michx.**	**Coastal Bedstraw**	**G5**	**S3**		
***Gentiana austromontana* Pringle & Sharp**	**Appalachian Gentian**	**G3**	**S3?**		
***Geranium robertianum* L.**	**Herb Robert**	**G5**	**S3**		
***Glyceria acutiflora* Torr.**	**Sharp-scaled Mannagrass**	**G5**	**S3**		
***Glyceria canadensis* (Michx.) Trin.**	**Canada Mannagrass**	**G5**	**S3**		
***Gymnocarpium appalachianum* Pryer & Haufler**	**Appalachian Oak Fern**	**G3**	**S3**		
***Gymnocladus dioicus* (L.) K. Koch**	**Kentucky Coffee-tree**	**G5**	**S3**		
***Gymnopogon brevifolius* Trin.**	**Short-leaf Beard Grass**	**G5**	**S3**		
***Helianthus hirsutus* Raf.**	**Hairy Sunflower**	**G5**	**S3**		
***Heuchera hispida* Pursh**	**Purple Alumroot**	**G3?**	**S3?**		
***Heuchera parviflora* Bartl.**	**Small-flowered Alumroot**	**G4**	**S3**		
Hexalectris spicata* (Walt.) Barnh. var. *spicata	**Crested Coralroot**	**G5T4T5**	**S3**		
***Hexastylis lewisii* (Fern.) Blomquist & Oosting**	**Lewis's Heartleaf**	**G3**	**S3**		
***Hottonia inflata* Ell.**	**Featherfoil**	**G4**	**S3**		
***Hydrastis canadensis* L.**	**Golden-seal**	**G3G4**	**S3**		
***Hydrolea quadrivalvis* Walt.**	**Waterpod**	**G5**	**S3**		
***Hypericum drummondii* (Grev. & Hook.) Torr. & Gray**	**Nits-and-lice**	**G5**	**S3**		

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***Hypericum mitchellianum* Rydb.**	**Blue Ridge St. John's-wort**	**G3**	**S3**		
***Hypericum virgatum* Lam.**	**Sharp-leaf St. John's-wort**	**G4?**	**S3**		
syn: H. *denticulatum* Walt. var. *acutifolium* (Ell.) Blake					
***Hypoxis curtissii* Rose in Small**	**Curtiss' Yellow Stargrass**	**G4?**	**S3**		
***Ilex vomitoria* Ait.**	**Yaupon**	**G5**	**S3**		
***Iresine rhizomatosa* Standl.**	**Eastern Bloodleaf**	**G5**	**S3**		
***Iris prismatica* Pursh ex Ker-Gwal.**	**Slender Blue Iris**	**G4G5**	**S3**		
***Iris versicolor* L.**	**Larger Blue Flag**	**G5**	**S3**		
***Isoetes riparia* Engelm. ex A. Braun**	**Shore Quillwort**	**G5**	**S3**		
***Juglans cinerea* L.**	**Butternut**	**G4**	**S3?**		
***Juncus longii* Fern.**	**Long's Rush**	**G3Q**	**S3?**		
Justicia ovata* (Walt.) Lindau var. *ovata	**Coastal Plain Water-willow**	**G5T4T5**	**S3**		
***Lechea maritima* Leggett ex B.S.P. var. *virginica* Hodgon**	**Virginia Beach Pinweed**	**G5T3Q**	**S3**		
***Leptochloa fascicularis* (Lam.) Gray**	**Bearded Sprangletop**	**G5**	**S3**		
syn: *L. fusca* (L.) Kunth ssp. *fascicularis* (Lam.) N. Snow					
***Liatris helleri* T.C. Porter**	**Heller's Blazing Star**	**GNR**	**S3**		
***Lilium philadelphicum* L.**	**Wood Lily**	**G5**	**S3**		
***Linum sulcatum* Riddell**	**Grooved Yellow Flax**	**G5**	**S3**		
***Listera smallii* Wieg.**	**Appalachian Twayblade**	**G4**	**S3**		
***Lithospermum latifolium* Michx.**	**American Gromwell**	**G4**	**S3**		
***Lithospermum tuberosum* Rugel ex DC.**	**Tuberous Gromwell**	**G4**	**S3**		
***Lonicera canadensis* Bartr. ex Marsh.**	**American Fly-honeysuckle**	**G5**	**S3**		
***Ludwigia glandulosa* Walt.**	**Cylindric-fruited Primrose-willow**	**G5**	**S3**		
***Ludwigia leptocarpa* (Nutt.) Hara**	**Angle-stem Primrose-willow**	**G5**	**S3**		
***Ludwigia sphaerocarpa* Ell.**	**Globe-fruited Seedbox**	**G5**	**S3**		
***Lygodium palmatum* (Bernh.) Sw.**	**American Climbing Fern**	**G4**	**S3**		
***Malaxis spicata* Sw.**	**Florida Adder's-mouth**	**G4?**	**S3**		
syn: M. *floridana* (Chapman) Kuntze					
***Meehania cordata* (Nutt.) Britt.**	**Meehan's Mint**	**G5**	**S3**		
***Micranthes caroliniana* (A. Gray) Small**	**Carolina Saxifrage**	**G3**	**S3**		
syn: *Saxifraga caroliniana* Gray					
***Milium effusum* L. var. *cisatlanticum* Fern.**	**Tall Millet Grass**	**G5TNR**	**S3**		
***Minuartia patula* (Michx.) Mattf.**	**Pitcher's Stitchwort**	**G4**	**S3**		

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***Monotropsis odorata* Schwein. *ex* Ell.**	**Sweet Pinesap**	**G3**	**S3**		
***Myriophyllum pinnatum* (Walt.) B.S.P.**	**Cut-leaf Water-milfoil**	**G5**	**S3**		
***Nabalus roanensis* Chickering**	**Roan Mountain Rattlesnake-root**	**G3**	**S3**		
syn: *Prenanthes roanensis* (Chickering) Chickering					
***Nelumbo lutea* Willd.**	**American Lotus**	**G4**	**S3**		
***Ophioglossum engelmannii* Prantl**	**Engelmann's Adder's-tongue**	**G5**	**S3**		
Packera paupercula (*Michx) Á. & D. Löve var. *paupercula	**Balsam Ragwort**	**G5TNR**	**S3?**		
syn: Senecio pauperculus Michx.					
***Panax quinquefolius* L.**	**Ginseng**	**G3G4**	**S3S4**		**LT**
***Paronychia baldwinii* (Torr. & Gray) Fenzl ex Walp.ssp. *riparia* (Chapman) Chaudhri**	**Baldwin's Nailwort**	**G4T4?**	**S3**		
***Parthenium integrifolium* L. var. *mabryanum* Mears**	**Mabry's Wild Quinine**	**G5T3**	**S3?**		
***Paspalum boscianum* Fluegge**	**Bull Paspalum**	**G5**	**S3**		
***Pedicularis lanceolata* Michx.**	**Swamp Lousewort**	**G5**	**S3**		
Pellaea glabella* Mett. ex Kuhn ssp. *glabella	**Smooth Cliff-brake**	**G5T5**	**S3**		
***Penstemon hirsutus* (L.) Willd.**	**Hairy Beard-tongue**	**G4**	**S3**		
***Phacelia purshii* Buckl.**	**Miami-mist**	**G5**	**S3**		
***Philadelphus hirsutus* Nutt.**	**Hairy Mock Orange**	**G5**	**S3**		
***Phlox nivalis* Lodd. ex Sweet**	**Trailing Phlox**	**G4**	**S3**		
***Phragmites australis* (Cav.) Trin. ex Steud. ssp. *americanus* Saltonstall, P.M. Peterson, & Soreng**	**American Common Reed**	**G5T5**	**S3**		
***Physalis walteri* Nutt.**	**Dune Ground-cherry**	**G4**	**S3**		
syn: *P. maritima* M.A. Curtiss syn: *P. viscosa* L. ssp. *maritima* (M.A. Curtiss) Waterfall					
***Physostegia leptophylla* Small**	**Slender-leaf False Dragonhead**	**G4?**	**S3**		
Platanthera flava* (L.) Lindl. var. *flava	**Southern Rein Orchid**	**G4?T4?Q**	**S3?**		
***Platanthera flava* (L.) Lindl. var. *herbiola* (R. Br. ex Ait. f.) Luer**	**Tubercled Rein Orchid**	**G4?T4Q**	**S3?**		
***Pogonia ophioglossoides* (L.) Ker-Gawl.**	**Rose Pogonia**	**G5**	**S3**		
***Polygala cruciata* L.**	**Cross-leaved Milkwort**	**G5**	**S3?**		
***Polygonella articulata* (L.) Meisn.**	**Coastal Jointweed**	**G5**	**S3**		
***Polygonum ramosissimum* Michx.**	**Bushy Knotweed**	**G5**	**S3**		
***Ponthieva racemosa* (Walt.) C. Mohr**	**Shadow Witch Orchid**	**G4G5**	**S3**		
***Potamogeton perfoliatus* L.**	**Perfoliate Pondweed**	**G5**	**S3**		
Treated as *P. perfoliatus* L. var. *bupleuroides* (Fern.) Farw. in Radford et al. (1968), and Fernald (1950)					

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Prosartes maculata* (Buckl.) Gray** syn: *Disporum maculatum* (Buckl.) Britt.	**Spotted Mandarin**	**G3G4**	**S3**		
Prunus alleghaniensis* Porter var. *alleghaniensis	**Allegheny Plum**	**G4T4**	**S3**		
***Quercus laevis* Walt.**	**Turkey Oak**	**G5**	**S3**		
***Quercus margarettiae* Ashe ex Small** syn: Q. *stellata* Wangenh. var. *margaretta* (Ashe ex Small) Sarg.	**Sand Post Oak**	**G5**	**S3**		
***Quercus virginiana* P. Mill.**	**Live Oak**	**G5**	**S3**		
Rhamnus lanceolata* Pursh var. *lanceolata	**Lance-leaf Buckthorn**	**G5T4T5**	**S3**		
***Rhododendron cumberlandense* E.L. Braun**	**Cumberland Azalea**	**G4?**	**S3**		
***Rhynchospora caduca* Ell.**	**Angle-stem Beaksedge**	**G5**	**S3**		
Rhynchospora cephalantha* Gray var. *cephalantha	**Common Bunched Beaksedge**	**G5T4T5**	**S3**		
***Rhynchospora macrostachya* Torr. ex Gray**	**Horned Beaksedge**	**G4**	**S3**		
***Rhynchospora perplexa* Britt.**	**Pineland Beaksedge**	**G5**	**S3**		
***Rhynchospora rariflora* (Michx.) Ell.**	**Few-flowered Beaksedge**	**G5**	**S3**		
***Ribes glandulosum* Grauer**	**Skunk Currant**	**G5**	**S3**		
***Ruellia humilis* Nutt.**	**Low Wild-petunia**	**G5**	**S3**		
***Ruellia purshiana* Fern.**	**Pursh's Wild-petunia**	**G3**	**S3**		
***Sabatia brachiata* Ell.**	**Narrow-leaf Rose-pink**	**G5?**	**S3**		
***Sabatia calycina* (Lam.) Heller**	**Long-lobed Arrowhead**	**G5?**	**S3**		
***Sabatia dodecandra* (L.) B.S.P.**	**Large Marsh-pink**	**G5?**	**S3**		
***Scirpus divaricatus* Ell.**	**Spreading Bulrush**	**G5**	**S3**		
***Scirpus hattorianus* Makino**	**Northern Bulrush**	**G5**	**S3**		
***Scirpus lineatus* Michx.** syn: S. *fontinalis* Harper	**Drooping Bulrush**	**G4**	**S3**		
Scutellaria saxatilis Riddell	**Rock Skullcap**	**G3**	**S3**		
***Sesuvium maritimum* (Walt.) B.S.P.**	**Small Sea-purslane**	**G5**	**S3**		
***Sideroxylon lycioides* L.** syn: *Bumelia lycioides* (L.) Pers.	**Buckthorn Bumelia**	**G5**	**S3**		
***Sisyrinchium fuscatum* Bickn.** syn: S. *arenicola* Bickn.	**Coastal Plain Blue-eyed-grass**	**G5?**	**S3**		
***Solidago faucibus* Wieboldt**	**Gorge Goldenrod**	**G2G4**	**S3**		
***Solidago flaccidifolia* Small** syn*: S. curtisii* Torr. & Gray var. *flaccidifolia* (Small) Cook & Semple	**Mountain Goldenrod**	**G5**	**S3?**		
***Solidago hispida* Muhl. ex Willd.**	**Hairy Goldenrod**	**G5**	**S3**		
***Solidago tarda* Mackenzie** Under *S. arguta* in Radford et al. (1968) Under *S. arguta* var. *arguta* in Kartesz (1999) syn: S. *ludoviciana* (Gray) Small	**Sandhill Goldenrod**	**G4?Q**	**S3?**		
***Sparganium eurycarpum* Engelm. ex Gray**	**Giant Bur-reed**	**G5**	**S3**		

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Spinulum annotinum* (L.) A. Haines** syn: *Lycopodium annotinum L.*	**Stiff Clubmoss**	**G5**	**S3?**		
***Spiranthes odorata* (Nutt.) Lindl.** syn: S. *cernua* (L.) L.C. Rich var. *odorata* (Nutt.) Correll	**Fragrant Ladies'-tresses**	**G5**	**S3**		
***Stachys hyssopifolia* Michx.**	**Hyssop-leaf Hedge-nettle**	**G4G5**	**S3**		
***Stachys latidens* Small ex Britt.**	**Broad-tooth Hedge-nettle**	**G4G5**	**S3**		
***Stellaria corei* Shinners** syn: *Stellaria pubera* Michx. var. *sylvatica* (Beguinot) Weath.	**Tennessee Starwort**	**G4**	**S3**		
***Stewartia malacodendron* L.**	**Silky Camellia**	**G4**	**S3**		
Styrax americanus* Lam. var. *americanus	**American Snowbell**	**G5TNR**	**S3**		
***Styrax grandifolius* Ait.**	**Bigleaf Snowbell**	**G5**	**S3**		
***Suaeda linearis* (Ell.) Moq.**	**Tall Sea-blite**	**G5**	**S3**		
Symphyotrichum ericoides* (L.) Nesom var. *ericoides syn: *Aster ericoides L.*	**White Heath Aster**	**G5T5**	**S3**		
***Symphyotrichum urophyllum* (Lindl.) G.L. Nesom**	**Arrow-leaved Aster**	**G4G5**	**S3**		
***Taenidia montana* (Mackenzie) Cronq.**	**Mountain Pimpernel**	**G3**	**S3**		
***Taxus canadensis* Marshall**	**Canada Yew**	**G5**	**S3**		
***Thermopsis mollis* (Michx.) M.A. Curtis ex Gray**	**Appalachian Golden-banner**	**G3G4**	**S3**		
***Tradescantia subaspera* Ker-Gawl.**	**Zigzag Spiderwort**	**G5**	**S3**		
***Tragia urticifolia* Michx.**	**Nettle-leaf Noseburn**	**G5**	**S3**		
***Trifolium virginicum* Small ex Small & Vail**	**Kates Mountain Clover**	**G3**	**S3**		
***Triglochin striata* Ruiz & Pavon**	**Southern Arrowgrass**	**G5**	**S3**		
Triosteum aurantiacum* Bickn. var. *aurantiacum	**Orange-fruited Horse-gentian**	**G5T5**	**S3**		
***Tsuga caroliniana* Engelmann**	**Carolina Hemlock**	**G3**	**S3**		
***Typha domingensis* Pers.**	**Southern Cattail**	**G4G5**	**S3?**		
***Uniola paniculata* L.**	**Sea Oats**	**G5**	**S3**		
***Utricularia geminiscapa* Benj.**	**Two-flowered Bladderwort**	**G4G5**	**S3**		
***Utricularia macrorhiza* Le Conte** syn: *U. vulgaris* L.	**Common Bladderwort**	**G5**	**S3**		
***Utricularia radiata* Small** syn: *U. inflata* Walt. var. *minor* Chapman	**Floating Bladderwort**	**G4**	**S3**		
Verbesina virginica* L. var. *virginica All Virginia *V. virginica* is var. *virginica*	**White Crownbeard**	**G5?T5?**	**S3**		
***Viola brittoniana* Pollard**	**Coast Violet**	**G4G5**	**S3?**		

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Viola esculenta* Ell.** syn: *Viola ×esculenta* Ell. (pro sp.) Under *V. septemloba* Le Conte in Radford et al. (1968)	**Salad Violet**	**G4G5**	**S3**		
***Viola macloskeyi* F. Lloyd var. *pallens* (Banks ex A.P. de Candolle) C.L. Hitchcock**	**Smooth White Violet**	**G5T5**	**S3**		
***Viola septentrionalis* Greene**	**Northern Blue Violet**	**G5**	**S3**		
***Wolffiella gladiata* (Hegelm.) Hegelm.** syn: *W. floridana* (J.D. Sm.) J.D. Sm. ex Hegelm.	**Sword Bogmat**	**G5**	**S3**		
***Zanthoxylum americanum* P. Mill.**	**Toothache Tree**	**G5**	**S3**		
***Zanthoxylum clava-herculis* L.**	**Hercules'-club**	**G4**	**S3**		

PART THREE:

VASCULAR PLANT REVIEW LIST
(Taxa of Uncertain Status)

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Agalinis fasciculata* (Ell.) Raf.**	**Tall False Foxglove**	**G5**	**SU**		
syn: *Gerardia fasciculata* (Ell.) Raf.					
***Agrostis altissima* (Walt.) Tuckerman**	**Coastal Bog Bentgrass**	**G4**	**SNR**		
***Allium burdickii* (Hanes) A.G. Jones**	**Narrow-leaved ramps**	**G4G5**	**SU**		
Alopecurus aequalis* Sobol. var. *aequalis	**Short-awn Foxtail Grass**	**G5T5**	**SNA**		
***Ampelopsis cordata* Michx.**	**Heart-leaf Peppervine**	**G5**	**SNR**		
***Andropogon glaucopsis* Ell.**	**Chalky Bluestem**	**G3G5**	**SNR**		
syn: *A. virginicus* L. var. *glaucopsis* (Ell.) A.S. Hitchc. syn: A. *glomeratus* (Walt.) Britt. var. *glaucopsis* (Ell.) A.S. Hitchc., Under *A. virginicus* L. in Radford *et al.* (1968)					
***Andropogon tenuispatheus* (Nash) Nash**	**Maritime Bushy Bluestem**	**G5**	**SU**		
syn: *A. glomeratus* (Walt.) Britt. var. *pumilus* Vasey ex Dewey					
***Antennaria howellii* Greene ssp. *petaloidea* (Fern.) Bayer**	**Small Pussytoes**	**G5T4T5**	**SU**		
syn: *A. petaloidea* (Fern.) Fern.					
***Arisaema triphyllum* (L.) Schott ssp. *stewardsonii* (Britt.) Huttleston**	**Bog Jack-in-the-pulpit**	**G5T4T5**	**SU**		
syn: *A. stewardsonii* Britt.					
***Asarum canadense* L. var. *acuminatum* Ashe**	**Wild ginger**	**G5TNR**	**SU**		
***Asplenium trichomanes* L. ssp. *quadrivalens* D.E. Meyer emend. Lovis**	**Limestone maidenhair**	**G5TNR**	**SU**		
***Boechera burkii* (Porter) Windham & Al-Shehbaz**	**Burk's Smooth Rock Cress**	**G3G5**	**SU**		
***Calystegia silvatica* (Kit.) Griseb. ssp. *fraterniflora* (Mackenzie & Bush) Brummitt**	**Large Bindweed**	**G5T5**	**SU**		
syn: *Convolvulus sepium* L. var. *fraterniflorus* Mackenzie & Bush					
***Carex cherokeensis* Schweinitz**	**Cherokee Sedge**	**G4G5**	**SNA**		
***Carex molesta* Mackenzie ex Bright**	**Troublesome Sedge**	**G4**	**SNR**		
***Carex muehlenbergii* Schkuhr ex Willd. var. *enervis* Boott**	**Small-fruited Muehlenberg's Sedge**	**G5T5**	**SNR**		
***Carex tribuloides* Wahlenberg var. *sangamonensis* Clokey**	**Midwestern Blunt Broom Sedge**	**G5T4T5**	**SNR**		
***Coleataenia anceps* (Michx.) Soreng ssp. *rhizomata* (A.S. Hitchc. & Chase) Soreng**	**Small Beaked Panic Grass**	**G5TNR**	**SU**		
syn: *Panicum anceps* Michx. var. *rhizomatum* (A.S. Hitchc. & Chase) Fern.					

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Crataegus disperma* Ashe**	**Two-seed Hawthorn**	**G4G5**	**SU**		
***Crataegus iracunda* Beadle**	**Forest Hawthorn**	**G5**	**SU**		
Included in *C. flabellata* (Bosc.) K. Koch. in Radford *et al*. (1968)					
***Crataegus vailiae* Britt.**	**Vail's Hawthorn**	**G4?Q**	**SU**		
***Crepidomanes intricatum* (Farrar) Ebihara & Weakley**	**Grotto-felt**	**G4G5**	**SU**		
syn: *Trichomanes intricatum* Farrar					
Cypripedium parviflorum* Salisb. var. *parviflorum	**Small Yellow Lady's-slipper**	**G5T3T5**	**SNR**		
***Desmodium paniculatum* (L.) DC. var. *epetiolatum* Schub.**	**Narrow-leaf Tick-trefoil**	**G5T1Q**	**SNR**		
***Diarrhena obovata* (Gleason) Brandenburg**	**Western Beakgrain**	**G4G5**	**SNA**		
syn: *D. americana* Beauv. var. *obovata* Gleason					
***Dichanthelium cryptanthum* (Ashe) LeBlond**	**Hidden-flowered Panic Grass**	**G2G3**	**S1**		
syn: *Panicum scabriusculum* (Ell.) Gould & Clark var. *cryptanthum* (Ashe) Gleason					
***Dichanthelium spretum* (J.A. Schultes) Freckmann**	**Eaton's Panic Grass**	**G5**	**SNR**		
syn: *Panicum spretum* J.A. Schultes					
***Digitaria villosa* (Walt.) Pers.**	**Shaggy Crabgrass**	**G5**	**SU**		
syn: D. *filiformis* (L.) Koeler var. *villosa* (Walt.) Fern.					
Eragrostis pectinacea* (Michx.) Nees ex Steud. var. *pectinacea	**Tufted Lovegrass**	**G5T5**	**SNR**		
***Eupatorium cordigerum* (Fern.) Fern.**	**Clasping Round-leaf Thoroughwort**	**GNR**	**SU**		
syn: *Eupatorium rotundifolium* L. var. *cordigerum* Fern.					
***Eupatorium vaseyi* Porter**	**Vasey's Thoroughwort**	**G3G5**	**SU**		
syn: *Eupatorium sessilifolium* L. var. *vaseyi* (Porter) Fern. & Grisc.					
syn: E. *album* L. var. *monardifolia* Fern.					
***Euphorbia pubentissima* Michx.**	**False Flowering Spurge**	**G5**	**SU**		
***Euphorbia spathulata* Lam.**	**Woodland Spurge**	**G5**	**SU**		
Included with *E. obtusata* Pursh in Harvill *et al*. (1992).					
***Euthamia hirtipes* (Fern.) Sieren**	**Marsh Flat-top Goldenrod**	**GNR**	**SNR**		
syn: E. *graminifolia* (L.) Nutt. var. *hirtipes* (Fern.) C.&J. Taylor					

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Galium orizabense* Hemsl. ssp. *laevicaule* (Weatherby & Blake) Dempster** syn: G. *pilosum* Ait. var. *laevicaule* Weatherby & Blake	**Bald Bedstraw**	**G5?T4?**	**SU**		
***Glandularia canadensis* (L.) Nutt.** syn: *Verbena canadensis* (L.) Britt.	**Rose Vervain**	**G5**	**SNA**		
***Gratiola virginiana* L. var. *aestuariorum* Pennell**	**Roundfruit hedge-hyssop**	**G5T2T4**	**SU**		
***Isolepis carinata* Hooker & Arnott ex Torr.** syn: *Isolepis koilolepis Steud.* syn: *Scirpus koilolepis* (Steud.) Gleason	**Keeled Bulrush**	**G5**	**SNA**		
Juncus validus* Coville var. *validus syn: J. *crassifolius* Buch.	**Round-headed Rush**	**G5T3T5**	**SNA**		
***Lathyrus pusillus* Ell.**	**Tiny Pea**	**G5?**	**SNA**		
***Lemna minuta* Kunth**	**Pale duckweed**	**G4**	**SU**		
***Leptochloa panicea* (Retz) Ohwi ssp. *brachiata*(Steudel) N. Snow**	**Red Sprangletop**	**GNRTNR**	**SNA**		
***Leptochloa panicoides* (J. Presl) A.S. Hitchc.** *syn: Diplachne panicoides* (J. Presl) McNeill	**Amazon Sprangletop**	**G5**	**SNA**		
***Liatris squarrulosa* Michx.** Under *L. aspera* Michx. in Harvill et al. (1992) syn: *L. earlei (Greene) K. Schum.*	**Appalachian Blazing Star**	**G4G5**	**SU**		
***Ludwigia polycarpa* Short & Peter**	**A seedbox**	**G4**	**SU**		
***Lycopus angustifolius* Ell.**	**Narrow-leaf Bugleweed**	**G4?Q**	**SU**		
***Malaxis bayardii* Fern.** Under *M. unifolia* Michx. in Radford et al. (1968)	**Appalachian Adder's-mouth**	**G1G2**	**SU**		
***Melampyrum lineare* Desr. var. *pectinatum* (Pennell) Fern.**	**Pine Barren Cow-wheat**	**G5T5**	**SU**		
***Orobanche riparia* L.T. Collins**	**River Broomrape**	**G4?**	**SU**		
***Panicum gattingeri* Nash**	**Gattinger's Panic Grass**	**G4**	**SNR**		
Physalis angulata* L. var. *angulata	**Cut-leaf Ground-cherry**	**G5TNR**	**SNA**		
***Planodes virginicum* (L.) E.L. Greene** syn: *Sibara virginica* (L.) Rollins	**Virginia Winged Rock Cress**	**G5**	**SNR**		
***Pycnanthemum beadlei* (Small) Fern.**	**Beadle's Mountain-mint**	**G2G4**	**SU**		

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***Pycnanthemum loomisii* Nutt.** Under *P. incanum* (L.) Michx. in Radford et al. (1968) syn: *Pycnanthemum incanum* (L.) Michx. var. *loomisii* (Nutt.) Fern.	**Loomis' Mountain-mint**	**G4?**	**SU**		
***Rosa blanda* Aiton**	**Smooth Rose**	**G5**	**SU**		
***Rudbeckia laciniata* L. var. *humilis* Gray** Under *R. laciniata* L. in Radford et al. (1968)	**Southeastern Cutleaf Coneflower**	**G5T3?**	**SU**		
***Sagittaria platyphylla* (Engelm.) J.G. Sm.**	**Delta Arrowhead**	**G5**	**SU**		
***Salix lucida* Muhl.**	**Shining Willow**	**G5**	**SNA**		
Silphium asteriscus* L. var. *asteriscus	**Starry Rosin Weed**	**G5TNR**	**SNR**		
***Silphium asteriscus* L. var. *latifolium* (Gray) Clevinger**	**Broad-leaved Rosin Weed**	**G4?T4?**	**SNR**		
***Sisyrinchium capillare* Bickn.** Under *S. albidum* Raf. in Radford et al. (1968)	**Wiry Blue-eyed-grass**	**GNR**	**SU**		
Solidago canadensis* L. var. *canadensis	**Canada Goldenrod**	**G5T5**	**SNR**		
***Solidago lancifolia* Torr. & Gray** Under *S. curtissii* Torr. & Gray in Kartesz (1999) Radford et al. (1968)	**Lance-leaf Goldenrod**	**G3G4Q**	**SU**		
Spiranthes lacera* (Raf.) Raf. var. *lacera	**A ladies'-tresses**	**G5T5**	**SU**		
Symphyotrichum ontarionis* (Wiegand) Nesom var. *ontarionis	**Bottomland Aster**	**G5TNR**	**SNR**		
***Symphyotrichum* x *schistosum* (Steele) Nesom** syn: *Aster schistosus* Steele syn: *A. x schistosus* (Steele) Nesom in Kartesz (1999)	**Millboro aster**	**GNA**	**SNA**		
***Tridens strictus* (Nutt.) Nash** syn: *Triodia stricta* (Nutt.) Benth. ex Vasey	**Long-spike Tridens**	**G5**	**SNA**		
***Trillium luteum* (Muhl.) Harbison**	**Yellow Trillium**	**G4**	**SE?**		
***Viola incognita* Brainerd** syn.: *Viola blanda* Willd. var. *palustriformis* Gray	**Large-leaved White Violet**	**G4G5T4T5**	**SNR**		
***Vittaria appalachiana* Farrar & Mickel**	**Appalachian Shoestring Fern**	**G4**	**SU**		

PART FOUR:

RARE LICHEN AND BRYOPHYTE LISTS

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
LICHENS					
***Alectoria fallacina* Motyka**	**Witch's-hair lichen**	**G2**	**SH**		
***Arctoparmelia centrifuga* (L.) Hale**	**Concentric ring lichen**	**G5**	**S1**		
***Buellia stellulata* (Taylor) Mudd**	**Button lichen**	**GNR**	**S1**		
***Calvitmela talayana* (Haugen & Timdal) Andreev**	**A lichen**	**GNR**	**S1**		
***Cetradonia linearis* (Evans) J.-C. Wei & Ahti** syn: *Gymnoderma lineare* (A.Evans) Yoshim. & Sharp	**Rock-gnome lichen**	**G3**	**S1**	**LE**	
***Cetrelia monachorum* (Zahlbr.) Culb. & C. Culb.**	**Sea-storm lichen**	**G2G4**	**SH**		
***Cladonia coccifera* (L.) Willd.**	**A Cladonia**	**G5**	**S1?**		
***Heterodermia appalachensis* (Kurok.) Culb.**	**Appalachian fringe lichen**	**G2?**	**SH**		
***Heterodermia erecta* Lendemer**	**A fringe lichen**	**G1?**	S1		
***Hypogymnia krogiae* Ohlsson**	**Freckled tube lichen**	**G3G4**	**S1**		
***Hypotrachyna lividescens* (Kurok.) Hale**	**A loop lichen**	**GNR**	S1		
***Hypotrachyna oostingii* (J.P. Dey) Hale**	**Oosting's loop lichen**	**G2?**	**SH**		
***Hypotrachyna prolongata* (Kurok.) Hale**	**A loop lichen**	**G3G4**	**SH**		
***Hypotrachyna virginica* (Hale) Hale** syn: *Parmelia virginica* Hale	**A loop lichen**	**G1G2**	**SH**		
***Melanelia culbersonii* (Hale) Thell**	**Appalachian camouflage lichen**	**G2G4**	**S2**		
***Parmelia omphalodes* (L.) Ach.**	**Smoky crottle**	**G2G4**	**S2?**		
***Parmotrema louisianae* (Hale) Hale**	**A ruffle lichen**	**G3G5**	**S1**		
***Peltigera hydrothyria* Miadikowski & Lutzona** syn: *Hydrothyria venosa* J.L. Russell	**Waterfan**	**G4**	**S1**		
***Porpidia lowiana* Gowan**	**A boulder lichen**	**G2G3**	**S1**		
***Porpidia tuberculosa* (Sm.) Hertel & Knoph**	**A boulder lichen**	**G2G4**	**S1**		
***Psilolechea clavulifera* (Nyl.) Coppins**	**A lichen**	**GNR**	**S1**		
***Punctelia graminicola* (B. de Lesd.) Egan**	**Speckled shield lichen**	**G?**	**S1**		
***Stereocaulon glaucescens* Tuck.**	**Bony foam lichen**	**G3**	**S2?**		
***Teloschistes flavicans* (Sw.) Norman**	**Powdered orange bush lichen**	**G4G5**	**SH**		
***Usnea angulata* Ach.**	**A beard lichen**	**G3G5**	**S1**		
LIVERWORTS					
***Anastrophyllum minutum* (Schreb.) R.M. Schust.**	**Comb Notchwort**	**G5**	**S1**		
***Aneura sharpii* Inoue & N.G. Mill.**	**A liverwort**	**G1G2**	**S1**		
***Barbilophozia attenuata* (Nees) Loeske**	**A liverwort**	**G5**	**S1**		
***Bazzania nudicaulis* A. Evans**	**A liverwort**	**G2G3**	**S1**		
***Bazzania tricrenata* (Wahlenb.) Trevis.**	**Three-toothed Whip Liverwort**	**G4**	**S1**		
***Cephaloziella spinicaulis* Douin**	**A liverwort**	**G3G4**	**S1**		

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
***LIVERWORTS*, continued**					
***Diplophyllum andrewsii* A. Evans**	**A moss**	**G3**	**SH**		
***Diplophyllum taxifolium* (Wahlenb.) Dumort.**	**Yew-leaved Earwort**	**G5**	**S1**		
***Drepanolejeunea appalachiana* R. M. Schuster**	**Appalachian threadwort**	**G2?**	**S1**		
***Frullania caulisequa* (Nees) Nees**	**A liverwort**	**GNR**	**SH**		
***Lejeunea blomquistii* (Evans) Schust.**	**Blomquist's Leafy Liverwort**	**G1G2**	**S1**		
***Lejeunea ruthii* (Evans) Schust.**	**A liverwort**	**G3G4**	**S1**		
***Leptoscyphus cuneifolius* (Hook.) Mitt.**	**Wedge Flapwort**	**G4G5**	**SH**		
***Marsupella paroica* R. M. Schust.**	**A liverwort**	**G3**	**SH**		
***Metzgeria temperata* Kuwahara**	**Whiskered Veilwort**	**G4**	**S1**		
***Pellia endiviifolia* (Dicks.) Dumort.**	**Endive Pellia**	**G5**	**SH**		
***Plagiochasma rupestre* (Forst.) Steph.**	**A flapwort**	**G5**	**S1**		
***Plagiochila exigua* (Taylor) Taylor**	**A liverwort**	**GNR**	**SH**		
***Plagiochila sullivantii* Gottsche ex A. Evans**	**Sullivant's leafy liverwort**	**G2**	**SH**		
***Schistochilopsis incisa* (Schrad.) Konstant.**	**Jagged notchwort**	**G5**	**S1**		
***Solenostoma pyrifolium* Steph.**	**A liverwort**	**GNR**	**SH**		
***Sphenolobopsis pearsonii* (Spruce) R.M. Schust**	**Horsehair threadwort**	**G2?**	**S1**		
***Tritomaria exsecta* (Schmidel ex Schrad.) Schiffn. ex Loeske**	**Cut Notchwort**	**G5**	**SH**		
***Tritomaria exsectiformis* (Breidl.) Schiffn. ex Loeske**	**Large cut notchwort**	**G5**	**SH**		
MOSSES					
***Bryoerythrophyllum ferruginascens* (Stirt.) Giacom.**	**Bryoerythrophyllum moss**	**G3G4**	**SH**		
***Calliergon cordifolium* (Hedw.) Kindb.**	**Calliergon moss**	**G5**	**S1**		
***Campylopus carolinae* Grout**	**A moss**	**G2**	**S1**		
***Campylopus surinamensis* Müll. Hal.**	**A moss**	**G4G5**	**S1**		
***Cirriphyllum piliferum* (Hedw.) Grout**	**Cirrhiphyllum moss**	**G5**	**S1**		
***Codriophorus aduncoides* (Bednarek-Ochyra) Bednarek-Ochyra & Ochyra**	**A moss**	**GNR**	**SH**		
***Conardia compacta* (Hook.) H. Rob.**	**A moss**	**G5**	**SH**		
***Coscinodon cribrosus* (Hedw.) Spruce**	**Copper Coscinodon**	**G3G4**	**S1**		
***Cryphaea nervosa* (Hook. & Wilson) Müll. Hal.**	**A moss**	**G4?**	**S1**		
***Dicranoweisia crispula* (Hedw.) Milde**	**Mountain Thatch Moss**	**G5**	**S1**		
***Dicranum muehlenbeckii* Bruch & Schimp.**	**A moss**	**G5**	**SH**		
***Entodon sullivantii* (Müll. Hal.) Lindb.**	**Sullivant's Entodon moss**	**G3G4**	**S2**		
***Forsstroemia producta* (Hornsch.) Paris**	**A moss**	**G5?**	**S1**		

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
MOSSES, continued					
Grimmia alpestris **(F. Weber & D. Mohr) Schleicher**	**A moss**	**G3G5**	**S1**		
Herpetineuron toccoae **(Sull. & Lesq.) Cardot**	**A moss**	**G4G5**	**S1**		
Heterocladium macounii **Best**	**A moss**	**G4**	**S1**		
Homalia trichomanoides **(Hedw.) Schimp. var. *trichomanoides***	**Lime Homalia moss**	**G5**	**SH**		
Homaliadelphus sharpii **(R.S. Williams) Sharp**	**Sharp's Homaliadelphus moss**	**G3?**	**S1**		
Hylocomiastrum umbratum **(Hedw.) M. Fleisch. ex Broth.**	**A moss**	**G5**	**SH**		
Imbribryum gemmiparum **(De. Not.) J.R. Spence & H.P. Ramsay**	**Bud-tipped Bryum**	**G3G5**	**S1**		
Leptodontium viticulosoides **var. *sulphureum*** **(Müll. Hal.) R.H. Zander**	**Granfather Mountain Leptodontium**	**G2**	**SH**		
Neckera complanata **(Hedw.) Hübener**	**A moss**	**G5**	**S1**		
Oncophorus rauei **(Austin) Grout**	**A moss**	**G3**	**SH**		
Orthotrichum elegans **Schwägr. ex Hook. & Grev.**	**A moss**	**G5**	**S1**		
Orthotrichum keeverae **Crum & Anders.**	**Keever's bristle-moss**	**G2**	**S1**		
Plagiothecium latebricola **BSG**	**Lurking leskea**	**G3G4**	**SNA**		
Platydictya minutissima	**Small willow moss**	**G3**	**SH**		
Polytrichastrum alpinum **(Hedw.) G. L. Sm. var. *alpinum***	**Alpine haircap moss**	**G5T5**	**SH**		
Polytrichastrum formosum **(Hedw.) G. L. Sm. var. *densifolium*** **(Mitten) Z. Iwatsuki & A. Noguchi**	**A haircap moss**	**G5TNR**	**SH**		
Pseudobryum cinclidioides **(Huebener) T.J. Kop.**	**River thyme moss**	**G5**	**SH**		
Rhabdoweisia crenulata **(Mitt.) H. Jameson**	**Himalayan Ribbed Weissia**	**G3G5**	**S1**		
Schistidium dupretii **(Thér.) W. A. Weber**	**A moss**	**GNR**	**SH**		
Schlotheimia rugifolia **(Hook.) Schwägr.**	**A moss**	**G3G5**	**SH**		
Sphagnum angustifolium **(C. Jens. ex Russ.) C. Jens.**	**Narrowleaf peatmoss**	**G5**	**S1S2**		
Sphagnum contortum **Schultz**	**A peatmoss**	**G5**	**S1**		
Sphagnum fuscum **(Schimp.) Klinggr.**	**Brown peatmoss**	**G5**	**SH**		
Sphagnum girgensohnii**Russ.**	**Girgensohn's peatmoss**	**G5**	**S1S2**		
Sphagnum macrophyllum **Bernh. ex Brid. var. *macrophyllum***	**Large-leaf peatmoss**	**G3G5**	**S2**		
Sphagnum portoricense **Hampe**	**Puerto Rico peatmoss**	**G5**	**S1**		
Sphagnum rubellum **Wils.**	**Red peatmoss**	**G5**	**S2**		
Syntrichia amphidiacea **(Müll. Hal.) R.H. Zandler**	**A moss**	**GNR**	**SH**		
Syrrhopodon incompletus **Schwägr.**	**A moss**	**G5**	**SH**		

Scientific Name	Common Name	Global Rank	State Rank	Federal Status	State Status
MOSSES, continued					
Tuerckheimia svihlae **(E.B. Bartram) R.H. Zander**	**A moss**	**GNR**	**S1**		
Ulota hutchinsiae **(Sm.) Hammar var. *rufescens* (E. Britton) Dixon**	**A moss**	**G5T3**	**SH**		

APPENDIX 1: Changes to the February, 2016 Lists

Additions to the rare vascular plant list

Scientific Name	Old Rank	New Rank
***Calystegia catesbeiana* Pursh**	N/A	S1
***Corallorhiza trifida* Châtelain**	N/A	S1
***Pityopsis graminifolia* (Michx.) Nutt. var. *tenuifolia* (Torr.) Semple & Bowers**	N/A	S1

Removals from the rare vascular plant list

Scientific Name	Old Rank	New Rank
***Dichanthelium annulum* (Ashe) LeBlond**	S2	S3

Rank changes to the rare vascular plant list

Scientific Name	Old Rank	New Rank
***Boechera dentata* (Raf.) Al-Shehbaz & Zarruchi**	S1S2	S1
***Cardamine flagellifera* O.E. Schulz**	SH	S1
***Carex sterilis* Willd.**	G4	G4G5
Cerastium velutinum* Raf. var. *velutinum	S1	S1S2
***Corallorhiza maculata* (Raf.) Raf. var. *occidentalis* (Lindl.) Cockerell**	S1	SH
Crataegus mollis* Scheele var. *mollis	G5TNR	G5T5
Crataegus succulenta* Schrad. ex Link var. *succulenta	G4G5TNR	G5T5
***Crotalaria purshii* DC.**	SH	S1
***Cuscuta cephalanthi* Engelm.**	SH	S1
***Cuscuta rostrata* Shuttlw. ex Engelm. & Gray**	S1	S1S2
***Cypripedium reginae* Walt.**	G4	G4G5
***Desmodium ochroleucum* M.A. Curtis ex Canby**	G1G2	G2
***Dichanthelium cryptanthum* (Ashe) LeBlond**	G2G3	G3G4Q
Epilobium ciliatum* Raf. ssp. *ciliatum	SH	S1
***Honckenya peploides* (L.) Ehrh. ssp. *robusta* (Fern.) Hulten**	G5T4	G5T5
***Hypericum denticulatum* Walt.**	SH	S1
***Packera millefolium* (Torr. & Gray) Weber & Löve**	G2	G3
***Platanthera leucophaea* (Nutt.) Lindl.**	S1	SH
***Poa languida* Hitchcock**	S2	S1
***Potamogeton oakesianus* J.W. Robbins**	G4	G5
***Schoenoplectus subterminalis* (Torr.) Sojak**	G4G5	G5
***Scirpus flaccidifolius* (Fern.) Schuyler**	S1	S1S2
***Smilax ecirrata* (Engelm. ex Kunth) S. Wats.**	G5?	G5
***Solidago stricta* Ait.**	S2	S1
***Spiranthes eatonii* Ames ex P.M. Brown**	SH	S1
***Trillium flexipes* Raf.**	S1	SH
***Vaccinium macrocarpon* Ait.**	G4	G5
***Valerianella chenopodiifolia* (Pursh) A.P. de Candolle**	G5	G4
***Yucca flaccida* Haworth**	N/A	S1

Nomenclatural changes to the rare vascular plant list

Old Name	New Name
***Betula cordifolia* Regel**	***Betula papyrifera* Marshall**
***Eupatorium* sp. nov.**	***Eupatorium maritimum* E.E. Schilling**

Removals from the vascular plant watchlist

Scientific Name	Old Rank	New Rank
***Ampelopsis arborea* (L.) Koehne**	S3	S4
***Croptilon divaricatum* (Nutt.) Raf.**	S3	S4

Rank changes to the vascular plant watchlist

Scientific Name	Old Rank	New Rank
***Carex leptonervia* (Fern.) Fern.**	G4	G5
***Phragmites australis* (Cav.) Trin. ex Steud. ssp. *americanus* Saltonstall, P.M. Peterson, & Soreng**	G5T4	G5T5

Removals from the vascular plant review list

Scientific Name	Old Rank	New Rank
***Calystegia soldanella* (L.) R. Br. ex Roemer & J.A. Schultes**	SNA	SNA
***Nothoscordum bivalve* (L.) Britt.**	SNA	S4
***Oenothera linifolia* Nutt.**	SNA	SNA
***Plantago heterophylla* Nutt.**	SNA	S4
***Solidago riddellii* Frank ex Riddell**	SNA	SNA

Additions to the rare bryophyte list - Liverworts

Scientific Name	Old Rank	New Rank
***Anastrophyllum minutum* (Schreb.) R.M. Schust.**	N/A	SH
***Barbilophozia attenuata* (Nees) Loeske**	N/A	SH
***Bazzania tricrenata* (Wahlenb.) Trevis.**	N/A	S1
***Diplophyllum taxifolium* (Wahlenb.) Dumort.**	N/A	SH
***Lejeunea blomquistii* (Evans) Schust.**	N/A	S1
***Tritomaria exsecta* (Schmidel ex Schrad.) Schiffn. ex Loeske**	N/A	SH

Rank Changes to the rare bryophyte list - Liverworts

Scientific Name	Old Rank	New Rank
***Drepanolejeunea appalachiana* R. M. Schuster**	SH	S1
***Metzgeria temperata* Kuwahara**	SH	S1

Additions to the rare bryophyte list - Mosses

Scientific Name	Old Rank	New Rank
***Dicranoweisia crispula* (Hedw.) Milde**	N/A	S1
***Neckera complanata* (Hedw.) Hübener**	N/A	S1
***Rhabdoweisia crenulata* (Mitt.) H. Jameson**	N/A	S1

Rank Changes to the rare bryophyte list - Mosses

Scientific Name	Old Rank	New Rank
***Conardia compacta* (Hook.) H. Rob.**	G3G5	G5
***Dicranum muehlenbeckii* Bruch & Schimp.**	G3G5	G5
***Orthotrichum elegans* Schwägr. ex Hook. & Grev.**	SH	S1
Polytrichastrum alpinum* (Hedw.) G. L. Sm. var. *alpinum	G5	G5T5
***Sphagnum portoricense* Hampe**	S1S2	S1

Species removed from the rare bryophyte list - Mosses

Scientific Name	Old Rank	New Rank
***Sphagnum cyclophyllum* Sull. & Lesq. ex Sull.**	S1S2	S4?
***Sphagnum fimbriatum* Wils. ex Wils. & J.D. Hook.**	S1	S3?
***Sphagnum flexuosum* Dozy & Molk.**	S1S2	S4?
***Sphagnum inundatum* Russ.**	S1S2	S4?
***Sphagnum molle* Sull.**	S2	S4?
***Sphagnum papillosum* Lindb.**	S1	S3?
***Sphagnum pulchrum* (Lindb.) Warnst.**	SH	SH
***Sphagnum quinquefarium* (Lindb. ex Braithw.) Warnst.**	S2S3	S4
***Sphagnum strictum* Sull.**	S2	S4
***Sphagnum torreyanum* Sull.**	S2	S3

Rank Changes to the rare Lichen List

Scientific Name	Old Rank	New Rank
***Alectoria fallacina* Motyka**	S1	SH
***Arctoparmelia centrifuga* (L.) Hale**	G3G5	G5
***Cetrelia monachorum* (Zahlbr.) Culb. & C. Culb.**	SU	SH
***Cetradonia linearis* (Evans) J.-C. Wei & Ahti**	G2	G3
***Heterodermia appalachensis* (Kurok.) Culb.**	S1	SH
***Hypotrachyna oostingii* (J.P. Dey) Hale**	SU	SH
***Hypotrachyna prolongata* (Kurok.) Hale**	S1	SH
***Hypotrachyna virginica* (Hale) Hale**	S1	SH

APPENDIX 2. RARE SPECIES SIGHTING FORM

An important component of the natural heritage inventory and protection process involves gathering information from state experts, professionals, and avocational naturalists throughout the state. To facilitate this, the Division of Natural Heritage has developed a rare species sighting form. If you would like to participate in ourinventory and protection activities, please take a few moments to complete the attached form for any taxon from our lists. This data will be incorporated into thenatural heritage data base and used exclusively for the protection of the rare taxon and its habitat. Please send the form or pertinent electronic files (including GIS data) to staff botanist John Townsend at: Department of Conservation and Recreation, Division of Natural Heritage, 600 East Main Street, 24th Floor, Richmond, VA 23219.

Thank you for your support. The Division of Natural Heritage can only realize the protection of the Commonwealth's natural diversity by working through a network of knowledgeable and concerned individuals.

TAXON NAME:

DATE SEEN:

CITY/COUNTY:

COLLECTION INFORMATION: (Include your personal collection number, if any, and the Herbarium where the specimen has been/will be deposited)

LOCATION: (Please provide as detailed a description as possible. (**Please include a topographic map or GIS file** showing the location.)

HABITAT DESCRIPTION: (Include associated species, natural features, vegetation, and other applicable habitat information).

POPULATION DATA: (Include number of individuals, age, size, spatial distribution, evidence of reproduction and other applicable population data.)

THREATS OR EVIDENCE OF DISTURBANCE TO SITE:

LAND OWNER(S):

REPORTED BY: (Please include name, address, telephone number, and email address.)

DATE OF THIS REPORT:

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Enclosure 6 Virginia Natural Heritage List of Rare Animals

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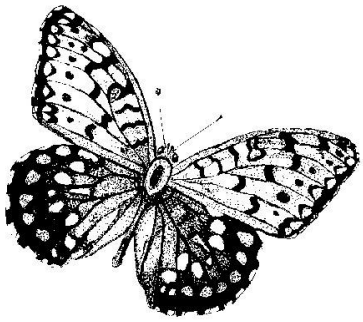
COMMONWEALTH of VIRGINIA

Natural Heritage Resources of Virginia: Rare Animals

Compiled by:
Steven M. Roble, Zoologist



Virginia Department of Conservation and Recreation
Division of Natural Heritage, Richmond, Virginia
Natural Heritage Technical Report 16-07. February 2016

DCR
Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL AND RECREATIONAL RESOURCES

NATURAL HERITAGE RESOURCES OF VIRGINIA:

RARE ANIMALS

FEBRUARY 2016

VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION
DIVISION OF NATURAL HERITAGE
600 EAST MAIN STREET
RICHMOND, VIRGINIA 23219
(804) 786-7951

List Compiled by

Steven M. Roble
Staff Zoologist

Cover illustrations (left to right) by Megan Rollins

Indiana Myotis
Red-cockaded Woodpecker
Regal Fritillary

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NATURAL HERITAGE RESOURCES
OF VIRGINIA: RARE ANIMALS

FEBRUARY 2016

INTRODUCTION

The Virginia Department of Conservation and Recreation's Division of Natural Heritage (DCR-DNH) was established in 1986 to protect Virginia's biological diversity. DCR-DNH is the state's first comprehensive program for conservation of our natural heritage, and includes an intensive statewide biological inventory, field surveys, electronic and manual database management, environmental review capabilities, and natural area protection and stewardship. Through its actions the Division identifies Natural Heritage Resources that are in need of conservation attention while creating an efficient means of evaluating the impacts of balanced economic growth. Natural Heritage Resources are defined in the Virginia Natural Area Preserves Act of 1989 (Section 10.1-209 through 217, Code of Virginia), as the habitat of rare, threatened, and endangered plant and animal species; exemplary natural communities, habitats, and ecosystems; and other natural features of the Commonwealth.

To achieve this protection, DCR-DNH maintains lists of the most significant elements of our natural diversity. These lists focus the Division's inventory on the Natural Heritage Resources most likely to be lost without conservation action in the near future. Most importantly, these lists are useful not only for DCR-DNH, but can be used by other agencies, organizations, and individuals to assist in the determination of actions in protection and development decision-making. In formulating these lists, the Division uses information from previous studies, museum records, observations and opinions of experts, DCR-DNH staff scientists, and field inventories.

The first list included in this report is the Rare Animal List. This list contains information on the legal and biological status of Virginia's rarest known native animals, including vertebrates, insects, and selected other invertebrate groups, **793** in total (189 vertebrates, 604 invertebrates). This list includes those species that are believed to be sufficiently rare or threatened to merit an inventory of their status and locations. Certain marine species that are listed as federally endangered or threatened are only included in the appendices. Only those species that use discrete habitat patches or can directly benefit from habitat protection are included in the main taxonomic lists.

The second list included in this report is the Animal Watchlist. This list contains information on the legal and biological status of **347** additional taxa (74 vertebrates, 273 invertebrates) that are decidedly uncommon in Virginia but not scarce enough to merit inclusion on the Rare Animal List. Species on this list are monitored to determine general population trends, and if a particular species is found to be rare or threatened, it is placed on the Rare Animal List. Some species included on the Animal Watchlist were formerly on the Rare Animal List but have been determined to be more common than previously believed. Other species on the Watchlist are declining and may warrant placement on the Rare Animal List in the future if their populations continue to decline.

The third list included in this report is the Animal Review List (Taxa of Uncertain Status). Many of these species lack numerical ranks, indicating that they are poorly known from a distributional and/or taxonomic standpoint. Although some of these species may prove to be conservation targets, more field and museum data are needed to assess their degree of rarity in Virginia and/or taxonomic status. There are **273** species (5 vertebrates, 268 invertebrates) in this category.

Natural Heritage Resource lists are necessarily dynamic, with updates occurring as new data become available. Such revisions assure the most current knowledge of the status of Virginia's animals. Animals are added to the list when it is determined that they have become rare or threatened to such an extent that their continued existence in the Commonwealth is in jeopardy. Animals are deleted from the list when additional field surveys or other new data indicate they are more common than previously believed and do not warrant priority conservation efforts.

All animals that are officially protected by federal or state endangered species acts are included in this list (except as noted above). Federally listed species are protected by the Endangered Species Act of 1973, as amended. The U.S. Department of the Interior's Fish and Wildlife Service administers the Act, listing and protecting federally endangered and threatened species. The Virginia Department of Game and Inland Fisheries has the regulatory responsibility for the listing and protection of the state's endangered and threatened animals (excluding the Class Insecta) under the Virginia Endangered Species Act (Section 29.1-564 through 570, Code of Virginia). The Office of Plant Protection within the Virginia Department of Agriculture and Consumer Services has regulatory

responsibility for the listing and protection of the state's insects (and plants) under the Virginia Endangered Plant and Insect Act (Section 3.1-1020 through 1030, Code of Virginia). DCR-DNH is a primary source of recommendations to each of the regulatory agencies for species that are in need of listing as endangered or threatened.

The Virginia Department of Conservation and Recreation, the U.S. Fish and Wildlife Service, the Virginia Department of Game and Inland Fisheries, and the Virginia Department of Agriculture and Consumer Services work cooperatively to insure the continued survival of Virginia's diverse fauna and other elements of natural diversity. The Division of Natural Heritage also works closely with many other state and federal agencies, local governments, conservation organizations, and many other organizations and individuals to seek adequate protection of Virginia's natural heritage.

LIST FORMAT

The lists are sorted by broad taxonomic groups and then ordered alphabetically by scientific name within each group. The format of each list consists of six fields: scientific name, common name, global rank, state rank, federal status, and state status. These fields are also used in the lists appearing in Appendices 1-3. To aid in the interpretation of the lists, a brief explanation of each field and a summary of abbreviations follow.

Column 1. Scientific name:

Nomenclature of animals is not contained in any single source. The most recent taxonomic sources are examined by the staff zoologist and, when necessary, direct consultations with experts are used to maintain the most scientifically accepted names for all animal groups. Divergences from these opinions are rare and generally occur only while an ongoing taxonomic study is being conducted. Contact the staff zoologist if you have questions or comments regarding the scientific names used herein.

Column 2. Common name:

A common name is provided for the convenience of the user. Standard common names have been developed and universally adopted for only a few animal groups; therefore, the user is cautioned to use scientific names whenever possible. The common names for most vertebrates and a few selected aquatic invertebrate groups (e.g., mussels) are recognized as stable. Most invertebrate species lack common names and it may not be practical to provide such names. They are usually indicated in the list as "a caddisfly", "a millipede", etc. The primary sources of common names applied to species in selected groups included in this list can be found on page 7. Many other common names that appear in the list, especially those of invertebrates, are not widely used or universally accepted.

Column 3. Global rank:

Global ranks are assigned by a consensus of the network of natural heritage programs, scientific experts, and NatureServe (a non-profit conservation organization) to designate the rangewide rarity of a species or subspecies. This system was originally developed by The Nature Conservancy and is widely used by other agencies (e.g., U.S. Fish and Wildlife Service, U.S. Forest Service) and organizations as the best available scientific and objective assessment of an animal's rarity and the level of threat to its existence. The ranks are assigned after considering a suite of factors including the number of occurrences (populations), number of individuals, and severity of threats to the species and its habitats. Global ranks found in the Rare Animal List are explained below:

G1 Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.

G2 Very rare and imperiled with 6 to 20 occurrences or few remaining individuals; or because of some factor(s) making it vulnerable to extinction.

G3 Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range; or vulnerable to extinction because of other factors. Usually fewer than 100 occurrences are documented.

G4 Common and apparently secure globally, although it may be rare in parts of its range, especially at the periphery.

G5 Very common and demonstrably secure globally, although it may be rare in parts of its range, especially at the periphery.

GH Formerly part of the world's fauna with some expectation that it may be rediscovered; generally applies to species that have not been verified for an extended period (usually >15 years) and for which some inventory has been attempted recently.

GX Believed to be extinct throughout its range with virtually no likelihood of rediscovery.

GU Possibly rare, but status uncertain and more data needed.

G? Unranked, or, if following a numerical ranking, rank uncertain (e.g., G3?).

G_G_ The rank is uncertain, but considered to be within the indicated range (e.g., G2G4) of ranks (also, T_T_).

G_Q Taxon has a questionable taxonomic assignment (e.g., G3Q) and may prove to be invalid upon further study.

G_T_ Signifies the rank of a subspecies (e.g., G5T1 would apply to a subspecies if the species is demonstrably secure globally (G5) but the subspecies warrants a rank of T1, critically imperiled.)

GNR A global conservation status rank has not been assigned to the species.

Column 4. State rank:

State ranks are assigned in a manner similar to that described for global ranks, with values that generally range from S1-S5, but consider only factors within the political boundaries of Virginia. For example, an animal that is endemic to Virginia (found nowhere else in the world) will have the same global and state ranks, whereas a species that may be common in the northeastern United States but only known from a few occurrences in Virginia will have global and state ranks that differ. State ranks found in the Rare Animal List are explained below:

S1 Extremely rare and critically imperiled with 5 or fewer occurrences or very few remaining individuals in Virginia; or because of some factor(s) making it especially vulnerable to extirpation in Virginia.

S2 Very rare and imperiled with 6 to 20 occurrences or few remaining individuals in Virginia; or because of some factor(s) making it vulnerable to extirpation in Virginia.

S3 Rare to uncommon in Virginia with between 20 and 100 occurrences; may have fewer occurrences if found to be common or abundant at some of these locations; may be somewhat vulnerable to extirpation in Virginia.

S4 Common and apparently secure in Virginia, although it may be rare in parts of its range.

SH Formerly part of Virginia's fauna with some expectation that it may be rediscovered; generally applies to species that have not been verified in the state for an extended period (usually >15 years) and for which some inventory has been attempted recently.

SX Believed to be extirpated from Virginia with virtually no likelihood of rediscovery.

SU Possibly rare, but status uncertain and more data needed.

S_? Rank uncertain. For example the rank S2? denotes a species that may range from S1 to S3.

S_S_ Rank is uncertain, but considered to be within the indicated range of ranks (e.g., S2S4).

S_B Breeding status of an animal (primarily used for birds) in Virginia; these species typically inhabit Virginia only during the breeding season.

S_B/S_N Breeding and nonbreeding status of an animal (primarily used for birds) in Virginia, when they differ.

SNA A conservation status rank is not applicable because the species is not a suitable target for conservation activities in Virginia (includes accidental species, transients, exotics, etc.).

SNR A state conservation status rank has not been assigned to the species.

Column 5. Federal status:

Federal status is determined by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. This status is used for all animals listed as endangered or threatened by the U.S. government and receiving protection under the federal Endangered Species Act. The list also notes those species that have been formally proposed for listing or are currently candidates under consideration for listing. The federal status formerly known as "Category 2, candidate species" was abolished on February 28, 1996; species formerly designated as "Category 1, candidate species" are now referred to simply as "candidate species."

LE Listed Endangered. A species threatened with extinction throughout all or a significant portion of its range.

LT Listed Threatened. A species likely to become endangered in the foreseeable future.

LE/PT Currently listed as endangered but proposed for downlisting to threatened.

LT/SA Listed as Threatened due to Similarity of Appearance. The species so closely resembles an endangered or threatened species or population that enforcement personnel of the U.S. Fish and Wildlife Service cannot readily distinguish between the taxa (e.g., the northern population of the bog turtle is federally listed as endangered, but turtles from the southern population, which includes Virginia, are not readily distinguishable from them).

PE Proposed Endangered. A species proposed for listing as endangered.

PT Proposed Threatened. A species proposed for listing as threatened.

C Candidate. There is enough available information to propose the species for listing, but listing is "precluded by other pending proposals of higher priority". (Formerly Candidate, Category 1)

Column 6. State status:

State status is determined by the Virginia Department of Game and Inland Fisheries (all animals except insects) and the Virginia Department of Agriculture and Consumer Services (insects only). The informal category of "Special Concern" species that was previously maintained by the Virginia Department of Game and Inland Fisheries was abolished by that agency on January 1, 2011.

LE Listed Endangered; defined as a species that is in danger of extinction throughout all or a significant portion of its range.

LT Listed Threatened; defined as a species that is likely to become endangered within the foreseeable future.

LT/PDL Listed as Threatened but proposed for delisting (removal from the state list of Endangered and Threatened wildlife). However, at the present time, the species is still listed as Threatened pending further action and is thus protected under Virginia's Endangered Species Act.

PE Proposed Endangered. A species proposed for listing as endangered.

PT Proposed Threatened. A species proposed for listing as threatened.

The following table summarizes the ranks and legal status of the rarest animals tracked by the Virginia Department of Conservation and Recreation, Division of Natural Heritage (pages 10-30 of this list).

Rank[a]	Fish	Amphibians	Reptiles	Birds[b]	Mammals	Invertebrates
GH	0	0	0	0	1	5
G1	7	1	1	0	0	170
G2	10	3	0	2	6	118
G3	15	4	4	6	9	117
SX	3	0	0	0	1	5
SH	2	0	1	6	0	54
S1	30	4	8	38	11	323
S2	36	15	5	23	6	217
Totals	71	19	14	67	18	604
Legal Status[c]						
FE	4	1	1	2	5	31
FT	4	0	2	2	1	2
PFE	0	0	0	0	0	1
SE	8	2	4	5	11	50
PSE	0	0	0	0	2	0
ST	14	2	3	7	0	14
PST	0	0	0	1	1	0

[a] Rounded ranks (e.g., G1G2 is combined with G1, S2S3 with S2, G2G4 is treated as G3, S1S3 is treated as S2, etc.); also T ranks are treated as equivalent to G ranks for the purposes of this table.

[b] Breeding ranks of birds were used as the S ranks for the purposes of this table (except for Red Knot).

[c] FE = Federally Endangered; FT = Federally Threatened; PFE = Proposed Federally Endangered; SE = State Endangered; PSE = Proposed State Endangered; ST = State Threatened; PST = Proposed State Threatened.

Changes in legal status since the March 2013 DCR rare animal list

New Listings:

Fluted Kidneyshell and Slabside Pearlymussel – listed as endangered by the U.S. Fish and Wildlife Service in September 2013.

Thomas' cave beetle – listed as endangered by the Virginia Department of Agriculture and Consumer Services in December 2013.

Red Knot – listed as threatened by the U.S. Fish and Wildlife Service in January 2015.

Northern Long-eared Myotis (bat) – listed as threatened by the U.S. Fish and Wildlife Service in May 2015.

Delistings:

Virginia Northern Flying Squirrel – delisted by the U.S. Fish and Wildlife Service in March 2013.

Delmarva Fox Squirrel – delisted by the U.S. Fish and Wildlife Service in December 2015.

PRIMARY SOURCES OF COMMON NAMES

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Turgeon, D.D., J.F. Quinn, Jr., A.E. Bogan, E.V. Coan, F.G. Hochberg, W.G. Lyons, P.M. Mikkelsen, R.J. Neves, C.F.E. Roper, G. Rosenberg, B. Roth, A. Scheltema, M.J. Sweeney, F.G. Thompson, M. Vecchione, and J.D. Williams. 1998. Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks. 2nd Edition. American Fisheries Society, Special Publication 26, Bethesda, Maryland. 526 pp.

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Odonata
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PART ONE:

RARE ANIMAL LIST

VA DEPARTMENT OF CONSERVATION & RECREATION
DIVISION OF NATURAL HERITAGE

VIRGINIA RARE ANIMAL LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
VERTEBRATES					
FISH					
Acipenser brevirostrum	Shortnose sturgeon	G3	SHB/S1N	LE	LE
Acipenser oxyrinchus	Atlantic sturgeon	G3	S2	LE	LE
= *Acipenser oxyrhynchus*					
Ameiurus brunneus	Snail bullhead	G4	S2		
Ammocrypta clara	Western sand darter	G3	S1		LT
= *Etheostoma clarum*					
Aplodinotus grunniens	Freshwater drum	G5	S2		
Chrosomus cumberlandensis	Blackside dace	G2	S1	LT	LT
= *Phoxinus cumberlandensis*					
Chrosomus tennesseensis	Tennessee dace	G3	S1		LE
= *Phoxinus tennesseensis*					
Chrosomus sp. 1	Clinch dace	G1	S1		
Cyprinella labrosa	Thicklip chub	G4	SH		
= *Hybopsis labrosa*					
Cyprinella whipplei	Steelcolor shiner	G5	S1		LT
= *Notropis whipplei*					
Enneacanthus chaetodon	Blackbanded sunfish	G3G4	S1		LE
Erimonax monachus	Spotfin chub (= turquoise shiner)	G2	S1	LT	LT
= *Cyprinella monacha,*					
= *Hybopsis monacha*					
Erimystax cahni	Slender chub	G1	S1	LT	LT
= *Hybopsis cahni*					
Erimyzon sucetta	Lake chubsucker	G5	S2		
Etheostoma acuticeps	Sharphead darter	G3	S1		LE
Etheostoma brevispinum	Carolina fantail darter	G4	S1		
Etheostoma caeruleum	Rainbow darter	G5	S2		
Etheostoma camurum	Bluebreast darter	G4	S2		
Etheostoma chlorobranchium	Greenfin darter	G4	S1		LT
Etheostoma cinereum	Ashy darter	G2G3	S1		
Etheostoma collis	Carolina darter	G3	S2		LT
Etheostoma denoncourti	Golden darter	G2	S1		LT
= *Etheostoma tippecanoe* (in part)					
Etheostoma jessiae	Blueside darter	G4	S1		
= *Etheostoma stigmaeum jessiae*					
Etheostoma meadiae	Bluespar darter	G4	S2		
= *Etheostoma stigmaeum meadiae*					
Etheostoma osburni	Candy darter	G3	S1		
Etheostoma percnurum	Duskytail darter	G1	S1	LE	LE
Etheostoma swannanoa	Swannanoa darter	G4	S2		
Etheostoma variatum	Variegate darter	G5	S1		LE
Etheostoma vulneratum	Wounded darter	G3	S2S3		
Fundulus rathbuni	Speckled killifish	G4	S2		
Hybopsis hypsinotus	Highback chub	G4	S2		
= *Notropis hypsinotus*					
Ichthyomyzon bdellium	Ohio lamprey	G3G4	S2		
Ichthyomyzon greeleyi	Mountain brook lamprey	G4	S2		
Labidesthes sicculus	Brook silverside	G5	S2		
Lythrurus lirus	Mountain shiner	G4	S2S3		
= *Notropis lirus*					

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
FISH (continued)					
Moxostoma carinatum	River redhorse	G4	S2S3		
Moxostoma sp. 4	Brassy jumprock	G4	S1S2		
Notropis alborus	Whitemouth shiner	G4	S1		LT
Notropis ariommus	Popeye shiner	G3	S2S3		
Notropis atherinoides	Emerald shiner	G5	S1S2		LT
Notropis bifrenatus	Bridle shiner	G3	S2		
Notropis semperasper	Roughhead shiner	G2G3	S2S3		
Notropis spectrunculus	Mirror shiner	G4	S2		
Notropis stramineus	Sand shiner	G5	S2		
Noturus eleutherus	Mountain madtom	G4	S2S3		
Noturus flavipinnis	Yellowfin madtom	G1	S1	LT	LT
Noturus flavus	Stonecat	G5	S2		
Noturus gilberti	Orangefin madtom	G2	S2		LT
Percina aurantiaca	Tangerine darter	G4	S2S3		
Percina bimaculata	Chesapeake logperch	G1G2	SX		
Percina burtoni	Blotchside logperch	G2G3	S1		
Percina copelandi	Channel darter	G4	S2		
Percina crassa	Piedmont darter	G4	S1		
Percina evides	Gilt darter	G4	S2		
Percina maculata	Blackside darter	G5	SX		
Percina rex	Roanoke logperch	G1G2	S1S2	LE	LE
Percina sciera	Dusky darter	G5	S1S2		
Percina williamsi = *Percina macrocephala* (in part)	Sickle darter	G2	S1S2		LT
Percopsis omiscomaycus	Trout-perch	G5	SX		
Phenacobius crassilabrum	Fatlips minnow	G3G4	S2		
Phenacobius mirabilis	Suckermouth minnow	G5	S1S2		
Phenacobius teretulus	Kanawha minnow	G3G4	S2S3		
Pimephales vigilax	Bullhead minnow	G5	S1		
Polyodon spathula	Paddlefish	G4	S1		LT
Sander canadensis = *Stizostedion canadense*	Sauger	G5	S2S3		
Thoburnia hamiltoni = *Moxostoma hamiltoni*	Rustyside sucker	G3	S2		
Uranidea baileyi = *Cottus baileyi*	Black sculpin	G4Q	S2		
Uranidea cognata = *Cottus cognatus*	Slimy sculpin	G5	S2		
Uranidea sp. 1 = *Cottus* sp. 1	Bluestone sculpin	G2	S2		
Uranidea sp. 4 = *Cottus* sp. 4	Clinch sculpin	G1G2	S1S2		
Uranidea sp. 5 = *Cottus* sp. 5	Holston sculpin	G2	S2		

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
AMPHIBIANS					
Ambystoma mabeei	Mabee's salamander	G4	S1S2		LT
Ambystoma talpoideum	Mole salamander	G5	S2		
Ambystoma tigrinum	Tiger salamander	G5	S1		LE
Anaxyrus quercicus = *Bufo quercicus*	Oak toad	G5	S2		
Cryptobranchus alleganiensis	Hellbender	G3G4	S2		
Desmognathus marmoratus = *Leurognathus marmoratus*	Shovel-nosed salamander	G4	S2		
Desmognathus organi	Northern Pygmy salamander	G3	S2		
Eurycea wilderae	Blue Ridge two-lined salamander	G5	S2		
Hyla gratiosa	Barking treefrog	G5	S2		LT
Necturus maculosus	Mudpuppy	G5	S2		
Necturus punctatus	Dwarf waterdog	G5	S2S3		
Plethodon hubrichti	Peaks of Otter salamander	G2	S2		
Plethodon punctatus	Cow Knob salamander	G3	S2		
Plethodon shenandoah	Shenandoah salamander	G1	S1	LE	LE
Plethodon sherando	Big Levels salamander	G2	S2		
Plethodon ventralis	Southern zigzag salamander	G4	S1		
Plethodon virginia	Shenandoah Mountain salamander	G2G3	S2		
Plethodon welleri	Weller's salamander	G3	S2		
Siren intermedia	Lesser siren	G5	S2S3		
REPTILES					
Apalone spinifera = *Trionyx spiniferus*	Spiny softshell	G5	S2		
Caretta caretta	Loggerhead (sea turtle)	G3	S1B/S1N	LT	LT
Crotalus horridus [Coastal Plain population]	Canebrake rattlesnake	G4	S1		LE
Deirochelys reticularia	Chicken turtle	G5	S1		LE
Glyptemys insculpta = *Clemmys insculpta*	Wood turtle	G3	S2		LT
Glyptemys muhlenbergii = *Clemmys muhlenbergii*	Bog turtle	G3	S2	LT/SA	LE
Lampropeltis nigra = *Lampropeltis getula nigra*	Eastern black kingsnake	G5	S2		
Lepidochelys kempii	Kemp's ridley (sea turtle)	G1	S1N	LE	LE
Ophisaurus ventralis	Eastern glass lizard	G5	S1		LT
Pituophis melanoleucus	Pine snake	G4	SH		
Regina rigida	Glossy crayfish snake	G5	S1		
Sternotherus minor	Loggerhead musk turtle	G5	S2		
Trachemys scripta troostii	Cumberland slider	G5T4	S1		
Virginia valeriae pulchra	Mountain earthsnake	G5T3T4	S1S2		

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
BIRDS					
Actitis macularius	Spotted Sandpiper	G5	S1B		
Aegolius acadicus	Northern Saw-whet Owl	G5	S1B/S2N		
Ammodramus caudacutus	Saltmarsh Sparrow	G4	S2B/S3N		
Ammodramus henslowii	Henslow's Sparrow	G4	S1B		LT
Anas discors	Blue-winged Teal	G5	S1B/S2N		
Anas strepera	Gadwall	G5	S2B/S4N		
Aquila chrysaetos	Golden Eagle	G5	SHB/S1N		
Ardea alba = *Casmerodius albus*	Great Egret	G5	S2S3B/S3N		
Asio flammeus	Short-eared Owl	G5	S1B/S2N		
Asio otus	Long-eared Owl	G5	S1		
Bartramia longicauda	Upland Sandpiper	G5	SHB		LT/PDL
Botaurus lentiginosus	American Bittern	G4	S1B/S2N		
Calidris canutus rufa	Red Knot	G4T2	S2N	LT	PT
Catharus guttatus	Hermit Thrush	G5	S1B/S5N		
Catharus ustulatus	Swainson's Thrush	G5	S1B		
Charadrius melodus	Piping Plover	G3	S2B/S1N	LT	LT
Charadrius wilsonia	Wilson's Plover	G5	S1B		LE
Chondestes grammacus	Lark Sparrow	G5	SHB		
Circus cyaneus	Northern Harrier	G5	S1S2B/S3N		
Cistothorus platensis	Sedge Wren	G5	S1B/S1S2N		
Contopus cooperi = *Nuttallornis borealis*	Olive-sided Flycatcher	G4	SHB		
Dolichonyx oryzivorus	Bobolink	G5	S1B		
Egretta caerulea	Little Blue Heron	G5	S2B/S3N		
Egretta thula	Snowy Egret	G5	S2B/S3N		
Egretta tricolor	Tricolored Heron	G5	S2B/S3N		
Empidonax alnorum	Alder Flycatcher	G5	S1S2B		
Empidonax flaviventris	Yellow-bellied Flycatcher	G5	S1B		
Eudocimus albus	White Ibis	G5	S1B		
Falco peregrinus	Peregrine Falcon	G4	S1B/S2N		LT
Fulica americana	American Coot	G5	S1B/S5N		
Gallinula galeata = *Gallinula chloropus* (in part)	Common Gallinule	G5	S1B/S1N		
Gelochelidon nilotica = *Sterna nilotica*	Gull-billed Tern	G5	S2B		LT
Geothlypis philadelphia = *Oporornis philadelphia*	Mourning Warbler	G5	S1B		
Haemorhous purpureus = *Carpodacus purpureus*	Purple Finch	G5	S1B/S5N		
Himantopus mexicanus	Black-necked Stilt	G5	S1B		
Hydroprogne caspia = *Sterna caspia*	Caspian Tern	G5	S1B/S2N		
Lanius ludovicianus	Loggerhead Shrike	G4	S1B/S2N		LT
Laterallus jamaicensis	Black Rail	G3G4	S1B/S1N		LE
Limnothlypis swainsonii	Swainson's Warbler	G4	S2B		
Loxia curvirostra	Red Crossbill	G5	S1		

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
BIRDS (continued)					
Melospiza georgiana georgiana	Swamp Sparrow	G5T5	S1B/S4S5N		
Melospiza georgiana nigrescens	Coastal Plain Swamp Sparrow	G5T3	S1B		
Mergus merganser	Common Merganser	G5	S1B/S4N		
Nyctanassa violacea = *Nycticorax violaceus*	Yellow-crowned Night-heron	G5	S2S3B/S3N		
Oreothlypis ruficapilla = *Vermivora ruficapilla*	Nashville Warbler	G5	S1B		
Parkesia noveboracensis = *Seiurus noveboracensis*	Northern Waterthrush	G5	S1B		
Pelecanus occidentalis	Brown Pelican	G4	S2B/S3N		
Peucaea aestivalis = *Aimophila aestivalis*	Bachman's Sparrow	G3	S1B		LT
Picoides borealis	Red-cockaded Woodpecker	G3	S1	LE	LE
Plegadis falcinellus	Glossy Ibis	G5	S2B/S1N		
Podilymbus podiceps	Pied-billed Grebe	G5	S1S2B/S4N		
Porzana carolina	Sora	G5	S1B/S2N		
Rallus elegans	King Rail	G4	S2B/S3N		
Rallus limicola	Virginia Rail	G5	S2B/S3N		
Regulus satrapa	Golden-crowned Kinglet	G5	S2B/S5N		
Rynchops niger	Black Skimmer	G5	S2B/S1N		
Setophaga fusca = *Dendroica fusca*	Blackburnian Warbler	G5	S2S3B		
Setophaga magnolia = *Dendroica magnolia*	Magnolia Warbler	G5	S2B		
Setophaga virens waynei = *Dendroica virens waynei*	Wayne's Black-throated Green Warbler	G5T3	S1B?		
Sitta canadensis	Red-breasted Nuthatch	G5	S2B/S4N		
Sphyrapicus varius	Yellow-bellied Sapsucker	G5	S1B/S4N		
Sterna dougallii	Roseate Tern	G4	SHB	LE	LE
Sternula antillarum = *Sterna antillarum*	Least Tern	G4	S2B		
Thalasseus maximus = *Sterna maxima*	Royal Tern	G5	S2B		
Thalasseus sandvicensis = *Sterna sandvicensis*	Sandwich Tern	G5	S1B		
Thryomanes bewickii altus	Appalachian Bewick's Wren	G5T2Q	SHB		LE
Troglodytes hiemalis = *Troglodytes troglodytes* (in part)	Winter Wren	G5	S2B/S4N		

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VIRGINIA RARE ANIMAL LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
MAMMALS					
Corynorhinus rafinesquii macrotis = *Plecotus rafinesquii macrotis*	Eastern big-eared bat	G3G4T3	S2		LE
Corynorhinus townsendii virginianus = *Plecotus townsendii virginianus*	Virginia big-eared bat	G3G4T2	S1	LE	LE
Erethizon dorsatum	North American porcupine	G5	S1		
Glaucomys sabrinus coloratus	Carolina northern flying squirrel	G5T2	S1	LE	LE
Glaucomys sabrinus fuscus	Virginia northern flying squirrel	G5T2	S1		LE
Lepus americanus	Snowshoe hare	G5	S1		LE
Martes pennanti	Fisher	G5	S1		
Microtus chrotorrhinus carolinensis	Southern rock vole	G4T3	S1		LE
Myotis austroriparius	Southeastern myotis (bat)	G3G4	S2		
Myotis grisescens	Gray myotis (bat)	G3	S1	LE	LE
Myotis leibii	Eastern small-footed myotis (bat)	G1G3	S2		
Myotis lucifugus	Little Brown Bat	G3	S1S3		PE
Myotis septentrionalis	Northern long-eared myotis (bat)	G2G3	S1S3	LT	PT
Myotis sodalis	Indiana bat (= social myotis)	G2	S1	LE	LE
Perimyotis subflavus = *Pipistrellus subflavus*	Tricolored Bat (= Eastern Pipistrelle)	G3	S1S3		PE
Puma concolor couguar = *Felis concolor couguar*	Eastern cougar (= mountain lion, puma)	G5THQ	SX	LE	LE
Sciurus niger cinereus	Delmarva fox squirrel	G5T3	S1		LE
Sorex palustris punctulatus	Southern water shrew	G5T3	S1S2		LE

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
INVERTEBRATES					
TURBELLARIA (FLATWORMS)					
Geocentrophora cavernicola	A cave planarian	G1G2	S1		
Procotyla typhlops	A groundwater planarian	G1G2	S1S2		
Sphalloplana chandleri	Chandler's planarian	G1G2	S1		
Sphalloplana consimilis	Powell Valley planarian	G2G3	S1		
Sphalloplana holsingeri	Holsinger's groundwater planarian	G1G2	SH		
Sphalloplana hypogea	A groundwater planarian	G1G2	S1S2		
Sphalloplana subtilis	Bigger's groundwater planarian	G1G2	SH		
Sphalloplana virginiana	Rockbridge County cave planarian	G1	S1		
GASTROPODA (SNAILS)					
Anguispira jessica	Mountain disc	G3G4	S1		
= Anguispira alternata jessica					
Elimia arachnoidea	Spider Elimia	G2G3	S2		LE
= Goniobasis arachnoidea					
Fontigens bottimeri	Appalachian springsnail	G2G3	S2S3		LE
Fontigens morrisoni	Virginia springsnail	G2	S2		LE
Fontigens tartarea	Organ cavesnail	G2	S1S2		
Fumonelix wheatleyi clingmanicus	Clingman covert	G4T2T3	S1S2		
= Mesodon clingmanicus					
Glyphyalinia raderi	Maryland glyph	G2	S1S2		
Helicodiscus diadema	Shaggy coil	G1	S1		LE
Helicodiscus lirellus	Rubble coil	G1	S1		LE
Helicodiscus multidens	Twilight coil	G3	S2		
Helicodiscus triodus	Talus coil	G2	S1S2		
Holsingeria unthanksensis	Thankless ghostsnail (= Unthanks Cave snail)	G2	S2		LE
Io fluvialis	Spiny riversnail	G2	S2		LT
Mesodon andrewsae	Balsam globe	G3	S1		
Millerelix plicata	Cumberland liptooth	G4	S1S3		
= Polygyra plicata					
Pallifera hemphilli	Black mantleslug	G4	S1		
Paravitrea blarina	Shrew supercoil	G3	S1		
Paravitrea dentilla	Comb supercoil	G1	S1		
Paravitrea hera	Spirit supercoil	G1	S1		LE
Paravitrea mira	Funnel supercoil	G2	S2		
Paravitrea septadens	Brown supercoil	G1	S1		LT
Paravitrea seradens	Barred supercoil	G3	S1S3		
Paravitrea subtilis	Slender supercoil	G2	S1S2		
Pleurocera gradata	Bottle hornsnail	G1G2	SH/SU		
Polygyriscus virginianus	Virginia coil (=Virginia fringed mountain snail)	G1	S1	LE	LE
Somatogyrus virginicus	Panhandle pebblesnail	G2G3	S2		
Stagnicola neopalustris	Piedmont pondsnail	GHQ	SH		
Stenotrema altispira	Highland slitmouth	G3	S1		
Triodopsis picea	Spruce Knob threetooth	G3	S1		
Ventridens coelaxis	Bidentate dome	G3	S2		

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
BIVALVIA (MUSSELS & CLAMS)					
Mussels					
Alasmidonta heterodon	Dwarf wedgemussel	G1G2	S1	LE	LE
Alasmidonta marginata	Elktoe	G4	S1S2		
Alasmidonta varicosa	Brook floater	G3	S1		LE
Alasmidonta viridis	Slippershell mussel	G4G5	S1		LE
= *Alasmidonta minor*					
Cumberlandia monodonta	Spectaclecase	G3	S1	LE	LE
Cyprogenia stegaria	Fanshell	G1Q	S1	LE	LE
= *Cyprogenia irrorata*					
Dromus dromas	Dromedary pearlymussel	G1	S1	LE	LE
Elliptio crassidens	Elephantear	G5	S1		LE
Elliptio lanceolata	Yellow lance	G2G3	S2S3		
Elliptio roanokensis	Roanoke slabshell	G3	S2		
Epioblasma brevidens	Cumberland combshell	G1	S1	LE	LE
Epioblasma capsaeformis	Oyster mussel	G1	S1	LE	LE
Epioblasma florentina aureola	Golden riffleshell	G1T1	S1	LE*	LE*
= *Epioblasma florentina walkeri* (in part)					
Epioblasma torulosa gubernaculum	Green-blossom pearlymussel	G2TX	SX	LE	LE
Epioblasma triquetra	Snuffbox	G3	S1	LE	LE
Fusconaia cor	Shiny pigtoe	G1	S1	LE	LE
= *Fusconaia edgariana*					
Fusconaia cuneolus	Fine-rayed pigtoe	G1	S1	LE	LE
Fusconaia masoni	Atlantic pigtoe	G2	S2		LT
= *Lexingtonia subplana* (Virginia pigtoe)					
Hemistena lata	Cracking pearlymussel	G1	S1	LE	LE
= *Lastena lata*					
Lampsilis abrupta	Pink mucket	G2	SX	LE	LE
= *Lampsilis orbiculata*					
Lampsilis cariosa	Yellow lampmussel	G3G4	S2		
Lampsilis radiata	Eastern lampmussel	G5	S2S3		
Lasmigona holstonia	Tennessee heelsplitter	G3	S1		LE
Lasmigona subviridis	Green floater	G3	S2		LT
Lemiox rimosus	Birdwing pearlymussel	G1	S1	LE	LE
= *Conradilla caelata*					
Leptodea fragilis	Fragile papershell	G5	S1		LT
Ligumia recta	Black sandshell	G5	S2		LT
= *Ligumia recta latissima*					
Pegias fabula	Little-winged pearlymussel	G1	S1	LE	LE
Plethobasus cyphyus	Sheepnose	G3	S1	LE	LE
Pleurobema collina	James spinymussel	G1	S1	LE	LE
Pleurobema cordatum	Ohio pigtoe	G4	S1		LE
Pleurobema oviforme	Tennessee clubshell	G2G3	S2S3		
= *Pleurobema maculatum*					
Pleurobema plenum	Rough pigtoe	G1	SH	LE	LE
Pleurobema rubrum	Pyramid pigtoe	G2G3	SH		LE
= *Pleurobema pyramidatum*					
Pleuronaia barnesiana	Tennessee pigtoe	G2G3	S2		
= *Fusconaia barnesiana*					
Pleuronaia dolabelloides	Slabside pearlymussel	G2	S2	LE	LE
= *Lexingtonia dolabelloides*					
Ptychobranchus subtentum	Fluted Kidneyshell	G2	S2	LE	LE

*Virginia populations are listed as federally and state endangered under the name Tan Riffleshell (*Epioblasma florentina walkeri*)

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Mussels (continued)					
Quadrula cylindrica strigillata	Rough rabbits foot	G3G4T2	S2	LE	LE
Quadrula intermedia	Cumberland monkeyface	G1	S1	LE	LE
Quadrula pustulosa	Pimple back	G5	S2		LT
Quadrula sparsa	Appalachian monkeyface	G1	S1	LE	LE
Quadrula verrucosa	Pistolgrip	G4G5	S2		LT
= *Tritogonia verrucosa*					
Toxolasma lividum	Purple liliput	G3Q	SH		LE
= *Carunculina lividus, Carunculina glans*					
Truncilla truncata	Deertoe	G5	S1		LE
Villosa fabalis	Rayed bean	G2	SX	LE	LE
Villosa perpurpurea	Purple bean	G1	S1	LE	LE
Villosa trabalis	Cumberland bean	G1	SX	LE	LE
ANNELIDA (SEGMENTED WORMS)					
Spelaedrilus multiporus	A cave lumbriculid worm	G1	S1		
Stylodrilus beattiei	A cave lumbriculid worm	G2G3	S1		
ARACHNIDA (SPIDERS, PSEUDOSCORPIONS & RELATIVES)					
Spiders					
Anahita punctulata	Southeastern wandering spider	G4	S2		
Anthrobia coylei	Coyle's cave spider	G2?	S1		
Anthrobia monmouthia	Mammoth Cave spider	G5	S2		
= *Anthrobia mammouthia*					
Bathyphantes weyeri	A cave spider	G4	S1		
Hypochilus thorelli	Thorell's lampshade-web spider	G4	S1		
Islandiana muma	A cave spider	G1G2	S1		
Microhexura montivaga	Spruce-fir moss spider	G1	S1	LE	LE
Nesticus mimus	A cave spider	G2	S1		
Nesticus paynei	A cave spider	G3G4	S1		
Mites					
Traegaardhia paralleloseta	A cave mite	G1	S1		
= *Foveacheles paralleloseta*					
Pseudoscorpions					
Apochthonius coecus	A cave pseudoscorpion	G1G2	S1		
Apochthonius holsingeri	A cave pseudoscorpion	G1G2	S1		
Chitrella superba	A cave pseudoscorpion	G1	S1		
Chitrella sp. 1	A cave pseudoscorpion	G1	S1		
Kleptochthonius anophthalmus	A cave pseudoscorpion	G1	S1		
Kleptochthonius binoculatus	A cave pseudoscorpion	G1G2	S1S2		
Kleptochthonius gertschi	Gertsch's cave pseudoscorpion	G1	S1		
Kleptochthonius lutzi	Lutz's cave pseudoscorpion	G1	S1		
Kleptochthonius proximosetus	A cave pseudoscorpion	G1	S1		
Kleptochthonius regulus	A cave pseudoscorpion	G1G2	S1		
Kleptochthonius similis	A cave pseudoscorpion	G1	S1		
Kleptochthonius sp. 1	A cave pseudoscorpion	G1	S1		
= *Kleptochthonius* sp. B					
Lissocreagris valentinei	Valentine's cave pseudoscorpion	G1	S1		
= *Microcreagris valentinei*					
Mundochthonius holsingeri	A cave pseudoscorpion	G1	S1		

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Scorpions					
Vaejovis carolinianus	Carolina scorpion	G5	S1		
CRUSTACEA (AMPHIPODS, ISOPODS & DECAPODS)					
Amphipods					
Bactrurus angulus	Cumberland Gap cave amphipod	G1	S1		
Crangonyx baculispina	Lancaster County amphipod	G1?	S1?		
Crangonyx fontinalis	Bland County amphipod	G1?	S1?		
Crangonyx montanus	A freshwater amphipod	G2	S2		
Stygobromus baroodyi	Rockbridge County cave amphipod	G2G3	S1S2		
Stygobromus biggersi	Bigger's cave amphipod	G2G4	S1S2		
Stygobromus conradi	Burnsville Cove cave amphipod	G2G3	S1S2		
Stygobromus cumberlandus	Cumberland cave amphipod	G3G4	S1S2		
Stygobromus ephemerus	Ephemeral cave amphipod	G1G2	S1		
Stygobromus fergusoni	Montgomery County cave amphipod	G2G3	S1		
Stygobromus finleyi	Finley's cave amphipod	G3G4	S1		
Stygobromus foliatus	A groundwater amphipod	G2	S2		
Stygobromus hoffmani	Alleghany County cave amphipod	G2	S2		
Stygobromus hubbardi	Hupp's Hill cave amphipod	G1	S1		
Stygobromus interitus	New Castle Murder Hole amphipod	G1G2	SH		
Stygobromus leensis	Lee County cave amphipod	G1G2	S1S2		
Stygobromus mausi	Round Hill cave amphipod	G1	S1		
Stygobromus morrisoni	Morrison's cave amphipod	G2G3	S1S2		
Stygobromus mundus	Bath County cave amphipod	G2G3	S1S2		
Stygobromus obrutus	Pittsylvania well amphipod	G1G2	SH		
Stygobromus phreaticus	Northern Virginia well amphipod	G1	S1		
Stygobromus pizzinii	Pizzini's amphipod	G3G4	S1S2		
Stygobromus pseudospinosus	Luray Caverns amphipod	G1	S1		
Stygobromus sextarius	Capital area groundwater amphipod	G1	S1		
Stygobromus stegerorum	Madison Cave amphipod	G1	S1		LT
Stygobromus sp. 7	Sherando spinosoid amphipod	G2	S2		
Stygobromus sp. 8	A groundwater amphipod	G2G3	S2S3		
Stygobromus sp. 16	Helsley's Cave amphipod	G1	S1		
Stygobromus sp. 17	Massanutten spring amphipod	G2	S2		
Stygobromus sp. 18	Big Levels spring amphipod	G1?	S1?		
Stygobromus sp. 23	Shenandoah Mountain spring amphipod	G1?	S1?		
Isopods					
Amerigoniscus henroti	Powell Valley terrestrial cave isopod	G1G2	S1S2		
Antrolana lira	Madison Cave isopod	G2G4	S2	LT	LT
Caecidotea attenuata	Dismal Swamp isopod	G1G3	S1S3		
Caecidotea bowmani	Natural Bridge cave isopod	G1G2	S1S2		
Caecidotea cumberlandensis	Cumberland Gap cave isopod	G1G2	S1		
Caecidotea henroti	Henrot's cave isopod	G2	S2		
Caecidotea incurva	Incurved cave isopod	G2G4	S2		
Caecidotea mausi	Maus' cave isopod	G2	S2		
Caecidotea phreatica	Phreatic isopod	G2G3	S1S3		
Ligidium elrodii leensis	Lee County terrestrial cave isopod	G4G5T1T2	S1S2		
Ligidium elrodii scottensis	Scott County terrestrial cave isopod	G4G5T1T2	S1S2		
Lirceus culveri	Rye Cove isopod	G1	S1		
Lirceus usdagalun	Lee County cave isopod	G2G3	S1	LE	LE
Miktoniscus racovitzai	Racovitza's terrestrial cave isopod	G3G4	S2		

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Decapods					
Cambarus callainus = *Cambarus veteranus* (in part)	Big Sandy Crayfish	G2	S1S2	PE	LE*
Cambarus hatfieldi	Tug Valley crayfish	G3	S1		
Cambarus jezerinaci	Spiny scale crayfish	G3	S2		
Cambarus monongalensis	Blue crawfish	G5	S1?		
Macrobrachium ohione	Ohio river shrimp	G4	S1		
Orconectes erichsonianus	Reticulate crayfish	G5	S2		
Orconectes virginiensis	Chowanoke crayfish	G3	S2S3		
DIPLOPODA (MILLIPEDES)					
Appalachioria falcifera = *Brachoria falcifera*	Big Cedar Creek millipede	G1	S1		
Appalachioria separanda hamata = *Brachoria separanda hamata*	A millipede	G3T2	S2		
Appalachioria separanda versicolor = *Brachoria separanda versicolor*	A millipede	G3T2	S2		
Appalachioria turneri = *Brachoria turneri*	Turner's millipede	G1	S1		
Boraria infesta	A millipede	G4	S2		
Brachoria sp. 1	Powell Mountain millipede sp 1	G1?	S1?		
Brachoria sp. 2	Powell Mountain millipede sp 2	G1?	S1?		
Brachoria cedra	cedar glade mimic millipede	G2G3	S2S3		
Brachoria dentata	Pennington Gap mimic millipede	G2G3	S2S3		
Brachoria hoffmani	Hoffman's mimic millipede	G2G3	S2S3		
Brachoria insolita	High Knob mimic millipede	G1	S1		
Brachoria laminata	Harman mimic millipede	G1	S1		
Brachoria mendota	Mendota mimic millipede	G2G3	S2S3		
Brachoria sheari	Shear's mimic millipede	G1	S1		
Brachoria virginia	Virginia mimic millipede	G1	S1		
Cherokia georgiana latassa	A millipede	G4T?	S1		
Cleidogona hoffmani	Hoffman's cleidogonid millipede	G3	S2S3		
Cleidogona lachesis	A millipede	G2	S1		
Cleidogona medialis	Blowing Rock millipede	G3G4	S2		
Conotyla aeto	Aeto millipede	G1	S1		
Conotyla celeno	Celeno millipede	G1	S1		
Conotyla venetia	Venetia millipede	G2	S2		
Desmonus earlei	Earle's millipede	G5	S1		
Dixioria brooksi	Brooks millipede	G1	S1		
Dixioria fowleri	Fowler's millipede	G2	S2		
Dixioria pela coronata = *Dixioria coronata*	A millipede	G2T2	S2		
Nannaria shenandoa	Shenandoah Mountain xystodesmid millipede	G1	S1		
Nannaria simplex	A millipede	G1	S1		
Nannaria sp. 1	Roaring Branch Nannaria millipede	G1?	S1?		
Pseudotremia armesi	Arme's rough-backed millipede	G2	S2		
Pseudotremia cavernarum	Ellett Valley Pseudotremia millipede	G2G3	S1		LT
Pseudotremia cerberus	Cerberus cave millipede	G1	S1		
Pseudotremia contorta	Twisted-gonopod cave millipede	G1	S1		
Pseudotremia culveri	Culver's cave millipede	G1	S1		
Pseudotremia deprehendor	A cave millipede	G2G3	S1S3		
Pseudotremia fergusoni	Ferguson's cave millipede	G1	S1		

*Listed as state endangered under the name *Cambarus veteranus*.

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Millipedes (continued)					
Pseudotremia inexpectata	Devault's cave millipede	G1	S1		
Pseudotremia fremens	Roaring Branch rough-backed millipede	G1?	S1?		
Pseudotremia hubbardi	Hubbard's cave millipede	G1G2	S1S2		
Pseudotremia jaculohamatum	Harpoon cave millipede	G1	S1		
Pseudotremia johnholsingeri	Holsinger's cave millipede	G1	S1		
Pseudotremia loomisi	Lommis' rough-backed millipede	G1	S1		
Pseudotremia momus	A millipede	G2	S2		
Pseudotremia orndorffi	Orndorff's cave millipede	G2	S2		
Pseudotremia peponocranium	Pumpkin-headed cave millipede	G1	S1		
Pseudotremia piscator	Fisher Cave millipede	G1	S1		
Pseudotremia princeps	South Branch Valley cave millipede	G1	S1		
Pseudotremia ryensis	Rye Cove cave millipede	G1	S1		
Pseudotremia salifodina	Jones' Saltpetre Cave millipede	G1	S1		
Pseudotremia sublevis	A millipede	G2G3	S2S3		
Pseudotremia tuberculata	A millipede	G2G3	S2		
Pseudotremia valga	A millipede	G1G2	S1S2		
Rhysodesmus restans	Relictual Appalachian millipede	G1G2	S1		
Sigmoria whiteheadi	Laurel Creek xystodesmid millipede	G1	S1		LT
Trichopetalum lunatum	A millipede	G5	S2		
Zygonopus weyeriensis = *Trichopetalum weyeriensis*	Grand Caverns blind cave millipede	G3G4	S2		
Zygonopus whitei = *Trichopetalum whitei*	Luray Caverns blind cave millipede	G3G4	S2		
CHILOPODA (CENTIPEDES)					
Escaryus cryptorobius	Montane centipede	G2	S2		
Escaryus orestes	Whitetop Mountain centipede	G1G2	S1S2		
Nampabius turbator	A cave centipede	G1G2	S1		
INSECTS					
COLLEMBOLA (SPRINGTAILS)					
Oncopodura hubbardi	A cave springtail	G1G2	S1S2		
Paleonura petebellingeri	A cave springtail	G1	S1		
Pseudosinella bona	A cave springtail	G2	S2		
Pseudosinella erehwon	A cave springtail	G2	S2		
Pseudosinella extra	A cave springtail	G1G2	S1		
Pseudosinella flatua	A cave springtail	G1G2	S1S2		
Pseudosinella gisini virginia	A cave springtail	G3G4T2	S2		
Pseudosinella hirsuta	A cave springtail	G5	S1		
Pseudosinella testa	Shelled Cave springtail	G2G3	S1		
Pseudosinella vespera	A cave springtail	G2	S1S2		
Pygmarrhopalites caedus	A cave springtail	G1G2	S1S2		
Pygmarrhopalites commorus	A cave springtail	G2G3	S2S3		
Pygmarrhopalites lacuna	A cave springtail	G1G2	S1S2		
Pygmarrhopalites obtusus	A cave springtail	G1	S1		
Pygmarrhopalites sacer	A cave springtail	G2	S2		
Pygmarrhopalites sextus	A cave springtail	G1	S1		
Pygmarrhopalites silvus	A cave springtail	G1G2	S1S2		
Speleonura kenchristianseni	A cave springtail	G1	S1		
Typhlogastrura valentini	A cave springtail	G1	S1		

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DIPLURA (DIPLURANS)					
Litocampa fieldingae	Fielding's cave dipluran	G2G3	S1S3		
Litocampa pucketti	Puckett's cave dipluran	G1G2	S1S2		
Litocampa sp. 1	A cave dipluran (Salamander Cave)	G1	S1		
Litocampa sp. 2	A cave dipluran (Ward Cove)	G1	S1		
Litocampa sp. 3	A cave dipluran (Pulaski/Wythe)	G2	S2		
Litocampa sp. 4	A cave dipluran (Rye Cove)	G2	S1S2		
EPHEMEROPTERA (MAYFLIES)					
Baetisca rubescens	A mayfly	G3G4	S1		
Barbaetis benfieldi	Benfield's bearded small minnow mayfly	G2G4	S1		
Habrophlebiodes celeteria	A mayfly	G2G4	S2		
Homoeoneuria cahabensis	Cahaba sand-filtering mayfly	G2G3	SU		
Isonychia hoffmani	Hoffman's Isonychia mayfly	G1G3	S1		
Isonychia serrata	A mayfly	G4	S1S3		
Iswaeon rubrolaterale = *Heterocloeon rubrolaterale*, = *Plauditus rubrolateralis*	A mayfly	G2	SU		
Leptophlebia johnsoni	Johnson's pronggill mayfly	G4	S1		
Neoephemera compressa	A mayfly	G1S3	S1?		
Pseudiron centralis	White sand-river mayfly	G5	S1		
Siphloplecton costalense	Spieth's great speckled olive mayfly	G2G4	SH		
Tsalia berneri = *Ephemerella berneri*	Berner's Ephemerella mayfly	G4	S2		
ODONATA (DAMSELFLIES & DRAGONFLIES)					
Damselflies					
Calopteryx aequabilis	River jewelwing	G5	SH		
Calopteryx amata	Superb jewelwing	G4	S1		
Enallagma annexum = *Enallagma cyathigerum* (in part)	Northern bluet	G5	S1		
Enallagma carunculatum	Tule bluet	G5	SH		
Enallagma ebrium	Marsh bluet	G5	S1		
Enallagma pallidum	Pale bluet	G4	S1S2		
Lestes disjunctus	Northern spreadwing	G5	S2		
Nehalennia gracilis	Sphagnum sprite	G5	S2		
Nehalennia irene	Sedge sprite	G5	S1S2		
Dragonflies					
Aeshna canadensis	Canada darner	G5	S1		
Aeshna constricta	Lance-tipped darner	G5	SH		
Aeshna tuberculifera	Black-tipped darner	G4	S2S3		
Aeshna verticalis	Green-striped darner	G5	S1		
Aphylla williamsoni	Two-striped forceptail	G5	S2		
Arigomphus furcifer	Lilypad clubtail	G5	SH		
Celithemis martha	Martha's pennant	G4	S2		
Celithemis ornata	Faded pennant	G5	SH		
Cordulegaster diastatops	Delta-spotted spiketail	G5	S1		
Coryphaeschna ingens	Regal darner	G5	S1		

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Dragonflies (continued)					
Epitheca canis	Beaverpond baskettail	G5	S1		
= Tetragoneuria canis					
Epitheca semiaquea	Mantled baskettail	G5	S1		
= Tetragoneuria semiaquea					
Gomphus adelphus	Moustached clubtail	G4	S1		
= Gomphus brevis					
Gomphus apomyius	Banner clubtail	G3G4	SH		
Gomphus borealis	Beaverpond clubtail	G4	SH		
Gomphus consanguis	Cherokee clubtail	G3	S2		
Gomphus descriptus	Harpoon clubtail	G4	S1		
Gomphus fraternus	Midland clubtail	G5	S2		
Gomphus parvidens	Piedmont clubtail	G4	S1		
Gomphus septima	Septima's clubtail	G2	S1		
Gomphus ventricosus	Skillet clubtail	G3	S1		
Gomphus viridifrons	Green-faced clubtail	G3G4	S2		
Ladona exusta	White corporal skimmer	G4	SH		
= Libellula exusta					
Ladona julia	Chalk-fronted corporal skimmer	G5	S2S3		
= Libellula julia					
Lanthus parvulus	Northern pygmy clubtail	G4	S2		
Leucorrhinia frigida	Frosted whiteface	G5	SH		
Leucorrhinia hudsonica	Hudsonian whiteface	G5	S1		
Leucorrhinia proxima	Red-waisted whiteface	G5	SH		
Macrodiplax balteata	Marl pennant	G5	S1		
Macromia alleghaniensis	Allegheny river cruiser	G4	S2		
Macromia margarita	Mountain river cruiser	G3	SH		
Nannothemis bella	Elfin skimmer	G4	S1		
Neurocordulia virginiensis	Cinnamon shadowdragon	G4	S2		
Neurocordulia yamaskanensis	Stygian shadowdragon	G5	S2		
Ophiogomphus aspersus	Brook snaketail	G4	S2		
Ophiogomphus carolus	Riffle snaketail	G5	S1		
Ophiogomphus howei	Pygmy snaketail	G3	S1S2		
Ophiogomphus incurvatus alleghaniensis	Allegheny snaketail	G3T2T3	S1		
= Ophiogomphus alleghaniensis					
Ophiogomphus incurvatus incurvatus	Appalachian snaketail	G3T2T3	S2		
Ophiogomphus mainensis	Maine snaketail	G4	S1		
Ophiogomphus susbehcha	St. Croix snaketail	G2	S1S2		
Rhionaeschna mutata	Spatterdock darner	G4	S2		
= Aeshna mutata					
Somatochlora elongata	Ski-tipped emerald	G5	S1S2		
Somatochlora filosa	Fine-lined emerald	G5	S2		
Somatochlora georgiana	Coppery emerald	G3G4	SH		
Somatochlora provocans	Treetop emerald	G4	S2		
Somatochlora williamsoni	Williamson's emerald	G5	SH		
Stylogomphus sigmastylus	Interior least clubtail	G5	S1		
Stylurus amnicola	Riverine clubtail	G4	S1		
Stylurus laurae	Laura's clubtail	G4	S2		
Stylurus notatus	Elusive clubtail	G3	SH		
Stylurus scudderi	Zebra clubtail	G4	S1S2		
Sympetrum obtrusum	White-faced meadowhawk	G5	S2		

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PLECOPTERA (STONEFLIES)					
Acroneuria flinti	Manassas stonefly	GH	SH		
Acroneuria kirchneri	Strawberry stonefly	G3G4	S1S3		
Acroneuria kosztarabi	Virginia stonefly	G1G2	S1S2		
Acroneuria yuchi	Ornate stonefly	G1G3	S1S3		
Allocapnia fumosa	Smokies snowfly	G2	S1S2		
Allocapnia illinoensis	Illinois snowfly	G3	S1S3		
Allocapnia simmonsi	Spatulate snowfly	G3	S1S2		
Allocapnia stannardi	Blue Ridge snowfly	G3	S1S3		
Alloperla stipitata	Blue Ridge sallfly	G2G3	S1S3		
Cultus decisus isolatus	Southern springfly	G4T2	S1S2		
Diploperla kanawholensis	Kanawhole springfly	G3	S1S3		
Diploperla morgani	Virginia springfly	G3	S2		
Isoperla major	Big stripetail stonefly	G1	S1		
Leuctra mitchellensis	Mitchell needlefly	G3	S1S2		
Leuctra monticola	Montane needlefly	G1Q	S1		
Megaleuctra flinti	Shenandoah needlefly	G2	S2		
Megaleuctra williamsae	Smokies needlefly	G2	S1S2		
Perlesta cranshawi	A stonefly	G1	S1?		
Perlesta durfeei	A stonefly	G1G3	S1S3		
Perlesta frisoni	Blue Ridge stonefly	G3	S1S2		
Prostoia hallasi	Swamp forestfly	G3	S1S3		
Remenus kirchneri	Blue Ridge springfly	G2	S2		
Strophopteryx limata	Newfound willowfly	G3	S1S2		
Sweltsa holstonensis	Holston sallfly	G1	S1		
Sweltsa palearata	Shenandoah sallfly	G2G3	S1S3		
Sweltsa voshelli	Virginia sallfly	G3	S2		
Taeniopteryx nelsoni	Cryptic willowfly	G1	S1		
Tallaperla lobata	Lobed roachfly	G2	S1S2		
Yugus arinus	Highlands springfly	G3	S1S3		
Yugus kondratieffi	A stonefly	G2G3	S1S3		
ORTHOPTERA (GRASSHOPPERS, KATYDIDS, CRICKETS & RELATIVES)					
Appalachia hebardi	Appalachian grasshopper	GH	SH		
HEMIPTERA (TRUE BUGS, CICADAS, LEAFHOPPERS & RELATIVES)					
Bothynotus johnstoni	A mirid bug	G3	S1S3		
Chelinidea vittiger	Opuntia squash bug	G3G5	S1		
Chlorochroa dismalia	Dismal Swamp green stink bug	G1G3	S1S3		
Ctenotrachelus shermani	Combneck assassin bug	G3	S1S3		
Gnathobleda litigiosa	An assassin bug	G5	S1		
Limnoporus dissortis	A water strider	G5	S1		
Melanaethus cavicollis	A burrower bug	G4	S1S3		
Phytocoris hoffmani	Spruce plant bug	GNR	S1S3		
Ploiaria carolina	Carolina thread-legged bug	G4?	S1S3		
Ploiaria hirticornis	An assassin bug	G3?	S1S3		
Pnirontis brimleyi	Brimley's assassin bug	G2	S1S3		
Puto kosztarabi	Buffalo Mountain mealybug	G1	S1		LE
Pycnoderiella virginiana	Seashore plant bug	GU	SU		
Ramphocorixa acuminata	Acuminate water boatman	G4	S1		
Sigara depressa	Virginia Piedmont water boatman	G1G2	S1S2		LE
Stenocoris tipuloides	Neotropical rice bug	G5	S1S3		

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COLEOPTERA (BEETLES)					
Arianops jeanneli	A cave pselaphid beetle	G1	S1		
Atheta annexa	A rove beetle	G4	S2		
Atheta troglophila	A rove beetle	G2	S1		
Cicindela abdominalis	Eastern pine barrens tiger beetle	G3G4	S1		
Cicindela ancocisconensis	Appalachian tiger beetle	G3	S2		
Cicindela dorsalis dorsalis = *Habroscelimorpha dorsalis dorsalis*	Northeastern beach tiger beetle	G3G4T2	S2	LT	LT
Cicindela formosa generosa	Big sand tiger beetle	G5T5	SH		
Cicindela gratiosa = *Ellipsoptera gratiosa*	Whitish tiger beetle	G3G4	S1		
Cicindela lepida = *Ellipsoptera lepida*	Ghost tiger beetle	G3G4	S1		
Cicindela limbalis	Common claybank tiger beetle	G5	S1		
Cicindela patruela	Northern barrens tiger beetle	G3	S2		
Cicindela trifasciata	S-banded tiger beetle	G5	S1		
Copris howdeni	Howden's Copris scarab beetle	G3?	S1		
Dryobius sexnotatus	Six-banded longhorn beetle	GNR	S2?		
Hemipeplus microphthalmus	A flat bark beetle	G4?	S1		
Hydraena maureenae	Maureen's shale stream beetle	G2?	S2?		
Lordithon niger	Black Lordithon rove beetle	GU	SH		
Nicrophorus americanus	American burying beetle	G2G3	SH	LE	
Nicrophorus carolinus	Carolina burying beetle	G4?	S1S3		
Pseudanophthalmus avernus	Avernus cave beetle	G1	S1		
Pseudanophthalmus cordicollis	Little Kennedy Cave beetle	G1	S1		
Pseudanophthalmus deceptivus	Deceptive cave beetle	G1	S1		
Pseudanophthalmus delicatus	Delicate cave beetle	G3G4	S2		
Pseudanophthalmus egberti	New River Valley cave beetle	G1G2	S1		
Pseudanophthalmus gracilis	Clover Hollow cave beetle	G1G2	S1S2		
Pseudanophthalmus hirsutus	Cumberland Gap cave beetle	G1G2	S1		
Pseudanophthalmus hoffmani	Hoffman's cave beetle	G2G3	S1S2		
Pseudanophthalmus holsingeri	Holsinger's cave beetle	G1	S1		LE
Pseudanophthalmus hortulanus	Burkes Garden cave beetle	G1	S1		
Pseudanophthalmus hubbardi	Hubbard's cave beetle	G1	S1		
Pseudanophthalmus hubrichti	Hubricht's cave beetle	G1	S1		
Pseudanophthalmus intersectus	Crossroads Cave beetle	G1G2	S1		
Pseudanophthalmus limicola	Maddens Cave beetle	G1G2	S1		
Pseudanophthalmus longiceps	Long-headed cave beetle	G1G2	S1		
Pseudanophthalmus nelsoni	Nelson's cave beetle	G1G2	S1		
Pseudanophthalmus parvicollis	Hupp's Hill cave beetle	G1	S1		
Pseudanophthalmus petrunkevitchi	Petrunkevitch's cave beetle	G1G2	S1		
Pseudanophthalmus pontis	Natural Bridge cave beetle	G1	S1		
Pseudanophthalmus potomaca	South Branch Valley cave beetle	G3G4	S2		
Pseudanophthalmus praetermissus	Overlooked cave beetle	G1	S1		
Pseudanophthalmus punctatus	Spotted cave beetle	G2G3	S1		
Pseudanophthalmus pusio	Ellett Valley cave beetle	G2G3	S1S2		
Pseudanophthalmus quadratus	Straley's Cave beetle	G1	S1		
Pseudanophthalmus rotundatus	Rotund cave beetle	G2	S1		
Pseudanophthalmus sanctipauli	Saint Paul cave beetle	G1G2	S1		
Pseudanophthalmus seclusus	Rye Cove cave beetle	G2G3	S2		
Pseudanophthalmus sericus	Silken cave beetle	G1	S1		
Pseudanophthalmus thomasi	Thomas' cave beetle	G1G2	S1		LE
Pseudanophthalmus vicarius	Vicariant cave beetle	G2G3	S1S2		
Pseudanophthalmus virginicus	Maiden Spring cave beetle	G1	SH		

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Beetles (continued)					
Pseudanophthalmus sp. 4	Greears cave beetle	G1	S1		
Pseudanophthalmus sp. 5	Rhea Valley cave beetle	G1	S1		
Pseudanophthalmus sp. 6	Wytheville cave beetle	G1	S1		
Pseudanophthalmus sp. 7	Dublin cave beetle	G1	S1		
Pseudanophthalmus sp. 8	Burnsville Cove cave beetle	G1	S1		
Pseudanophthalmus sp. 9	Banner Cave beetle	G1	S1		
Pseudanophthalmus sp. 10	Indian Cave beetle	G1	S1		
Pseudanophthalmus sp. 11	Showalters Cave beetle	G1	S1		
Pseudanophthalmus sp. 12	Catawba Cave beetle	G1	S1		
Pseudanophthalmus sp. 13	McMullens Cave beetle	G1	S1		
Pseudanophthalmus sp. 14	Karl's Pit cave beetle	G1	S1		
Pseudanophthalmus sp. 42	Elk Garden cave beetle	G1	S1		
Pseudanophthalmus sp. 43	Rosedale cave beetle	G1	S1		
Sphaeroderus schaumii = *Sphaeroderus nitidicollis schaumii*	Schaum's false snail-eating beetle	G4	S2		
Stenelmis gammoni	Gammon's riffle beetle	G1G3	S1		
MECOPTERA (SCORPIONFLIES)					
Brachypanorpa jeffersoni	Jefferson's short-nosed scorpionfly	G2	S1S2		
TRICHOPTERA (CADDISFLIES)					
Agraylea costello	A microcaddisfly	G3	S1S2		
Agraylea multipunctata	A microcaddisfly	G5	SH		
Anabolia apora	A limnephilid caddisfly	G1G3	S1S3		
Arctopsyche irrorata	A hydropsychid caddisfly	G4	S1		
Brachycentrus incanus	A brachycentrid caddisfly	G5	SH		
Ceraclea ruthae	A leptocerid caddisfly	G4	S1		
Ceratopsyche etnieri	Buffalo Springs caddisfly	G2	S1S2		
Ceratopsyche macleodi	A hydropsychid caddisfly	G3G4	S1S2		
Cernotina calcea	A polycentropodid caddisfly	G5	S1		
Cernotina pallida	A polycentropodid caddisfly	G3G4	SH		
Cernotina truncona	A polycentropodid caddisfly	G4	S1		
Cheumatopsyche speciosa	A hydropsychid caddisfly	G5	SH		
Cheumatopsyche etrona	A hydropsychid caddisfly	G4G5	S1		
Cheumatopsyche virginica	A hydropsychid caddisfly	G5	S1		
Glossosoma lividum	A glossosomatid caddisfly	G5	S1S2		
Goerita semata	A caddisfly	G3	S1		
Hydropsyche bassi	A hydropsychid caddisfly	G2	S2		
Hydroptila anisoforficata	A microcaddisfly	G1G2	SU		
Hydroptila coweetensis	A microcaddisfly	G1G2	SU		
Lepidostoma mitchelli	A lepidostomatid caddisfly	G3	S1		
Lepidostoma modestum	A lepidostomatid caddisfly	G3G4	S2		
Nemotaulius hostilis	A limnephilid caddisfly	G5	S1		
Neophylax acutus	A uenoid caddisfly	G2G3	S1S3		
Neophylax atlanta	A uenoid caddisfly	G2G4	SH		
Neophylax etnieri	A uenoid caddisfly	G3	S1S3		
Neophylax toshioi	A uenoid caddisfly	G1G2	S1S2		
Oligostomis pardalis	A phryganeid caddisfly	G5	S1S2		
Polycentropus rickeri	A polycentropodid caddisfly	G3G4	SH		
Potamyia flava	A hydropsychid caddisfly	G5	SH		
Psilotreta rossi	An odontocerid caddisfly	G3	S2		

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Caddisflies (continued)					
Rhyacophila appalachia	Appalachian rhyacophilid caddisfly	G3	S2		
Rhyacophila kondratieffi	A rhyacophilid caddisfly	G2G3	S2S3		
Rhyacophila mainensis	A rhyacophilid caddisfly	G5	S1S2		
Rhyacophila mycta	A rhyacophilid caddisfly	G3	S1S2		
Rhyacophila teddyi	A rhyacophilid caddisfly	G2G3	S2		
Rhyacophila simmonsi	A rhyacophilid caddisfly	G1G3	S1S3		
Rhyacophila tricornuta	A rhyacophilid caddisfly	G1G3	S1S3		
Wormaldia mohri	A philopotamid caddisfly	G2G3	S1		
Wormaldia thyria	A philopotamid caddisfly	G3	S2		
LEPIDOPTERA (BUTTERFLIES, SKIPPERS & MOTHS)					
Butterflies					
Anaea andria	Goatweed leafwing	G4G5	S1		
Boloria selene	Silver-bordered fritillary	G5	S2		
Calephelis virginiensis	Little metalmark	G4	SH		
Callophrys hesseli = *Mitoura hesseli*	Hessel's hairstreak	G3G4	S1		
Callophrys irus = *Incisalia irus, Deciduphagus irus*	Frosted elfin	G3	S2?		
Callophyrs polios = *Incisalia polios, Deciduphagus polios*	Hoary elfin	G5	S1S3		
Chlosyne harrisii	Harris's checkerspot	G4	S1		
Colias interior	Pink-edged sulphur	G5	S1S2		
Erora laeta	Early hairstreak	GU	S2		
Euchloe olympia	Olympia marble	G4G5	S2		
Lycaena hyllus	Bronze copper	G5	S1		
Neonympha helicta = *Neonympha areolatus septentrionalis*	Helicta satyr	G3G4	S2		
Neonympha mitchellii	Mitchell's satyr	G2	S1	LE	LE
Phyciodes batesii batesii	Tawny crescent	G4T1	SX		
Phyciodes cocyta = *Phyciodes pascoensis, Phyciodes selenis*	Northern crescent	G5	S1S3		
Polygonia faunus smythi	Smyth's green comma	G5T3	S1S3		
Satyrium kingi	King's hairstreak	G3G4	S2		
Speyeria atlantis	Atlantis fritillary	G5	S2		
Speyeria idalia	Regal fritillary	G3	S1		
Skippers					
Amblyscirtes alternata	Dusky roadside skipper	G2G3	SH		
Atrytone arogos arogos	Arogos skipper	G3T1T2	SH		
Erynnis lucilius	Columbine duskywing	G4	S1S3		
Erynnis martialis	Mottled duskywing	G3	S1S3		
Erynnis persius persius	Persius duskywing	G5T1T3	S1		
Euphyes bimacula	Two-spotted skipper	G4	S2		
Euphyes conspicua	Black dash	G4	SH		
Euphyes dukesi	Dukes' skipper	G3	S2		
Euphyes pilatka	Palatka skipper (= sawgrass skipper)	G3G4	S1		
Hesperia attalus slossonae	Seminole skipper (= dotted skipper)	G3G4T3	SH		
Megathymus yuccae	Yucca giant skipper	G5	SH		
Problema bulenta	Rare skipper	G2G3	S1S2		
Pyrgus centaureae wyandot = *Pyrgus wyandot*	Appalachian grizzled skipper	G5T1T2	S1		LT

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Moths					
Acherdoa ferraria	Chocolate moth	G5	S2		
Acrapex relicta	Cane-boring moth	G4	S2S3		
Acronicta albarufa	Barrens dagger moth	G3G4	S1S3		
Acronicta brumosa	A dagger moth	G4?	S1S2		
Acronicta dolli	Doll's dagger moth	G3G4	S1S3		
= Merolonche dolli					
Amolita roseola	Roseate grass moth	G5	S1		
Anaplectoides brunneomedia	Brown-lined dart moth	G4	S2		
Apamea smythi	Smyth's Apamea moth	GH	SH		
Aplectoides condita	A noctuid moth	G4	S1S3		
Apodrepanulatrix liberaria	New Jersey tea inchworm moth	G3	S2		
Arctia caja	Great Tiger Moth	G5	S1		
Argillophora furcilla	A cane moth	G3G4	S1S3		
Argyrostrotis deleta	A noctuid moth	G4G5	S1S3		
Argyrostrotis sylvarum	Woodland chocolate moth	G4	S1S3		
Brachionycha borealis	Boreal fan moth	G4	S1S3		
Callosamia securifera	Sweetbay silkmoth	G4	S1S2		
Catocala consors	Consort underwing	G4	SH		
Catocala dulciola	Sweet underwing	G3	S1S3		
Catocala herodias gerhardi	Pine barrens underwing	G3T3	S2S3		
Catocala marmorata	Marbled underwing	G3G4	S2		
Catocala messalina	Messalina underwing	G4?	SH		
Catocala pretiosa pretiosa	Precious underwing	G4T2	SH		
Catocala relicta	White underwing	G5	S2		
Catocala ulalume	Ulalume underwing	G4	S1S3		
Cerma cora	Owl-eyed Bird Dropping Moth	G3G4	S1S3		
Coptotriche perplexa	Chestnut leaf-mining moth	GHQ	SH		
= Tischeria perplexa					
Crambidia cephalica	Yellow-headed lichen moth	G5	S1S2		
Ctenucha virginica	Virginia Ctenucha moth	G5	S2		
Cycnia inopinatus	Unexpected Cycnia moth	G4	S1S3		
Cymatophora approximaria	Giant gray moth	G4G5	S1S3		
Dargida rubripennis	Pink-streak moth	G3G4	S2		
= Faronta rubripennis					
Dichagyris grotei	A noctuid moth	G4	S1S3		
= Loxagrotis apicalis, Richia grotei					
Drasteria graphica	Graphic moth	G4	S1S3		
Eilema bicolor	Bicolored moth	G5	S1		
Erastria coloraria	Broad-lined Erastria moth	G3G4	S2?		
Euchlaena milnei	Milne's Euchlaena moth	G2G4	S2		
Eulithis propulsata	Currant Eulithis moth	GNR	S1S3		
Euxoa fumalis	A dart moth	GNR	S1S3		
Euxoa immixta	Mixed dart moth	G4	S1S3		
Exyra ridingsii	Green pitcher plant moth	G2G4	SH		
Franclemontia interrogans	A cane moth	G3G4	S1S3		
Gondysia telma	Telma darkwing moth	GNR	S1S2		
= Neadysgonia telma					
Graphiphora augur	Double Dart Moth	G5	S1		
Hadena ectypa	Catchfly moth	G3G4	S2		
Heterocampa astarte	A prominent moth	G4G5	S1S2		
Hyppa contrasta	Summer Hyppa moth	G3G4	S1S3		
Idaea tacturata	A geometrid moth	G4	S1S2		
Leucania calidior	A cane moth	G2G4	S2		

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Moths (continued)					
Lithophane adipel	A pinion moth	G4	S1S3		
= Lithophane lepida adipel					
Lithophane georgii	Large grey pinion moth	G5	S1S2		
Lithophane lemmeri	Lemmer's pinion moth	G3G4	S1S3		
Loscopia roblei	A cane moth	G3G4	S1S2		
Lytrosis permagnaria	A geometrid moth	G3G4	S2		
Macaria distribuaria	A geometrid moth	G4	S1S2		
= Semiothisa distribuaria					
Meropleon cosmion	A noctuid moth	G4	S2S3		
Meropleon titan	A noctuid moth	G2G4	S1S3		
Metria amella	A noctuid moth	G5	S1S2		
Nemoria tuscarora	Tuscarora emerald	GU	S1S3		
Odontosia elegans	Elegant prominent	G5	S1S3		
Oligia bridghamii	Bridgham's brocade moth	G4	S1		
Oxycilla mitographa	A noctuid moth	G4	SH		
Paectes abrostolella	A noctuid moth	G4	S1S2		
Papaipema araliae	Aralia shoot borer moth	G3G4	S2S3		
Papaipema astuta	Yellow stoneroot borer moth	G2G4	S1S3		
Papaipema duovata	Seaside goldenrod borer moth	G4	S2S3		
Papaipema duplicata	Dark stoneroot borer moth	G2G4	S2		
Papaipema necopina	Sunflower borer moth	G4?	S1S3		
Papaipema stenocelis	Chain fern borer moth	G4	S1S3		
Papaipema sp. 3	Southeastern cane borer moth	G4	S2S3		
Platypolia anceps	A noctuid moth	GNR	S1S2		
Polia purpurissata	Purple arches moth	GNR	SH		
Properigea costa	A noctuid moth	G4	S2		
Protodeltote sp. 1	A noctuid moth	G1G3	S1S2		
Psectrotarsia hebardi	Hebard's noctuid moth	GU	SH		
= Erythroecia hebardi					
Ptichodis bistrigata	Southern Ptichodis moth	G3	S1S3		
Pygarctia abdominalis	Yellow-edged Pygarctia moth	G3	S1S2		
Pyrrhia aurantiago	Aureolaria seed borer moth	G3G4	S1S3		
= Rhodoecia aurantiago					
Rheumaptera hastata	Spear-marked black moth	G5	S2		
Schinia siren	A flower moth	GNR	S1S2		
= Schinia inclara					
Schizura apicalis	Plain Schizura moth	G3G4	S1S3		
Speranza exonerata	Barrens Speranza moth	G3G4	S1S3		
Speranza ribearia	Currant spanworm moth	G4	S2S3		
= Itame ribearia					
Sphinx franckii	Franck's sphinx	G4	S2S3		
Sympistis perscripta	Scribbled sallow moth	G4	S1S3		
= Lepipolys perscripta					
Synanthedon castaneae	Chestnut clearwing moth	G3G5	SH		
Syngrapha alias	Hooked silver Y moth	G5	S1S2		
Syngrapha rectangula	Salt-and-pepper looper moth	G5	S2		
Tricholita notata	Marked Tricholita moth	G5	SH		
Xanthorhoe iduata	A geometrid moth	G4	S1S3		
Zale curema	A noctuid moth	G4	S1S3		
Zale lunifera	Pine barrens Zale moth	G3G4	S2		

VA DEPARTMENT OF CONSERVATION & RECREATION
DIVISION OF NATURAL HERITAGE

VIRGINIA RARE ANIMAL LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
DIPTERA (TRUE FLIES)					
Basilia boardmani	Southeastern myotis bat fly	G3	S1S2		
Fletcherimyia fletcheri	Pitcher plant fly	G5	S1S2		
Metriocnemus knabi	Pitcher plant midge	G5	S2		
Spelobia tenebrarum	A cave fly	G5	S1		
Wyeomyia smithii =*Wyeomyia haynei*	Pitcher plant mosquito	G5	S2		
HYMENOPTERA (BEES, WASPS, ANTS, & RELATIVES)					
Bombus affinis	Rusty-patched bumble bee	G1	S1		
ANIMAL ASSEMBLAGES					
Landbird Migratory Concentration Area		G3	S1		
Shorebird Migratory Concentration Area		G3	S2		
Colonial Wading Bird Colony		G5	S2		
Bird Nesting Colony		G5	SNR		
Freshwater Mussel Concentration Site		G3	SNR		
Monarch Butterfly Migratory Roost Site		GU	S1		

PART TWO:

ANIMAL WATCHLIST

NATURAL HERITAGE ANIMAL WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
VERTEBRATES					
FISH					
Ambloplites cavifrons	Roanoke bass	G3	S3		
Chologaster cornuta	Swampfish	G5	S3		
Enneacanthus obesus	Banded sunfish	G5	S3		
Erimystax dissimilis = *Hybopsis dissimilis*	Streamline chub	G4	S3		
Erimystax insignis = *Hybopsis insignis*	Blotched chub	G4	S3		
Etheostoma kanawhae	Kanawha darter	G4	S3		
Etheostoma simoterum	Snubnose darter	G3G4	S3		
Etheostoma tennesseense	Tennessee darter	G5	S3		
Etheostoma zonale	Banded darter	G5	S3		
Fundulus catenatus	Northern studfish	G5	S3		
Fundulus lineolatus	Lined topminnow	G5	S3		
Lampetra aepyptera	Least brook lamprey	G5	S3		
Lampetra appendix	American brook lamprey	G4	S3		
Margariscus margarita = *Semotilus margarita*	Pearl dace	G4	S3		
Moxostoma ariommum = *Scartomyzon ariommus*	Bigeye jumprock	G4	S3		
Moxostoma duquesnei	Black redhorse	G5	S3		
Notropis chalybaeus	Ironcolor shiner	G4	S3		
Notropis chiliticus	Redlip shiner	G4	S3		
Notropis sp. 4	Sawfin shiner	G4	S3		
Percina caprodes	Logperch	G5	S3		
Percina gymnocephala	Appalachia darter	G4	S3		
Percina oxyrhynchus	Sharpnose darter	G4	S3		
Phenacobius uranops	Stargazing minnow	G4	S3		
Uranidea kanawhae = *Cottus kanawhae*	Kanawha sculpin	G4	S3		
AMPHIBIANS					
Aneides aeneus	Green salamander	G3G4	S3		
Desmognathus orestes	Blue Ridge dusky salamander	G4	S3		
Lithobates virgatipes = *Rana virgatipes*	Carpenter frog	G4	S3		
Plethodon kentucki	Cumberland Plateau salamander	G4	S3		
Plethodon montanus	Northern Gray-cheeked salamander	G4	S3		
Plethodon yonahlossee	Yonahlossee salamander	G4	S3		
Pseudacris nigrita	Southern chorus frog	G5	S3		
Pseudacris ocularis = *Limnaoedus ocularis*	Little grass frog	G5	S3		
Siren lacertina	Greater siren	G5	S3		
Stereochilus marginatus	Many-lined salamander	G5	S3		
REPTILES					
Farancia erytrogramma	Rainbow snake	G4	S3		
Graptemys geographica	Northern map turtle	G5	S3		
Malaclemys terrapin	Diamond-backed terrapin	G4	S3		
Opheodrys vernalis = *Liochlorophis vernalis*	Smooth greensnake	G5	S3		
Plestiodon anthracinus = *Eumeces anthracinus*	Coal skink	G5	S3		
Tantilla coronata	Southeastern crowned snake	G5	S3		

NATURAL HERITAGE ANIMAL WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
BIRDS					
Accipiter cooperii	Cooper's Hawk	G5	S3B/S3N		
Ardea herodias	Great Blue Heron	G5	S3B/S5N		
Cardellina canadensis = *Wilsonia canadensis*	Canada Warbler	G5	S3S4B		
Certhia americana	Brown Creeper	G5	S3B/S5N		
Empidonax minimus	Least Flycatcher	G5	S3S4B		
Haematopus palliatus	American Oystercatcher	G5	S3B/S3N		
Haliaeetus leucocephalus	Bald Eagle	G5	S3S4B/S3S4N		
Ictinia mississippiensis	Mississippi Kite	G5	S2B		
Ixobrychus exilis	Least Bittern	G5	S3B/S3N		
Nycticorax nycticorax	Black-crowned Night-heron	G5	S3B/S4N		
Passerculus sandwichensis	Savannah Sparrow	G5	S3S4B/S4N		
Petrochelidon pyrrhonota	Cliff Swallow	G5	S3S4B		
Riparia riparia	Bank Swallow	G5	S3B		
Setophaga cerulea = *Dendroica cerulea*	Cerulean Warbler	G4	S3S4B		
Spiza americana	Dickcissel	G5	S2S3B		
Sterna forsteri	Forster's Tern	G5	S3B/S3N		
Sterna hirundo	Common Tern	G5	S3B		
Tyto alba	Barn Owl	G5	S3B/S3N		
Vermivora chrysoptera	Golden-winged Warbler	G4	S3B		
Vermivora cyanoptera = *Vermivora pinus*	Blue-winged Warbler	G5	S3B		
MAMMALS					
Blarina brevicauda telmalestes	Dismal Swamp short-tailed shrew	G5T3	S3		
Lasionycteris noctivagans	Silver-haired bat	G5	SUB/S4N		
Lasiurus cinereus	Hoary bat	G5	SUB/S3N		
Lontra canadensis = *Lutra canadensis*	Northern river otter	G5	S4		
Mustela nivalis	Least weasel	G5	S3		
Neotoma magister	Allegheny (or Appalachian) woodrat	G3G4	S3		
Peromyscus gossypinus	Cotton mouse	G5	S3		
Sciurus niger niger	Southeastern fox squirrel	G5T5	S3		
Sorex dispar	Long-tailed or rock shrew	G4	S3		
Sorex longirostris fisheri	Dismal Swamp southeastern shrew	G5T4	S3		LT/PDL
Spilogale putorius	Eastern spotted skunk	G4	S3S4		
Sylvilagus obscurus = *Sylvilagus transitionalis* ?	Appalachian cottontail (New England cottontail)	G4	S4?		
Sylvilagus palustris	Marsh rabbit	G5	S3		
Synaptomys cooperi helaletes	Dismal Swamp bog lemming	G5T3	S3		

NATURAL HERITAGE ANIMAL WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
INVERTEBRATES					
GASTROPODA (SNAILS)					
Elimia catenaria	Gravel Elimia	G4	S3		
= Pleurocera catenaria					
Fontigens orolibas	Blue Ridge springsnail	G3	S3		
Glyphyalinia picea	Rust glyph	G3	S1S3		
Glyphyalinia virginica	Depressed glyph	G3	S3		
Hendersonia occulta	Cherrystone Drop	G4	S3		
Leptoxis praerosa	Onyx rocksnail	G5	S3		
= Anculosa subglobosa					
Megapallifera wetherbyi	Blotchy mantleslug	G2G3	S1S3		
Mesodon elevatus	Proud globe	G5	S2?		
Mesomphix rugeli	Wrinkled button	G4	S3		
Patera panselenus	Virginia bladetooth	G3	S2?		
= Mesodon panselenus					
Philomycus virginicus	Virginia mantleslug	G3	S3		
Promenetus exacuous	Sharp Sprite	G5	S3		
Triodopsis burchi	Pittsylvania three-tooth	G3	S3		
Triodopsis fraudulenta	Baffled three-tooth	G4	S3		
Triodopsis tennesseensis	Budded three-tooth	G4	S3		
Ventridens arcellus	Golden dome	G4	S3		
Ventridens lasmodon	Hollow dome	G4	S3		
Ventridens pilsbryi	Yellow dome	G4	S3		
BIVALVIA (MUSSELS & CLAMS)					
Alasmidonta undulata	Triangle floater	G4	S3S4		
Anodonta implicata	Alewife floater	G5	S3?		
Fusconaia subrotunda	Longsolid	G3	S3		
Leptodea ochracea	Tidewater mucket	G3G4	S3		
= Ligumia ochracea					
Ligumia nasuta	Eastern pondmussel	G4	S3		
Medionidus conradicus	Cumberland moccasinshell	G3G4	S3S4		
Strophitus undulatus	Creeper	G5	S3S4		
Villosa constricta	Notched rainbow	G3	S3		
Villosa vanuxemensis	Mountain creekshell	G4	S3S4		
ARACHNIDA (SPIDERS, PSEUDOSCORPIONS & RELATIVES)					
Spiders					
Antrodiaetus robustus	Robust trapdoor spider	G3?	S2?		
Hypochilus gertschi	Gertsch's lampshade-web spider	G3	S3		
Hypochilus pococki	Pocock's lampshade-web spider	G4G5	S2S3		
Nesticus holsingeri	Holsinger's cave spider	G3G4	S3		
Nesticus tennesseensis	A cave spider	G3G4	S3S4		
Sphodros atlanticus	Atlantic purse-web spider	G4	S3		
Sphodros coylei	Coyle's purse-web spider	G4?	S3		
Sphodros niger	Black purse-web spider	G4G5	S3		
Pseudoscorpions					
Chitrella cavicola	A cave pseudoscorpion	G3	S3		

NATURAL HERITAGE ANIMAL WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
CRUSTACEA (AMPHIPODS, ISOPODS & DECAPODS)					
Amphipods					
Crangonyx antennatus	Appalachian Valley cave amphipod	G5	S3		
Gammarus pseudolimnaeus	Northern spring amphipod	G5	S3		
Stygobromus araeus	Tidewater interstitial amphipod	G3	S3		
Stygobromus abditus	James Cave amphipod	G3	S3		
Stygobromus estesi	Craig County cave amphipod	G4	S3		
Stygobromus gracilipes	Shenandoah Valley cave amphipod	G3G4	S3		
Stygobromus indentatus	Tidewater amphipod	G3	S3		
Stygobromus spinosus	Blue Ridge spring amphipod	G3	S3		
Isopods					
Caecidotea holsingeri	Greenbrier Valley cave isopod	G5	S3		
Caecidotea pricei	Price's cave isopod	G5	S3		
Caecidotea recurvata	Southwestern Virginia cave isopod	G5	S3		
Caecidotea richardsonae	Tennessee Valley cave isopod	G5	S3		
Caecidotea vandeli	Vandel's cave isopod	G3G4	S3		
Decapods					
Cambarus angularis	Angled crayfish	G3	S3		
Cambarus chasmodactylus	New River crayfish	G4	S3		
Cambarus diogenes	Devil crawfish	G5	S3		
Cambarus longirostris	Longnose crayfish	G5Q	S3		
Cambarus sciotensis	Teays River crayfish	G5	S3		
Fallicambarus fodiens = *Fallicambarus uhleri*	Digger crayfish	G5	S3		
Orconectes cristavarius	Spiny stream crayfish	G5	S3		
Orconectes forceps	Surgeon crayfish	G5	S3		
Orconectes obscurus	Allegheny crayfish	G5	S3		
DIPLOPODA (MILLIPEDES)					
Abacion tesselatum	A millipede	G5	S3		
Andrognathus corticarius	A millipede	G5	S3		
Apheloria montana	A millipede	G5	S3		
Apheloria tigana	A millipede	G5	S3		
Brachycybe lecontii	A millipede	G5	S3		
Buotus carolinus	A millipede	G3	S3		
Cambala hubrichti	A millipede	G5	S3		
Cambala minor	A millipede	G5	S3		
Conotyla melinda	Melinda millipede	G3	S3		
Gyalostethus monticolens	A millipede	G4	S3		
Nannaria ericacea	McGraw Gap xystodesmid millipede	G3	S3		
Nannaria morrisoni	A millipede	G3	S3		
Nannaria wilsoni	A millipede	G3	S3		
Rudiloria kleinpeteri	A millipede	G3	S3		
Rudiloria trimaculata tortua	A millipede	G5T2	S2?		
Semionellus placidus	A millipede	G3	S3		
Zygonopus packardi = *Trichopetalum packardi*	Packard's blind cave millipede	G4	S3		

NATURAL HERITAGE ANIMAL WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
INSECTS					
COLLEMBOLA (SPRINGTAILS)					
Pseudosinella granda	A cave springtail	G3	S3		
Pygmarrhopalites carolynae	A cave springtail	G4	S3		
Pygmarrhopalites clarus	A cave springtail	G4	S3		
Pygmarrhopalites marshalli	A cave springtail	G3	S3		
Pygmarrhopalites pavo	A cave springtail	G3?	S3		
Schaefferia hubbardi	A cave springtail	G3	S3		
Sinella barri	Barr's cave springtail	G5	S3		
DIPLURA (DIPLURANS)					
Litocampa cookei	Cooke's cave dipluran	G5	S3		
ODONATA (DAMSELFLIES & DRAGONFLIES)					
Damselflies					
Argia bipunctulata	Seepage dancer	G4	S3		
Calopteryx angustipennis	Appalachian jewelwing	G4	S3		
Enallagma daeckii	Attenuated bluet	G4	S3		
Enallagma doubledayi	Atlantic bluet	G5	S3		
Enallagma dubium	Burgundy bluet	G5	S3		
Enallagma hageni	Hagen's bluet	G5	S3		
Enallagma weewa	Blackwater bluet	G5	S3		
Ischnura prognata	Furtive forktail	G4	S3		
Lestes forcipatus	Sweetflag spreadwing	G5	S3		
Nehalennia integricollis	Southern sprite	G5	S3		
Telebasis byersi	Duckweed firetail	G5	S3		
Dragonflies					
Anax longipes	Comet darner	G5	S3		
Cordulegaster erronea	Tiger spiketail	G4	S3		
Cordulia shurtleffii	American emerald	G5	S3		
Epitheca spinosa = *Tetragoneuria spinosa*	Robust baskettail	G4	S3		
Gomphaeschna antilope	Taper-tailed darner	G4	S3		
Gomphus abbreviatus	Spine-crowned clubtail	G4	S3		
Gomphus dilatatus	Blackwater clubtail	G5	S3		
Gomphus quadricolor	Rapids clubtail	G3G4	S3		
Gomphus rogersi	Sable clubtail	G4	S3		
Helocordulia selysii	Selys' sundragon	G4	S3		
Leucorrhinia intacta	Dot-tailed whiteface	G5	S3		
Libellula flavida	Yellow-sided skimmer	G5	S3		
ORTHOPTERA (GRASSHOPPERS, KATYDIDS, CRICKETS & RELATIVES)					
Scudderia septentrionalis	Northern bush katydid	G3?	S3		
COLEOPTERA (BEETLES)					
Cicindela dorsalis media = *Habroscelimorpha dorsalis media*	White tiger beetle	G3G4T3T4	S3		
Cicindela purpurea	Purple tiger beetle	G5	S3		
Cicindela splendida	Splendid tiger beetle	G5	S3		

NATURAL HERITAGE ANIMAL WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Beetles (continued)					
Megacephala carolina = *Tetracha carolina*	Carolina big-headed tiger beetle	G5	S3		
Nicrophorus defodiens	A burying beetle	G4	S3		
Phloeoxena signata	A ground beetle	G3?	S3		
TRICHOPTERA (CADDISFLIES)					
Adicrophleps hitchcocki	A brachycentrid caddisfly	G4G5	S1S3		
Agapetus tomus	A glossosomatid caddisfly	G5	S1S3		
Agarodes libalis	Spring-loving psiloneuran caddisfly	G3	S1S3		
Ceraclea neffi	A leptocerid caddisfly	G5	S1S3		
Ceraclea punctata	A leptocerid caddisfly	G5	S1S3		
Ceraclea spongillovorax	A leptocerid caddisfly	G3G4	S1S3		
Ceraclea uvalo	A leptocerid caddisfly	G2G4	S1S3		
Cheumatopsyche parentum	A hydropsychid caddisfly	G3	S3		
Chimarra augusta	A philopotamid caddisfly	G3G4	S3		
Culoptila cantha	A glossosomatid caddisfly	G5	S1S3		
Heteroplectron americanum	A caddisfly	G5	S2		
Homoplectra monticola	A hydropsychid caddisfly	G2G3	S2S3		
Hydropsyche brunneipennis	A hydropsychid caddisfly	G3G4	S1S3		
Hydropsyche catawba	A hydropsychid caddisfly	G3	S3		
Hydropsyche frisoni	A hydropsychid caddisfly	G5	S1S3		
Hydropsyche hoffmani	A hydropsychid caddisfly	G3G4	S3		
Hydropsyche opthalmica	A hydropsychid caddisfly	G3	S3		
Hydropsyche potomacensis	A hydropsychid caddisfly	G2G3	S2S3		
Hydropsyche rotosa	A hydropsychid caddisfly	G2G3	S2S3		
Ironoquia lyrata	A limnephilid caddisfly	G5	S1S3		
Lepidostoma bryanti	A lepidostomatid caddisfly	G5	S1S3		
Lepidostoma carrolli	A lepidostomatid caddisfly	G5	S1S3		
Lepidostoma ontario	A lepidostomatid caddisfly	G5	S1S3		
Lepidostoma serratum	A lepidostomatid caddisfly	G4	S1S3		
Micrasema scotti	A brachycentrid caddisfly	G3G4	S3		
Micrasema sprulesi	A brachycentrid caddisfly	G5	S1S3		
Molanna tryphena	A molannid caddisfly	G5	S1S2		
Molanna uniophila	A molannid caddisfly	G5	S1S2		
Neophylax stolus	A uenoid caddisfly	G3	S3		
Ochrotrichia denningi	A microcaddisfly	G2G4	S1S3		
Ochrotrichia graysoni	A microcaddisfly	G3G4	S1S3		
Oxyethira pescadori	Pescador's bottle-cased caddisfly	G3G4	S1S2		
Parapsyche cardis	A hydropsychid caddisfly	G4	S2		
Phylocentropus auriceps	A caddisfly	G3G4	S2		
Phylocentropus carolinus	A caddisfly	G5	S2		
Polycentropus centralis	A polycentropodid caddisfly	G5	S1S2		
Polycentropus pixi	A polycentropodid caddisfly	G4	S1S2		
Pycnopsyche virginica	A limnephilid caddisfly	G3G4	S3		
Rhyacophila atrata	A rhyacophilid caddisfly	G5	S2		
Rhyacophila shenandoahensis	Shenandoah rhyacophilid caddisfly	G3	S3		
Setodes guttatus	A leptocerid caddisfly	G5	S1S3		
Theliopsyche grisea	A lepidostomatid caddisfly	G4	S1S3		
Theliopsyche melas	A lepidostomatid caddisfly	G4G5	S1S3		
Triaenodes dipsius	A leptocerid caddisfly	G5	S1S3		
Triaenodes taenia	A leptocerid caddisfly	G3G4	S1S3		

NATURAL HERITAGE INVERTEBRATE WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
LEPIDOPTERA (BUTTERFLIES, SKIPPERS & MOTHS)					
Butterflies					
Atlides halesus	Great purple hairstreak	G4G5	S3		
Calephelis borealis	Northern metalmark	G3G4	S3		
Celastrina nigra = *Celastrina ebenina*	Dusky azure	G4	S3S4		
Danaus plexippus plexippus	Monarch (eastern population)	G4T1	SU		
Enodia creola	Creole pearly eye	G3G4	S3S4		
Pieris virginiensis	West Virginia white	G3?	S3		
Satyrium edwardsii	Edwards' hairstreak	G4	S3		
Satyrium favonius ontario = *Fixsenia favonius ontario*	Northern oak hairstreak	G4T4	S3		
Speyeria diana	Diana fritillary	G3G4	S3		
Skippers					
Amblyscirtes aesculapias	Lace-winged roadside skipper	G3G4	S3		
Amblyscirtes carolina	Carolina roadside skipper	G3G4	S3S4		
Amblyscirtes reversa	Reversed roadside skipper	G3G4	S3		
Hesperia leonardus	Leonard's skipper	G4	S3?		
Poanes aaroni	Aaron's skipper	G4	S3		
Poanes yehl	Yehl skipper	G4	S3		
Polites mystic	Long dash	G5	S3		
Thorybes confusis	Confused cloudywing	G4	S2S4		
Moths					
Abrostola ovalis	A noctuid moth	G4	S2S4		
Acronicta haesitata	Hesitant dagger moth	G5	S2S4		
Acronicta radcliffei	Radcliffe's dagger moth	G5	S2S4		
Acronicta tristis	A dagger moth	GNR	S1S3		
Anaplectoides prasina	Green arches	G5	S1S3		
Apamea cariosa	A noctuid moth	G4	S1S3		
Apamea lignicolora	Wood-colored Apamea moth	G5	S2S4		
Apamea plutonia	A noctuid moth	G4	S2S4		
Apamea sordens = *Apamea finitima*	Bordered Apamea moth	GNR	S1S3		
Argyrostrotis quadrifilaris	Four-lined chocolate moth	G4	S1S3		
Arugisa latiorella = *Arugisa watsoni*	A noctuid moth	G4	S1S3		
Autographa ampla	Large looper moth	G5	S1S3		
Bellura brehmei	A wetland borer moth	GNR	S2S4		
Cabera quadrifasciaria	Four-lined Cabera moth	GNR	S1S3		
Callopistria granitosa	Granitosa fern moth	G4	S1S3		
Capsula subflava = *Archanara subflava*	A sedge borer moth	G4	S1S3		
Catocala angusi	Angus' underwing	G4	S2S4		
Catocala concumbens	Sleepy underwing	G5	S1S3		
Catocala crataegi	Hawthorn underwing	G5	S2S4		
Catocala insolabilis	Inconsolable underwing	G5	S1S3		
Catocala miranda	Miranda underwing	G3G4	S2S4		
Catocala parta	Mother underwing	G5	S2S4		
Catocala robinsoni	Robinson's underwing	G4	S3		
Catocala sappho	Sappho underwing	G4	S1S3		
Catocala serena	Serene underwing	G5	S2S4		
Crambidia pura	Pure lichen moth	G4	S1S3		
Cucullia florea	A noctuid moth	GNR	S2S4		

NATURAL HERITAGE INVERTEBRATE WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Moths (continued)					
Cutina aluticolor	A cypress moth	GNR	S3		
Darapsa versicolor	Hydrangea sphinx	G4	S2S4		
Dasychira pinicola	Pine tussock moth	G4	S1S3		
Dasychira plagiata	A tussock moth	GNR	S2S4		
Derrima stellata	Pink star moth	G4	S1S3		
Diachrysia balluca	A noctuid moth	GNR	S1S3		
Dysstroma truncata	Marbled carpet	GNR	S2S4		
Emarginea percara	A noctuid moth	G4	S3		
Erastria cruentaria	Thin-lined Erastria moth	G4	S2S4		
Eueretagrotis attenta	Attentive dart moth	G4	S1S3		
Eueretagrotis perattenta	Two-spot dart moth	G5	S1S3		
Eueretagrotis sigmoides	Sigmoid dart moth	G5	S3		
Eulithis molliculata	Dimorphic Eulithis moth	G4	S3		
Euxoa bostoniensis	Boston dart moth	GNR	S2S4		
Euxoa declarata	A dart moth	G4G5	S1S3		
Euxoa messoria	A dart moth	GNR	S2S4		
Euxoa obeliscoides	A dart moth	GNR	S2S4		
Euxoa redimicula	Fillet dart moth	GNR	S2S4		
Euxoa scholastica	Scholastic dart moth	GNR	S2S4		
Euxoa violaris	Violet dart moth	G4	S1S3		
Feralia comstocki	Comstock's sallow	G5	S1S3		
Givira francesca	A carpenterworm moth	GNR	S1S3		
Haploa colona	Colona moth	G4G5	S2S4		
Heliomata infulata	Rare spring moth	G3G4	S2S4		
Homochlodes disconventa	Dark Homochlodes moth	G4	S2S4		
Hydraecia stramentosa	Figwort borer moth	G4	S2S4		
Hypena sordidula	Sordid Hypena moth	G4?	S2S4		
= Bomolocha sordidula					
Iridopsis pergracilis	A geometrid moth	G4G5	S1S3		
= Anacamptodes pergracilis					
Isoparce cupressi	Cypress sphinx	G4	S3		
Lintneria eremitus	Hermit sphinx	G4G5	S1S3		
= Sphinx eremitus					
Lithophane petulca	Wanton noctuid moth	G5	S1S3		
Lithophane querquera	Shivering pinion moth	GNR	S2S4		
Lophocampa maculata	Spotted Tussock Moth	G5	S1S3		
Melanchra assimilis	Black arches	G5	S1S3		
Melipotis jucunda	Merry Melipotis moth	G5	S1S3		
Mesoleuca ruficillata	White-ribboned carpet	G4	S2S4		
Metanema inatomaria	Pale Metanema moth	GNR	S1S3		
Metarranthis sp. 1	Mid-Atlantic Metarranthis moth	G3G4	S1S3		
Morrisonia triangula	Triangle-barred Morrisonia moth	G3G4	S2S4		
Nemoria elfa	Elfin emerald	G4?	S1S3		
Neoligia crytora	A noctuid moth	GNR	S2S4		
= Oligia crytora					
Neoligia exhausta	A noctuid moth	GNR	S1S3		
= Oligia exhausta					
Panopoda repanda	Orange Panopoda moth	G5	S3		
Panthea acronyctoides	Black zipzag	G5	S2S4		
Papaipema impecuniosa	Aster borer moth	G5	S2S4		
Papaipema nepheleptena	Turtlehead borer moth	G4	S2S4		
Papaipema polymniae	Leafcup borer moth	G4	S2S4		
Papaipema pterisii	Bracken fern borer moth	G5	S3		
Papaipema speciosissima	Osmunda borer moth	G4	S3		
Papaipema unimoda	Meadow rue borer moth	G5	S2S4		
Pero zalissaria	A geometrid moth	G4	S3		

NATURAL HERITAGE INVERTEBRATE WATCH LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Moths (continued)					
Petrophora subaequaria	Northern Petrophora moth	G4G5	S1S3		
Polychrysia morigera	A noctuid moth	G4	S3		
Protapamea danieli	A cane moth	GNR	S1S3		
Protodeltote albidula	A noctuid moth	G5	S1S3		
= Lithacodia albidula					
Pseudohermonassa tenuicula	A dart moth	G4	S1S3		
= Xestia tenuicula					
Schinia florida	Primrose moth	G5	S2S4		
Schinia nubila	A flower moth	G5	S2S4		
Schinia saturata	Brown flower moth	G5	S2S4		
Sideridis congermana	German cousin moth	GNR	S1S3		
Speranza abruptata	A geometrid moth	G5	S2S4		
= Itame abruptata					
Speranza evagaria	A geometrid moth	G4G5	S1S3		
= Itame evagaria					
Speranza exauspicata	A geometrid moth	G4G5	S1S3		
= Itame exauspicata					
Speranza subcessaria	Barred Itame moth	G4	S2S4		
= Itame subcessaria					
Sphinx chersis	Great ash sphinx	G4G5	S2S4		
Sphinx drupiferarum	Wild cherry sphinx	G4	S1S3		
Spragueia dama	Southern Spragueia moth	G5	S2S4		
Xanthorhoe labradorensis	Labrador carpet	G4	S2S4		
Zale calycanthata	Double-banded Zale moth	G4	S2S4		
Zale submediana	A noctuid moth	G4	S2S4		

PART THREE:

ANIMAL REVIEW LIST
(Taxa of Uncertain Status)

NATURAL HERITAGE ANIMAL REVIEW LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
VERTEBRATES					
FISH					
Lepomis marginatus	Dollar sunfish	G5	SNR		
AMPHIBIANS					
Lithobates kauffeldi = *Rana kauffeldi*	Atlantic Coast leopard frog	GNR	SU		
REPTILES					
Lampropeltis elapsoides = *Lampropeltis triangulum elapsoides*	Scarlet kingsnake	G5	S2S4		
MAMMALS					
Peromyscus leucopus easti	Pungo mouse	G5T1	S1?		
Sylvilagus floridanus hitchensi	Smith Island cottontail	G5THQ	SH		
INVERTEBRATES					
GASTROPODA (SNAILS)					
Catinella hubrichti	Snowhill ambersnail	G3	SU		
Discus nigrimontanus	Black Mountain disc	G4	SU		
Euchemotrema leai = *Stenotrema leai aliciae*	Lowland pillsnail	G5	SU		
Fumonelix christyi = *Mesodon christyi*	Glossy covert	G3	SU		
Gastrocopta clappi = *Gastrocopta armifera clappi*	Bluegrass snaggletooth	G4G5	SU		
Gastrocopta pellucida	Slim snaggletooth	G5	SU		
Gastrodonta fonticula = *Gastrocopta interna fonticula*	Appalachia bellytooth	G3G4	SU		
Glyphyalinia praecox	Brilliant glyph	G4	SU		
Glyphyalinia sculptilis	Suborb glyph	G4	SU		
Helicodiscus shimeki	Temperate coil	G4G5	SU		
Holsingeria sp. 1	Skyline Caverns snail	G1Q	S1		
Inflectarius kalmianus = *Mesodon kalmianus*	Brown globelet	G3	SU		
Lobosculum pustuloides = *Polygyra pustuloides*	Tiny Liptooth	G4	SU		
Mesomphix subplanus	Flat button	G3G4	SU		
Oxyloma subeffusum	Chesapeake ambersnail	G3	SU		
Pallifera varia	Variable mantleslug	G2G4	SU		
Paravitrea grimmi	Buff Supercoil	G1G3Q	SU		
Paravitrea placentula	Glossy supercoil	G3	SU		
Paravitrea pontis	Natural Bridge supercoil	G3	SU		
Paravitrea reesei	Round supercoil	G3	SU		
Patera laevior	Smooth Bladetooth	G4	SU		
Pomatiopsis cincinnatiensis	Brown walker	G4	SU		
Pupilla muscorum	Widespread column	G5	SU		
Somatogyrus pennsylvanicus	Shale pebblesnail	G3	SU		
Stenotrema pilula	Pygmy slitmouth	G3G4	SU		
Stenotrema spinosum	Carinate slitmouth	G4	SU		
Striatura exigua	Ribbed striate	G5	SU		
Striatura milium	Fine-ribbed striate	G5	SU		
Triodopsis anteridon	Carter threetooth	G3	SU		
Triodopsis pendula	Hanging Rock threetooth	G3	SU		

NATURAL HERITAGE ANIMAL REVIEW LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Snails (continued)					
Vallonia parvula	Trumpet vallonia	G4	SU		
Ventridens decussatus	Crossed dome	G3	SU		
Ventridens lawae	Rounded dome	G4	SU		
Vertigo bollesiana	Delicate vertigo	G4	SU		
Vertigo clappi	Cupped vertigo	G1G2	SU		
Vertigo oralis	Palmetto vertigo	G5	SU		
Vertigo parvula	Smallmouth Vertigo	G3	SU		
Vertigo teskeyae	Swamp vertigo	G5	SU		
Vertigo ventricosa	Five-tooth vertigo	G5	SU		
Vitrinizonites latissimus	Glassy grapeskin	G4	SU		
BIVALVIA (MUSSELS & CLAMS)					
Clams					
Pisidium equilaterale	Round peaclam	G4G5	SU		
ARACHNIDA (SPIDERS, PSEUDOSCORPIONS & RELATIVES)					
Spiders					
Amaurobius borealis	An amaurobiid spider	G5	SU		
Barronopsis jeffersi	A funnel-web spider	G3	SU		
Castianeira trilineata	A two-clawed hunting spider	G4?	SU		
Clubiona spiralis	A two-clawed hunting spider	G4	SU		
Drassyllus louisianus	A gnaphosid spider	G4?	SU		
Drassyllus sp. 1	A gnaphosid spider	GU	SU		
Pisaurina dubia	A nursery-web spider	G4	SU		
Xysticus emertoni	Emerton's crab spider	G5	SU		
Sphodros rufipes	Red-legged purse-web spider	G4	SU		
Harvestmen					
Leiobunum hoffmani	A harvestman	GNR	S2?		
Pseudoscorpions					
Kleptochthonius polychaetus	Shenandoah pseudoscorpion	GU	SU		
CRUSTACEA (AMPHIPODS, ISOPODS & DECAPODS)					
Amphipods					
Crangonyx acicularis	A freshwater amphipod	G1G3	SU		
Crangonyx gracilis	A freshwater amphipod	G4	SU		
Stygobromus sp. 10	A cave amphipod (Botetourt Co.)	G1	S1		
Stygobromus sp. 11	A cave amphipod (Nelson Co.)	G1	S1		
Stygobromus sp. 12	A cave amphipod (Rockbridge Co.)	G1	S1		
Stygobromus sp. 19	A cave amphipod (Scott Co.)	G1	S1		
Stygobromus sp. 20	A cave amphipod (Bath, Highland Co.)	G1	S1		
Isopods					
Caecidotea sp. nov.	A groundwater isopod (Caroline Co.)	GNR	SNR		
Branchiopods					
Eulimnadia sp. 1	A clam shrimp	GNR	SU		
Decapods					
Cambarus buntingi	Longclaw crayfish	G4Q	S2		

NATURAL HERITAGE ANIMAL REVIEW LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
DIPLOPODA (MILLIPEDES)					
Auturus erythropygos	A millipede	G3	SU		
Chaetaspis albus	A millipede	G4	SU		
Euryurus leachii fraternus	A millipede	G4T?	SU		
Okeanobates americanus	A millipede	G4	SU		
Onomeris underwoodi	A millipede	G5	SU		
Orinisobates nigrior	A millipede	G4	SU		
Petaserpes rosalbus = *Polyzonium rosalbum*	A millipede	G5	SU		
Pseudopolydesmus paludicolus	A millipede	GU	SU		
Striaria columbiana	A millipede	G2	SU		
Striaria sp. 1	A millipede	G1	S1		
CHILOPODA (CENTIPEDES)					
Escaryus ethopus	A centipede	GNR	SU		
INSECTS					
DIPLURA (DIPLURANS)					
Litocampa sp. 10	A cave dipluran (Smyth)	G1	S1		
Litocampa sp. 11 (near *cookei*)	A cave dipluran (Lee/Scott/Wise)	G2	S2		
EPHEMEROPTERA (MAYFLIES)					
Ameletus cryptostimulus	Allegheny mayfly	G4	S2S4		
Ameletus tarteri	Tarter's Ameletus mayfly	G2G4	SU		
Isonychia arida	A mayfly	G5	SU		
Isonychia georgiae	Georgia Isonychia mayfly	G4	SU		
Isonychia tusculanensis	A mayfly	G4	SU		
Iswaeon anoka = *Heterocloeon anoka*	A mayfly	G5	SU		
Paraleptophlebia assimilis	A mayfly	G4	SU		
Paraleptophlebia jeanae	A mayfly	G3G4	SU		
Rhithrogena anomala	A mayfly	G3G4	SU		
Waynokiops dentatogriphus	A mayfly	GNR	SNR		
ODONATA (DAMSELFLIES & DRAGONFLIES)					
Epitheca costalis = *Tetragoneuria costalis*	Stripe-winged baskettail	G5	S2S4		
Gomphus hybridus	Cocoa clubtail	G4	SU		
Lestes dryas	Emerald spreadwing	G5	SNR		
Lestes vidua	Carolina spreadwing	G5	SNA		
Sympetrum internum = *Sympetrum janeae*	Cherry-faced meadowhawk	G5	SU		
PLECOPTERA (STONEFLIES)					
Allocapnia harperi	Stonyfork snowfly	G4	SU		
Alloperla banksi	Tufted sallfly	G4	SU		
Alloperla biserrata	Dusky sallfly	G3	SU		
Alloperla idei	*Vernal sallfly	G3	SU		
Alloperla nanina	Swannanoa sallfly	G4	SU		
Alloperla neglecta	Tennessee sallfly	G3	SU		
Bolotoperla rossi	Smoky willowfly	G4	SU		
Hansonoperla appalachia	Appalachian stonefly	G3	SU		
Isogenoides varians	Rock Island springfly	G3G4	SU		

NATURAL HERITAGE ANIMAL REVIEW LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Stoneflies (continued)					
Isoperla nelsoni	Nelson stripetail stonefly	GNR	SNR		
Isoperla powhatan	Powhatan stripetail stonefly	GNR	SNR		
Isoperla reesi	Elk Garden stripetail stonefly	GNR	SNR		
Isoperla stewarti	Stewart stripetail stonefly	GNR	SNR		
Isoperla yuchi	Yuchi stripetail stonefly	GNR	SNR		
Ostrocerca complexa	Notched forestfly	G4	S1S3		
Ostrocerca prolongata	Bent forestfly	G3	S1S3		
Paragnetina ichusa	Widecollar stonefly	G3	S1S3		
Perlesta roblei	Dragon Run stonefly	G3	SU		
Perlesta shawnee	Shawnee stonefly	G3	SU		
Perlesta teaysia	Teays stonefly	G4	SU		
Pteronarcys comstocki	Spiny salmonfly	G3	SU		
Pteronarcys scotti	Carolina salmonfly	G4	SU		
Shipsa rotunda	Intrepid forestfly	G5	SU		
Tallaperla cornelia	Southeastern roachfly	G4	SU		
ORTHOPTERA (GRASSHOPPERS, KATYDIDS, CRICKETS & RELATIVES)					
Melanoplus celatus	A spur-throat grasshopper	GU	SU		
Melanoplus devius	A spur-throat grasshopper	GU	SU		
Melanoplus impudicus	Immodest spur-throat grasshopper	G4G5	SU		
Melanoplus pachycercus	A spur-throat grasshopper	G2G3	SNR		
HEMIPTERA (TRUE BUGS, CICADAS, LEAFHOPPERS & RELATIVES)					
Acantholomidea denticulata	A shield bug	GNR	SU		
Allopodops mississippiensis	Mississippi turtle bug	G2G3	SU		
Botocudo modestus	A seed bug	G5	SU		
Corixidea major	A true bug	GU	SU		
Elasmostethus atricornis	Hercules club stink bug	G3?	SU		
Eurygaster alternata	A shield bug	G5	SU		
Galgupha denudata	A shield bug	G3	SU		
Glyptocombus saltator	A true bug	GNR	SU		
Isocytus chapmani	Chapman’s shore bug	GNR	SU		
Isthmocorius piceus	Black stalk-eyed bug	G5	SU		
Ligyrocoris depictus	A seed bug	G4?	SU		
Nannocoris arenarius	A true bug	GU	SU		
Neolygus crataegi	Hawthorn plant bug	GNR	SU		
Nepa apiculata	A water scorpion	GNR	SU		
Oncozygia clavicornis	A turtle bug	G3	SU		
Plagiognathus repetitus	Pine barrens plant bug	GNR	SU		
Pnirontis languida	An assassin bug	G4	SU		
Ranatra australis	Southern water scorpion	G5	SU		
Ranatra drakei	Drake’s water scorpion	G4	SU		
Stachyocnemus apicalis	Sandpit alydid bug	G4	SU		
Tominotus communis	A burrower bug	G5	SU		
Trialeurodes phlogis	Phlox whitefly	GU	SU		
COLEOPTERA (BEETLES)					
Anthophylax hoffmani	A longhorned beetle	GNR	S1S3		
Calligrapha pnirsa	A leaf beetle	G3	S1S3		
Cyclotrachelus incisus	A ground beetle	G4	SU		
Diabrotica cristata	A leaf beetle	GNR	SU		
Eucaerus varicornis	A ground beetle	G4?	SU		
Helops sulcipennis	A flightless darkling beetle	G3?	S1S3		

NATURAL HERITAGE ANIMAL REVIEW LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Beetles (continued)					
Hoperius planatus	A predaceous diving beetle	GNR	SU		
Hydrobiomorpha casta	A water scavenger beetle	GNR	SU		
Laccophilus schwarzi	Schwarz' diving beetle	GNR	SU		
Paralichas trivittis = *Odontonyx trivittis*	A beetle	GNR	SU		
Pentagonica picticornis	A ground beetle	GNR	SU		
Phanaeus igneus	A scarab beetle	G5	SU		
Pseudaptinus lecontei	A ground beetle	GNR	SU		
Pseudaptinus pygmaeus = *Thalpius pygmaeus*	A ground beetle	GNR	SU		
Sosylus costatus	A beetle	GNR	SU		
Stenocorus schaumi	Schaum's longhorn beetle	GNR	SU		
Urographis triangulifer = *Graphisurus triangulifer*	A longhorned beetle	G4?	SU		
MECOPTERA (SCORPIONFLIES)					
Boreus nivoriundus	A snow scorpionfly	G4	SU		
TRICHOPTERA (CADDISFLIES)					
Agapetus hessi	A glossosomatid caddisfly	G4G5	S2S4		
Agapetus iridis	A glossosomatid caddisfly	G5	S2S4		
Agapetus minutus	A glossosomatid caddisfly	G4G5	SU		
Agapetus pinatus	A glossosomatid caddisfly	G5	S2S4		
Brachycentrus solomoni	A brachycentrid caddisfly	G4	S2S4		
Brachycentrus spinae	A brachycentrid caddisfly	G4	S2S4		
Ceraclea ophioderus	A leptocerid caddisfly	G5	S2S4		
Ceratopsyche alhedra	A hydropsychid caddisfly	G5	S2S4		
Cheumatopsyche gracilis	A hydropsychid caddisfly	G5	S2S4		
Cheumatopsyche gyra	A hydropsychid caddisfly	G4G5	S2S4		
Cheumatopsyche halima	A hydropsychid caddisfly	G5	S2S4		
Frenesia difficilis	A limnephilid caddisfly	G5	S2S4		
Frenesia missa	A limnephilid caddisfly	G5	S2S4		
Goerita betteni	A caddisfly	G4	S2S4		
Glossosoma intermedium	A glossosomatid caddisfly	G5	S2S4		
Homoplectra doringa	A hydropsychid caddisfly	G5	S2S4		
Hydropsyche franclemonti	A hydropsychid caddisfly	G5	S2S4		
Hydroptila acadia	A microcaddisfly	GU	SU		
Hydroptila ajax	A microcaddisfly	G5	SU		
Hydroptila amoena	A microcaddisfly	G5	SU		
Hydroptila artesa	A microcaddisfly	G2G3	SU		
Hydroptila dentata	A microcaddisfly	G3G4	SU		
Hydroptila eramosa	A microcaddisfly	G1G3	SU		
Hydroptila fiskei	A microcaddisfly	G4	SU		
Hydroptila lennoxi	A microcaddisfly	G2G4	SU		
Hydroptila lonchera	A microcaddisfly	G2G3	SU		
Hydroptila maculata	A microcaddisfly	G3G4	SH/SU		
Hydroptila spinata	A microcaddisfly	G4	SU		
Hydroptila talladega	A microcaddisfly	G4	SU		
Hydroptila tortosa	A microcaddisfly	G4G5	SH/SU		
Hydroptila vala	A microcaddisfly	G4	SU		
Hydroptila virgata	A microcaddisfly	G5	SU		
Ironoquia parvula	A limnephilid caddisfly	G5	S2S4		
Ithytrichia clavata	A microcaddisfly	G5	SU		
Lepidostoma pictile	A lepidostomatid caddisfly	G5	S2S4		

NATURAL HERITAGE ANIMAL REVIEW LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Caddisflies (continued)					
Leptocerus americanus	A leptocerid caddisfly	G5	S2S4		
Limnephilus indivisus	A limnephilid caddisfly	G5	S2S4		
Limnephilus moestus	A limnephilid caddisfly	G5	S2S4		
Macrostemum transversum	A hydropsychid caddisfly	G3G5	S2S4		
Mayatrichia ayama	A microcaddisfly	G5	SU		
Micrasema burksi	A brachycentrid caddisfly	G4G5	S2S4		
Neophylax ornatus	A uenoid caddisfly	G4G5	S2S4		
Neophylax wigginsi	A uenoid caddisfly	G3G4	S2S4		
Neotrichia vibrans	A microcaddisfly	G5	SU		
Ochrotrichia arva	A microcaddisfly	G4G5	SU		
Ochrotrichia tarsalis	A microcaddisfly	G5	SU		
Ochrotrichia wojcickyi	A microcaddisfly	G4G5	SU		
Orthotrichia cristata	A microcaddisfly	G5	SU		
Oxyethira dualis	A microcaddisfly	G5	SH/SU		
Oxyethira janella	Little-entrance Oxyethiran microcaddisfly	G5	SU		
Oxyethira michiganensis	A microcaddisfly	G5	SU		
Oxyethira rivicola	A microcaddisfly	G5	SU		
Paranyctiophylax denningi	A polycentropodid caddisfly	G4G5	SU		
Paranyctiophylax serratus	A polycentropodid caddisfly	G4	SU		
Polycentropus interruptus	A polycentropodid caddisfly	G5	SU		
Polycentropus nascotius	A polycentropodid caddisfly	G5	SU		
Polycentropus pentus	A polycentropodid caddisfly	G5	SU		
Pseudostenophylax sparsus	A limnephilid caddisfly	G5	S2S4		
Ptilostomis semifasciata	A phryganeid caddisfly	G5	S2S4		
Pycnopsyche conspersa	A limnephilid caddisfly	G3G4	S2S4		
Pycnopsyche flavata	A limnephilid caddisfly	G4	S2S4		
Rhyacophila acutiloba	A rhyacophilid caddisfly	G5	S2S4		
Rhyacophila formosa	A rhyacophilid caddisfly	G5	S2S4		
Rhyacophila invaria	A rhyacophilid caddisfly	G5	S2S4		
Rhyacophila manistee	A rhyacophilid caddisfly	G5	S2S4		
Rhyacophila otica	A rhyacophilid caddisfly	G3G4Q	S1S3		
Rhyacophila vibox	A rhyacophilid caddisfly	G5	S2S4		
Stactobiella martynovi	A microcaddisfly	G4	SU		
Wormaldia shawnee	A philopotamid caddisfly	G4G5	S2S4		
LEPIDOPTERA (BUTTERFLIES, SKIPPERS & MOTHS)					
Butterflies					
Celastrina lucia = *Celastrina ladon lucia*	Northern spring azure	G5	SU		
Celastrina serotina	Cherry gall azure	G5	SU		
Euphydryas phaeton	Baltimore checkerspot	G4	SU		
Papilio appalachiensis = *Pterourus appalachiensis*	Appalachian tiger swallowtail	G4	SU		
Satyrium caryaevorus	Hickory hairstreak	G4	SU		
Skippers					
Autochton cellus	Golden-banded skipper	G4	SU		
Moths					
Acronicta dactylina	Fingered dagger moth	G5	SU		
Acronicta subochrea	Puzzling dagger moth	G4?	SU		
Apameini new genus 2, sp. 1	A cane moth	GNR	SNR		
Apameini new genus 2, sp. 2	A cane moth	GNR	SNR		
Apameini new genus 2, sp. 3	A cane moth	GNR	SNR		

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
Moths (continued)					
Bellura vulnifica	A wetland borer moth	GNR	SU		
= *Bellura melanopyga*					
Catocala antinympha	Sweetfern underwing	G5	SU		
Cucullia alfarata	A noctuid moth	G4	SU		
Eupithecia peckorum	Peck's Eupithecia moth	G4	SU		
Glena cognataria	Blueberry Gray	G4	SU		
Hydriomena bistriolata	A geometrid moth	GNR	SU		
Hydriomena divisaria	Black-dashed Hydriomena moth	GNR	SU		
Idia majoralis	Major Idia moth	GNR	SU		
Lacinipolia lustralis	A noctuid moth	GNR	SU		
Leucania commoides	A noctuid moth	G5	SU		
Lithophane innominata	Nameless pinion moth	G5	SU		
Lithophane querquera	Shivering pinion moth	GNR	S2S4		
Orthofidonia exornata	A geometrid moth	GNR	SU		
Papaipema nelita	Coneflower borer moth	G4	SU		
Psaphida grandis	Gray sallow	G4	SU		
= *Eutolype grandis*					
Psaphida thaxterianus	A noctuid moth	G4	SU		
Schinia bina	Bina flower moth	G4	SU		
Sympistis badistriga	Brown-lined sallow moth	G4	SU		
= *Homohadena badistriga*					
Tarache delecta	Delightful Bird-dropping moth	GU	SU		
= *Acontia delecta*					
Virbia ferruginosa	Rusty tiger moth	G5	SU		
= *Holomelina ferruginosa*					
Virbia immaculata	Immaculate tiger moth	G4	SU		
= *Holomelina immaculata*					
Zale sp. 2 near *squamularis*	A Zale moth	G4Q	SU		
Zale sp. 3 near *buchholzi*	Maritime Zale moth	G3G4	SU		
Zanclognatha theralis	A noctuid moth	G4	SU		
= *Zanclognatha gypsalis*					
HYMENOPTERA (BEES, WASPS, ANTS, & RELATIVES)					
Bombus bohemicus	Ashton cuckoo bumble bee	G?	SH/SU		
= *Bombus ashtoni*					
Bombus citrinus	Lemon Cuckoo bumble bee	G4G5	SU		
Bombus fraternus	Southern Plains bumble bee	G4	SU		
Bombus pensylvanicus	American bumble bee	G3G4	SU		
Bombus sandersoni	Sanderson bumble bee	G4G5	SU		
Bombus terricola	Yellow-banded bumble bee	G2G4	SU		

APPENDIX 1. FEDERALLY ENDANGERED AND THREATENED VERTEBRATE ANIMALS OF VIRGINIA

(exclusive of extirpated species, see Appendix 3)

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
VERTEBRATES					
FISH					
Acipenser brevirostrum	Shortnose sturgeon	G3	SHB/S1N	LE	LE
Acipenser oxyrinchus	Atlantic sturgeon	G3	S2	LE	LE
Chrosomus cumberlandensis = *Phoxinus cumberlandensis*	Blackside dace	G2	S1	LT	LT
Erimonax monachus = *Cyprinella monacha, Hybopsis monacha*	Spotfin chub (= turquoise shiner)	G2	S1	LT	LT
Erimystax cahni = *Hybopsis cahni*	Slender chub	G1	S1	LT	LT
Etheostoma percnurum	Duskytail darter	G1	S1	LE	LE
Noturus flavipinnis	Yellowfin madtom	G1	S1	LT	LT
Percina rex	Roanoke logperch	G1G2	S1S2	LE	LE
AMPHIBIANS					
Plethodon shenandoah	Shenandoah salamander	G1	S1	LE	LE
REPTILES					
Caretta caretta	Loggerhead (sea turtle)	G3	S1B/S1N	LT	LT
Chelonia mydas	Green turtle	G3	SNA	LT	LT
Dermochelys coriacea	Leatherback (sea turtle)	G2	SNA	LE	LE
Eretmochelys imbricata	Atlantic hawksbill (sea turtle)	G3	SNA	LE	LE
Glyptemys muhlenbergii = *Clemmys muhlenbergii*	Bog turtle	G3	S2	LT/SA	LE
Lepidochelys kempii	Kemp's ridley (sea turtle)	G1	S1N	LE	LE
BIRDS					
Calidris canutus rufa	Red Knot	G4T2	S2N	LT	
Charadrius melodus	Piping Plover	G3	S2B/S1N	LT	LT
Picoides borealis	Red-cockaded Woodpecker	G3	S1	LE	LE
Setophaga kirtlandii = *Dendroica kirtlandii*	Kirtland's Warbler	G1	SNA	LE	LE
Sterna dougallii	Roseate Tern	G4	SHB	LE	LE
MAMMALS					
Balaenoptera borealis	Sei whale	G3	SNA	LE	LE
Balaenoptera musculus	Blue whale	G3G4	SNA	LE	LE
Balaenoptera physalus	Fin whale	G3G4	SNA	LE	LE
Corynorhinus townsendii virginianus = *Plecotus townsendii virginianus*	Virginia big-eared bat	G3G4T2	S1	LE	LE
Eubalaena glacialis = *Balaena glacialis*	Northern right whale	G1	SNA	LE	LE
Glaucomys sabrinus coloratus	Carolina northern flying squirrel	G5T2	S1	LE	LE
Megaptera novaeangliae	Humpback whale	G4	S1N	LE	LE
Myotis grisescens	Gray myotis (bat)	G3	S1	LE	LE
Myotis sodalis	Indiana bat (= social myotis)	G2	S1	LE	LE
Myotis septentrionalis	Northern long-eared Myotis (bat)	G1G3	S1S3	LT	
Physeter macrocephalus = *Physeter catodon*	Sperm whale	G3G4	SNA	LE	LE
Trichechus manatus	West Indian manatee	G2	SNA	LE/PT	LE

APPENDIX 2. FEDERALLY ENDANGERED AND THREATENED INVERTEBRATE ANIMALS OF VIRGINIA

(exclusive of extirpated species, see Appendix 3)

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
INVERTEBRATES					
GASTROPODA (SNAILS)					
Polygyriscus virginianus	Virginia coil (= Virginia fringed mountain snail)	G1	S1	LE	LE
BIVALVIA (MUSSELS)					
Alasmidonta heterodon	Dwarf wedgemussel	G1G2	S1	LE	LE
Cumberlandia monodonta	Spectaclecase	G3	S1	LE	LE
Cyprogenia stegaria	Fanshell	G1Q	S1	LE	LE
Dromus dromas	Dromedary pearlymussel	G1	S1	LE	LE
Epioblasma brevidens	Cumberland combshell	G1	S1	LE	LE
Epioblasma capsaeformis	Oyster mussel	G1	S1	LE	LE
*Epioblasma florentina walkeri**	Tan riffleshell	G1T1	S1	LE	LE
Epioblasma triquetra	Snuffbox	G3	S1	LE	LE
Fusconaia cor	Shiny pigtoe	G1	S1	LE	LE
Fusconaia cuneolus	Fine-rayed pigtoe	G1	S1	LE	LE
Hemistena lata	Cracking pearlymussel	G1	S1	LE	LE
Lemiox rimosus	Birdwing pearlymussel	G1	S1	LE	LE
Pegias fabula	Little-winged pearlymussel	G1	S1	LE	LE
Plethobasus cyphyus	Sheepnose	G3	S1	LE	LE
Pleurobema collina	James spinymussel	G1	S1	LE	LE
Pleurobema plenum	Rough pigtoe	G1	SH	LE	LE
Pleuronaia dolabelloides	Slabside pearlymussel	G2	S2	LE	LE
Ptychobranchus subtentum	Fluted Kidneyshell	G2	S2	LE	LE
Quadrula cylindrica strigillata	Rough rabbits foot	G3G4T2	S2	LE	LE
Quadrula intermedia	Cumberland monkeyface	G1	S1	LE	LE
Quadrula sparsa	Appalachian monkeyface	G1	S1	LE	LE
Villosa perpurpurea	Purple bean	G1	S1	LE	LE
CRUSTRACEA (AMPHIPODS, ISOPODS & DECAPODS)					
Antrolana lira	Madison Cave isopod	G2G4	S2	LT	LT
Lirceus usdagalun	Lee County cave isopod	G2G3	S1	LE	LE
ARACHNIDA (SPIDERS, PSEUDOSCORPIONS & RELATIVES)					
Microhexura montivaga	Spruce-fir moss spider	G1	S1	LE	LE
INSECTA (INSECTS)					
Beetles					
Cicindela dorsalis dorsalis = *Habroscelimorpha dorsalis dorsalis*	Northeastern beach tiger beetle	G4T2	S2	LT	LT
Nicrophorus americanus	American burying beetle	G2G3	SH	LE	
Butterflies					
Neonympha mitchellii	Mitchell's satyr	G2	S1	LE	LE

*Virginia populations were recently described as a new subspecies, *Epioblasma florentina aureola* (golden riffleshell).

APPENDIX 3. EXTINCT AND EXTIRPATED ANIMALS OF VIRGINIA

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
VERTEBRATES					
FISH					
Moxostoma lacerum = *Lagochila lacera*	Harelip sucker	GX	SX		
Percina bimaculata	Chesapeake darter	G1G2	SX		
Percina maculata	Blackside darter	G5	SX		
Percopsis omiscomaycus	Trout-perch	G5	SX		
BIRDS					
Conuropsis carolinensis	Carolina parakeet	GX	SX		
Ectopistes migratorius	Passenger pigeon	GX	SX		
Vermivora bachmanii	Bachman's warbler	GH	SX	LE	LE
MAMMALS					
Bos bison = *Bison bison*	American bison	G4	SX		
Canis lupus = *Canis lycaon*	Gray (= eastern timber) wolf	G4G5	SX	LE	LE
Canis rufus	Red wolf	G1Q	SX	LE	
Cervus elaphus = *Cervus canadensis*	Wapiti or elk	G5	SX*		
Puma concolor couguar = *Felis concolor couguar*	Eastern cougar (= mountain lion, puma)	G5THQ	SX	LE	LE
INVERTEBRATES					
BIVALVIA (MUSSELS)					
Epioblasma haysiana	Acornshell	GX	SX		
Epioblasma lenior	Narrow catspaw	GX	SX		
Epioblasma torulosa gubernaculum	Green-blossom pearlymussel	G2TX	SX	LE	LE
Lampsilis abrupta	Pink mucket	G2	SX	LE	LE
Villosa fabalis	Rayed bean	G2	SX	LE	LE
Villosa trabalis	Cumberland bean	G1	SX	LE	LE
INSECTS					
Phyciodes batesii batesii	Tawny crescent	G4T1	SX		

*The last record of a native elk in Virginia was from 1855. Small numbers of reintroduced elk from eastern Kentucky have moved into far southwestern Virginia in recent years and are currently considered a game species by the Virginia Department of Game and Inland Fisheries, which has initiated a reintroduction program in that portion of the state.

APPENDIX 4. LIST OF SYNONYMS

Synonym	Name used in lists above	Common name	Page
Acipenser oxyrhynchus	*Acipenser oxyrinchus*	Atlantic sturgeon	10
Acontia delecta	*Tarache delecta*	Delightful Bird-dropping moth	48
Aeshna mutata	*Rhionaeschna mutata*	Spatterdock darner	23
Aimophila aestivalis	*Peucaea aestivalis*	Bachman's Sparrow	14
Alasmidonta minor	*Alasmidonta viridis*	Slippershell mussel	17
Anacamptodes pergracilis	*Iridopsis pergracilis*	A geometrid moth	39
Anculosa subglobosa	*Leptoxis praerosa*	Onyx rocksnail	34
Anguispira alternata jessica	*Anguispira jessica*	Mountain disc	16
Anthrobia mammouthia	*Anthrobia monmouthia*	A cave spider	18
Apamea finitima	*Apamea sordens*	Bordered Apamea moth	38
Archanara subflava	*Capsula subflava*	A sedge borer moth	38
Arugisa watsoni	*Arugisa latiorella*	A noctuid moth	38
Balaena glacialis	*Eubalaena glacialis*	Northern right whale	49
Bellura melanopyga	*Bellura vulnifica*	A wetland borer moth	48
Bison bison	*Bos bison*	Bison	51
Bombus ashtoni	*Bombus bohemicus*	Ashton cuckoo bumble bee	48
Bomolocha sordidula	*Hypena sordidula*	Sordid Hypena moth	39
Brachoria falcifera	*Appalachioria falcifera*	Big Cedar Creek millipede	20
Brachoria separanda hamata	*Appalachioria separanda hamata*	A millipede	20
Brachoria separanda versicolor	*Appalachioria separanda versicolor*	A millipede	20
Brachoria turneri	*Appalachioria turneri*	Turner's millipede	20
Bufo quercicus	*Anaxyrus quercicus*	Oak toad	12
Cambarus veteranus (in part)	*Cambarus callainus*	Big Sandy Crayfish	20
Canis lycaon	*Canis lupus*	Gray wolf	51
Carpodacus purpureus	*Haemorhous purpureus*	Purple Finch	13
Carunculina glans	*Toxolasma lividus*	Purple liliput	18
Carunculina lividus	*Toxolasma lividus*	Purple liliput	18
Casmerodius albus	*Ardea alba*	Great Egret	13
Celastrina ebenina	*Celastrina nigra*	Dusky azure	38
Celastrina ladon lucia	*Celastrina lucia*	Northern spring azure	47
Cervus canadensis	*Cervus elaphus*	Wapiti or elk	51
Clemmys insculpta	*Glyptemys insculpta*	Wood turtle	12
Clemmys muhlenbergii	*Glyptemys muhlenbergii*	Bog turtle	12
Conradilla caelata	*Lemiox rimosus*	Birdwing pearlymussel	17
Cottus baileyi	*Uranidea baileyi*	Black sculpin	11
Cottus cognatus	*Uranidea cognata*	Slimy sculpin	11
Cottus kanawhae	*Uranidea kanawhae*	Kanawha sculpin	32
Cottus sp. 1	*Uranidea* sp. 1	Bluestone sculpin	11
Cottus sp. 4	*Uranidea* sp. 4	Clinch sculpin	11
Cottus sp. 5	*Uranidea* sp. 5	Holston sculpin	11
Cyprinella monacha	*Erimonax monachus*	Spotfin chub (= turquoise shiner)	10
Cyprogenia irrorata	*Cyprogenia stegaria*	Fanshell	17
Deciduphagus irus	*Callophrys irus*	Frosted elfin	27
Deciduphagus polios	*Callophyrs polios*	Hoary elfin	27
Dendroica cerulea	*Setophaga cerulea*	Cerulean Warbler	33
Dendroica fusca	*Setophaga fusca*	Blackburnian Warbler	14
Dendroica kirtlandii	*Setophaga kirtlandii*	Kirtland's Warbler	49
Dendroica magnolia	*Setophaga magnolia*	Magnolia Warbler	14
Dendroica virens waynei	*Setophaga virens waynei*	Wayne's Black-throated Green Warbler	14
Dixioria coronata	*Dixioria pela coronata*	A millipede	19
Ellipsoptera gratiosa	*Cicindela gratiosa*	Whitish tiger beetle	25
Ellipsoptera lepida	*Cicindela lepida*	Ghost tiger beetle	25
Enallagma cyathigerum (in part)	*Enallagma annexum*	Northern bluet	22
Ephemerella berneri	*Tsalia berneri*	Berner's Ephemerella mayfly	22
Epioblasma florentina walkeri (in part)	*Epioblasma florentina aureola*	Golden riffleshell	17
Erythroecia hebardi	*Psectrotarsia hebardi*	Hebard's noctuid moth	29
Etheostoma clarum	*Ammocrypta clara*	Western sand darter	10

APPENDIX 4 (continued)

Synonym	Name used in lists above	Common name	Page
Etheostoma stigmaeum jessiae	*Etheostoma jessiae*	Blueside darter	10
Etheostoma stigmaeum meadiae	*Etheostoma meadiae*	Bluespar darter	10
Etheostoma tippecanoe (in part)	*Etheostoma denoncourti*	Golden darter	10
Eumeces anthracinus	*Plestiodon anthracinus*	Coal skink	32
Eutolype grandis	*Psaphida grandis*	Gray sallow	43
Fallicambarus uhleri	*Fallicambarus fodiens*	A crayfish	35
Faronta rubripennis	*Dargida rubripennis*	Pink-streak moth	28
Felis concolor couguar	*Puma concolor couguar*	Eastern cougar	15
Fixsenia favonius ontario	*Satyrium favonius ontario*	Northern oak hairstreak	38
Foveacheles paralleloseta	*Traegaardia paralleloseta*	A cave mite	18
Fusconaia barnesiana	*Pleuronaia barnesiana*	Tennessee pigtoe	17
Fusconaia edgariana	*Fusconaia cor*	Shiny pigtoe	17
Gallinula chloropus (in part)	*Gallinula galeata*	Common Gallinule	13
Gastrocopta armifera clappi	*Gastrocopta clappi*	Bluegrass snaggletooth	42
Gastrocopta interna fonticula	*Gastrodonta fonticula*	Appalachia bellytooth	42
Gomphus brevis	*Gomphus adelphus*	Moustached clubtail	23
Goniobasis arachnoidea	*Elimia arachnoidea*	Spider Elimia	16
Graphisurus triangulifer	*Urographis triangulifer*	A longhorned beetle	46
Habroscelimorpha dorsalis dorsalis	*Cicindela dorsalis dorsalis*	Northeastern beach tiger beetle	25
Habroscelimorpha dorsalis media	*Cicindela dorsalis media*	White tiger beetle	36
Heterocloeon anoka	*Iswaeon anoka*	A mayfly	44
Heterocloeon rubrolaterale	*Iswaeon rubrolaterale*	A mayfly	22
Holomelina ferruginosa	*Virbia ferruginosa*	Rusty tiger moth	48
Holomelina immaculata	*Virbia immaculata*	Immaculate tiger moth	48
Homohadena badistriga	*Sympistis badistriga*	Brown-lined sallow moth	48
Hybopsis cahni	*Erimystax cahni*	Slender chub	10
Hybopsis dissimilis	*Erimystax dissimilis*	Streamline chub	32
Hybopsis insignis	*Erimystax insignis*	Blotched chub	32
Hybopsis labrosa	*Cyprinella labrosa*	Thicklip chub	10
Hybopsis monacha	*Erimonax monachus*	Spotfin chub (= turquoise shiner)	10
Incisalia irus	*Callophrys irus*	Frosted elfin	27
Incisalia polios	*Callophyrs polios*	Hoary elfin	27
Itame abruptata	*Speranza abruptata*	A geometrid moth	40
Itame evagaria	*Speranza evagaria*	A geometrid moth	40
Itame exauspicata	*Speranza exauspicata*	A geometrid moth	40
Itame ribearia	*Speranza ribearia*	Currant spanworm moth	29
Itame subcessaria	*Speranza subcessaria*	Barred Itame moth	40
Lagochila lacera	*Moxostoma lacerum*	Harelip sucker	51
Lampropeltis getula nigra	*Lampropeltis nigra*	Eastern black kingsnake	12
Lampropeltis triangulum elapsoides	*Lampropeltis elapsoides*	Scarlet kingsnake	42
Lampsilis orbiculata	*Lampsilis abrupta*	Pink mucket	17
Lastena lata	*Hemistena lata*	Cracking pearlymussel	17
Lepipolys perscripta	*Sympistis perscripta*	Scribbled sallow moth	29
Leurognathus marmoratus	*Desmognathus marmoratus*	Shovel-nosed salamander	12
Lexingtonia dolabelloides	*Pleuronaia dolabelloides*	Slabside pearlymussel	17
Lexingtonia subplana	*Fusconaia masoni*	Atlantic pigtoe	17
Libellula exusta	*Ladona exusta*	White corporal skimmer	23
Libellula julia	*Ladona julia*	Chalk-fronted corporal skimmer	23
Ligumia ochracea	*Leptodea ochracea*	Tidewater mucket	34
Ligumia recta latissima	*Ligumia recta*	Black sandshell	17
Limnaoedus ocularis	*Pseudacris ocularis*	Little grass frog	32
Liochlorophis vernalis	*Opheodrys vernalis*	Smooth greensnake	32
Lithacodia albidula	*Protodeltote albidula*	A noctuid moth	40
Lithobates virgatipes	*Rana virgatipes*	Carpenter frog	34
Lithophane lepida adipel	*Lithophane adipel*	A pinion moth	29
Loxagrotis apicalis	*Dichagyris grotei*	A noctuid moth	28
Lutra canadensis	*Lontra canadensis*	River otter	33
Merolonche dolli	*Acronicta dolli*	Doll's dagger moth	28

APPENDIX 4 (continued)

Synonym	Name used in lists above	Common name	Page
Mesodon christyi	*Fumonelix christyi*	Glossy covert	42
Mesodon clingmanicus	*Fumonelix wheatleyi clingmanicus*	Clingman covert	16
Mesodon kalmianus	*Inflectarius kalmianus*	Brown globelet	42
Mesodon panselenus	*Patera panselenus*	Virginia bladetooth	34
Microcreagris valentinei	*Lissocreagris valentinei*	Valentine's cave pseudoscorpion	18
Mitoura hesseli	*Callophrys hesseli*	Hessel's hairstreak	27
Moxostoma ariommum	*Scartomyzon ariommus*	Bigeye jumprock	34
Moxostoma hamiltoni	*Thoburnia hamiltoni*	Rustyside sucker	11
Neadysgonia telma	*Gondysia telma*	Telma darkwing moth	28
Neonympha areolatus septentrionalis	*Neonympha helicta*	Helicta satyr	27
Notropis hypsinotus	*Hybopsis hypsinotus*	Highback chub	10
Notropis lirus	*Lythrurus lirus*	Mountain shiner	10
Notropis whipplei	*Cyprinella whipplei*	Steelcolor shiner	10
Nuttallornis borealis	*Contopus cooperi*	Olive-sided Flycatcher	13
Nycticorax violaceus	*Nyctanassa violacea*	Yellow-crowned Night-heron	14
Odontonyx trivittis	*Paralichas trivittis*	A beetle	46
Oligia crytora	*Neoligia crytora*	A noctuid moth	39
Oligia exhausta	*Neoligia exhausta*	A noctuid moth	39
Ophiogomphus alleghaniensis	*Ophiogomphus incurvatus alleghaniensis*	Allegheny snaketail	23
Oporornis philadelphia	*Geothlypis philadelphia*	Mourning Warbler	13
Percina macrocephala	*Percina williamsi*	Sickle darter	11
Phoxinus cumberlandensis	*Chrosomus cumberlandensis*	Blackside dace	10
Phoxinus tennesseensis	*Chrosomus tennesseensis*	Tennessee dace	10
Phyciodes pascoensis	*Phyciodes cocyta*	Northern crescent	27
Phyciodes selenis	*Phyciodes cocyta*	Northern crescent	27
Physeter catodon	*Physeter macrocephalus*	Sperm whale	49
Pipistrellus subflavus	*Perimyotis subflavus*	Tricolored bat	15
Plauditus rubrolateralis	*Iswaeon rubrolaterale*	A mayfly	22
Plecotus rafinesquii macrotis	*Corynorhinus rafinesquii macrotis*	Eastern big-eared bat	15
Plecotus townsendii virginianus	*Corynorhinus townsendii virginianus*	Virginia big-eared bat	15
Pleurobema maculatum	*Pleurobema oviforme*	Tennessee clubshell	17
Pleurobema pyramidatum	*Pleurobema rubrum*	Pyramid pigtoe	17
Pleurocera catenaria	*Elimia catenaria*	Gravel Elimia	35
Polygyra plicata	*Millerelix plicata*	Cumberland liptooth	16
Polygyra pustuloides	*Lobosculum pustuloides*	Tiny Liptooth	42
Polyzonium rosalbum	*Petaserpes rosalbus*	A millipede	44
Pterourus appalachiensis	*Papilio appalachiensis*	Appalachian tiger swallowtail	47
Pyrgus wyandot	*Pyrgus centaureae wyandot*	Appalachian grizzled skipper	27
Rana kauffeldi	*Lithobates kauffeldi*	Atlantic Coast leopard frog	42
Rana virgatipes	*Lithobates virgatipes*	Carpenter frog	32
Rhodoecia aurantiago	*Pyrrhia aurantiago*	Aureolaria seed borer moth	29
Richia grotei	*Dichagyris grotei*	A noctuid moth	28
Scartomyzon ariommus	*Moxostoma ariommum*	Bigeye jumprock	32
Schinia inclara	*Schinia siren*	A flower moth	29
Seiurus noveboracensis	*Parkesia noveboracensis*	Northern Waterthrush	14
Semiothisa distribuaria	*Macaria distribuaria*	A geometrid moth	29
Semotilus margarita	*Margariscus margarita*	Pearl dace	32
Sphaeroderus nitidicollis schaumii	*Sphaeroderus schaumii*	Schaum's false snail-eating beetle	26
Sphinx eremitus	*Lintneria eremitus*	Hermit sphinx	39
Stenotrema leai alicia	*Euchemotrema leai*	Lowland pillsnail	42
Sterna antillarum	*Sternula antillarum*	Least Tern	14
Sterna caspia	*Hydroprogne caspia*	Caspian Tern	13
Sterna maxima	*Thalasseus maximus*	Royal Tern	14
Sterna nilotica	*Gelochelidon nilotica*	Gull-billed Tern	13
Sterna sandvicensis	*Thalasseus sandvicensis*	Sandwich Tern	14
Stizostedion canadense	*Sander canadensis*	Sauger	11
Sylvilagus transitionalis	*Sylvilagus obscurus*	Appalachian cottontail	33

APPENDIX 4 (continued)

Synonym	Name used in lists above	Common name	Page
Sympetrum janeae	*Sympetrum internum*	Cherry-faced meadowhawk	44
Tetracha carolina	*Megacephala carolina*	Carolina big-headed tiger beetle	37
Tetragoneuria canis	*Epitheca canis*	Beaverpond baskettail	23
Tetragoneuria costalis	*Epitheca costalis*	Stripe-winged baskettail	44
Tetragoneuria semiaquea	*Epitheca semiaquea*	Mantled baskettail	23
Tetragoneuria spinosa	*Epitheca spinosa*	Robust baskettail	36
Thalpius pygmaeus	*Pseudaptinus pygmaeus*	A ground beetle	46
Tischeria perplexa	*Coptotriche perplexa*	Chestnut leaf-mining moth	28
Trichopetalum packardi	*Zygonopus packardi*	Packard's blind cave millipede	35
Trichopetalum weyeriensis	*Zygonopus weyeriensis*	Grand Caverns blind cave millipede	21
Trichopetalum whitei	*Zygonopus whitei*	Luray Caverns blind cave millipede	21
Trionyx spiniferus	*Apalone spinifera*	Spiny softshell	12
Tritogonia verrucosa	*Quadrula verrucosa*	Pistolgrip	18
Troglodytes troglodytes (in part)	*Troglodytes hiemalis*	Winter Wren	14
Vermivora pinus	*Vermivora cyanoptera*	Blue-winged Warbler	33
Vermivora ruficapilla	*Oreothlypis ruficapilla*	Nashville Warbler	14
Wilsonia canadensis	*Cardellina canadensis*	Canada Warbler	33
Wyeomyia haynei	*Wyeomyia smythii*	Pitcher plant mosquito	30
Xestia tenuicula	*Pseudohermonassa tenuicula*	A dart moth	40
Zanclognatha gypsalis	*Zanclognatha theralis*	A noctuid moth	48

APPENDIX 5. RARE SPECIES SIGHTING FORM

Virginia Department of Conservation and Recreation, Division of Natural Heritage
600 E. Main Street, Richmond, Virginia 23219
(804) 786-7951

An important component of the natural heritage inventory and protection process involves gathering information from state experts, professionals, and avocational naturalists throughout the state. To facilitate this, the Division of Natural Heritage has developed this rare species sighting form. If you would like to participate in our inventory and protection activities, please take a few moments to complete the attached form for any species from our rare species list. These data will be evaluated for incorporation into the natural heritage database and used exclusively for the protection of the rare species and its habitat. Please send the form to the staff zoologist at the address above. Thank you for your support. The Division of Natural Heritage can only realize the protection of the Commonwealth's natural diversity by working through a network of knowledgeable and concerned individuals.

SPECIES OBSERVED:

DATE OBSERVED:

COUNTY:

USGS QUADRANGLE MAP NAME (if known; mark location on a photocopy of the appropriate map and submit with this form):

LOCATION (Provide a detailed description, including directions from nearest town, road intersection, etc.):

HABITAT DESCRIPTION (Include associated species, elevation, natural features, natural community type, etc.):

POPULATION DATA (Number of individuals observed, age, size, evidence of reproduction,etc.):

LANDOWNER (If know, provide name, address, and phone number):

THREATS TO SPECIES OR EVIDENCE OF HABITAT DISTURBANCE:

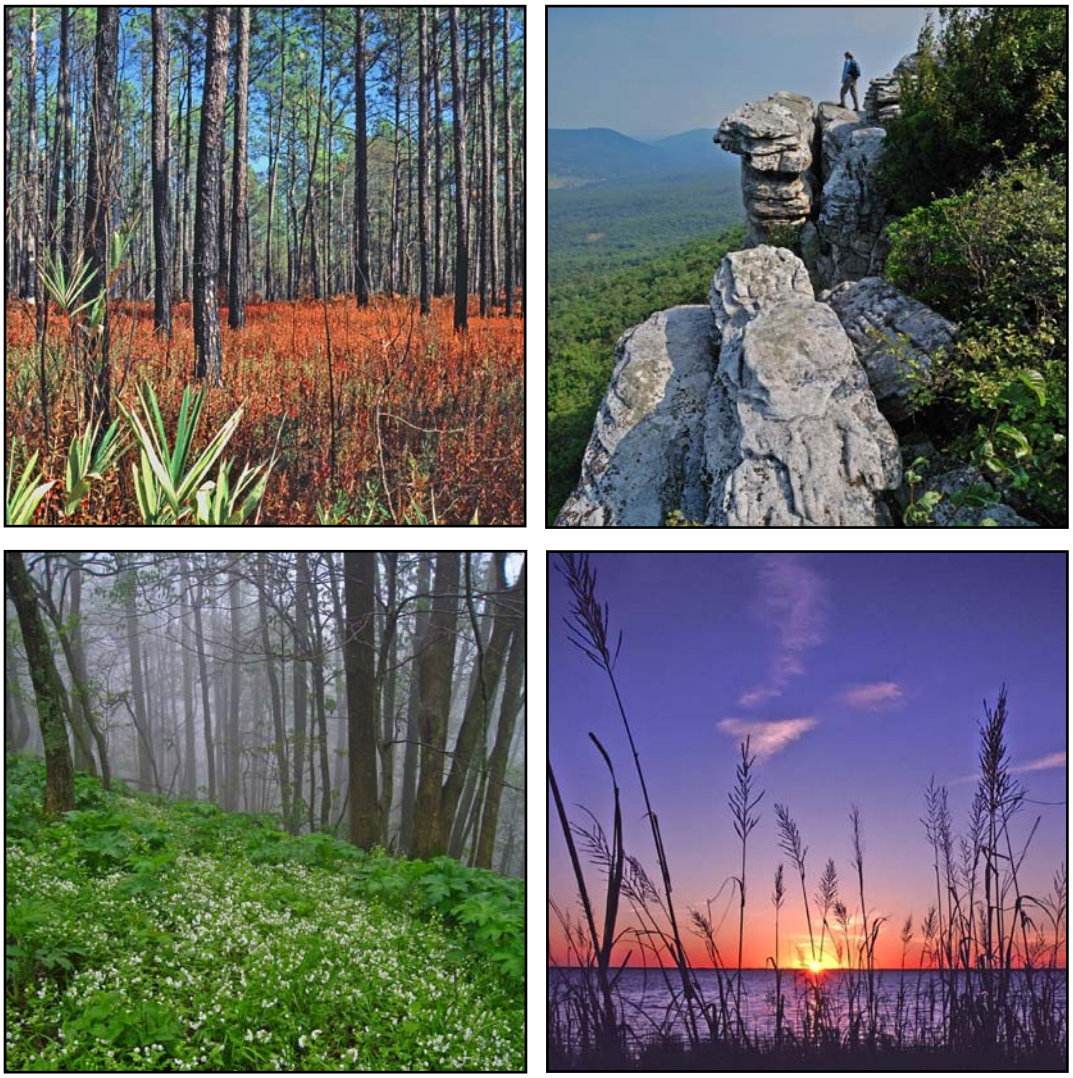
REPORTED BY (Include name, address, and phone number):

DATE OF REPORT:

Enclosure 7 Virginia Natural Heritage List of Rare Natural Communities

COMMONWEALTH of VIRGINIA

The Natural Communities of Virginia: Ecological Groups and Community Types



Virginia Department of Conservation and Recreation
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Natural Heritage Technical Report 13-16
July 2013

Cover photos by Gary Fleming

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The Natural Communities of Virginia: Ecological Groups and Community Types

a listing with conservation status ranks

July 2013

Virginia Department of Conservation and Recreation
Division of Natural Heritage
600 East Main Street, 24th Floor
Richmond, Virginia 23219

List Compiled by

Gary P. Fleming, Vegetation Ecologist
Karen D. Patterson, Vegetation Ecologist

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INTRODUCTION

The Virginia Department of Conservation and Recreation's Division of Natural Heritage (DCR-DNH) was established to protect Virginia's biological diversity. DCR-DNH is the state's first comprehensive program for conservation of our natural heritage, and includes an intensive statewide biological inventory, field surveys, database management, environmental review, GIS analysis and mapping, and natural area protection and stewardship. Through its actions the Division identifies Natural Heritage Resources that are in need of conservation attention while creating an efficient means of evaluating the impacts of balanced economic growth. Natural Heritage Resources are defined in the Virginia Natural Area Preserves Act of 1989 (Section 10.1-209 through 217, Code of Virginia), as the habitats of rare, threatened, and endangered plant and animal species; exemplary natural communities, habitats, and ecosystems; and other natural features of the Commonwealth.

To help prioritize conservation efforts, DCR-DNH maintains Natural Heritage Resource lists of rare plants and animals. These lists are revised as new data become available, usually every one to two years. Natural communities are described, inventoried, and tracked using a hierarchical classification developed by DCR-DNH Ecologists. The classification provides a framework in which to describe natural communities at a scale that is meaningful for conservation and land protection and management.

This document lists the full classification hierarchy and includes the 94 ecological groups and 317 community types currently defined for Virginia. It is meant to function as a companion to the Division's website, which provides descriptions and illustrations of all Ecological Groups, as well as more detailed information about the methods used to develop the classification. The website and classification can be accessed at the following link: http://www.dcr.virginia.gov/natural_heritage/natural_communities/ncintro.shtml

Classification Structure

The divisions of the Virginia classification hierarchy, from the top down, are: System, Ecological Class, Ecological Community Group, and Community Type.

The **System** is the upper-most level of the classification hierarchy. The System level is based on gross hydrologic regime and includes five divisions: the **Terrestrial System** includes all upland (non-wetland) habitats, while the **Palustrine System** encompasses all non-tidal wetlands dominated by woody plants and herbaceous emergents. The **Estuarine System** includes emergent and floating / submergent tidal wetlands, extending to the upstream limits of tidal influence. The **Riverine System** and the **Marine System** are each represented by a single ecological group that supports vascular plants. This system-level treatment generally follows Cowardin et al. (1979), except that freshwater tidal wetlands are included in the Estuarine System, and some communities that would be placed in the Lacustrine System of Cowardin et al. (1979) are included in the Palustrine System. Classifications of deepwater Lacustrine, Riverine, Estuarine, and Marine System communities that lack vascular plants, as well as of Subterranean System (cave) communities, are currently under study or development by other groups of specialists.

Ecological Class is a level of the classification that is meant to aid in organizing ecological community groups. We have defined 14 Ecological classes to organize the natural communities of Virginia. These classes are not necessarily mutually exclusive, but serve to group physiographically and topographically related community groups, which often co-occur on the landscape. Each Ecological Class is described below:

Terrestrial Ecological Classes:

- *High-Elevation Mountain Communities* - Ecological community groups with distributions centered above 1,070 m (3,500 ft) elevation and representing structurally and compositionally diverse vegetation rich in northern species.
- *Low-Elevation Mesic Forests* - Ecological community groups with distributions centered below 1,070 m (3,500 ft) elevation and representing mesophytic to submesophytic forest vegetation. A few community types of the Rich Cove and Slope Forests, Acidic Cove Forests, and Eastern Hemlock - Hardwood Forests occasionally extend into the high-elevation zone (> 1,070 m).

- *Low-Elevation Dry and Dry-Mesic Forests and Woodlands* - Ecological community groups with distributions centered below 1,070 m (3,500 ft) elevation and representing xerophytic to submesophytic forest and woodland vegetation. A few community types of the Montane Mixed Oak and Oak-Hickory Forests, Oak / Heath Forests, and Pine - Oak / Heath Woodlands extend significantly into the high-elevation zone (> 1,070 m), but are retained in this Class because of their compositional similarity to other members of these groups.
- *Low-Elevation Rock Outcrops and Barrens* - Ecological community groups with distributions centered below 1,070 m (3,500 ft) elevation and representing edaphically (or in one case, fire-) controlled woodland, scrub, herbaceous, and moss/lichen vegetation.
- *Maritime Zone Communities* - Ecological community groups with distributions and vegetation controlled by oceanic influences (e.g., deep sand deposits, salt spray, maritime microclimates). In Virginia, these are confined to narrow zones along both flanks of the Eastern Shore, the western shore of the Chesapeake Bay, and the Atlantic shore in extreme southeastern Virginia.
- *Sandy Woodlands of the Coastal Plain and Outer Piedmont* - Ecological community groups representing woodland vegetation of oligotrophic, fire-influenced or edaphically stressful, non-marine sandy habitats at very low elevations.

Palustrine Ecological Classes:

- *Alluvial Floodplain Communities* - Ecological community groups of alluvial habits with overland, non-tidal flooding regimes. Structurally and compositionally diverse vegetation is represented.
- *Non-Alluvial Wetlands of the Mountains* - Ecological community groups of groundwater-controlled, non-alluvial wetlands in the mountain region, including seeps, bogs, fens, and ponds. Structurally and compositionally diverse vegetation is represented.
- *Non-Alluvial Wetlands of the Coastal Plain and Piedmont* - Ecological community groups of groundwater-controlled, non-alluvial wetlands in the Coastal Plain and Piedmont. Structurally and compositionally diverse vegetation is represented.
- *Saturated Peatlands of the Coastal Plain* - Ecological community groups of fire-influenced, groundwater controlled, non-alluvial, Coastal Plain wetlands with deep organic soils and a saturated hydrologic regime. This class is represented in Virginia by woodland and forest vegetation, although shrublands are components further south. It is confined to the extreme southeastern portion of the state.
- *Non-Tidal Maritime Wetlands* - Ecological community groups of mostly groundwater-controlled wetlands subject to oceanic influences (e.g., deep sand deposits, salt spray, maritime microclimates). In Virginia, these are confined to narrow zones along both flanks of the Eastern Shore, the western shore of the Chesapeake Bay, and the Atlantic shore in extreme southeastern Virginia.

Riverine Ecological Class:

- *Riverine Vegetation* – Ecological communities of freshwater river channels, including floating and submergent herbaceous vegetation at water depths that exclude emergent species but permit bottom rooting of aquatic species. Vegetation with emergent species is included in the Palustrine Ecological classes.

Estuarine Ecological Class:

- *Tidal Wetlands* - Ecological community groups of regularly or irregularly flooded, lunar tidal wetlands and irregularly flooded, wind-tidal wetlands. Structurally and compositionally diverse vegetation is represented. In the descriptions that follow, the terms "high" and "low" marsh refer to the relative elevation of stands within the intertidal zone.

Marine Ecological Class:

- *Marine Vegetation* – Ecological community groups of sparsely vegetated ocean shores and flats where the substrate is exposed and flooded by ocean tides; includes vegetation of the splash zone.

The **Ecological Community Group** is the level of the classification that organizes community types. Ecological community groups are aggregations of community types with topographic, edaphic, physiognomic, and gross floristic similarities. Community types within an ecological community group are often distributed in different regions of the state and have floristic differences that result from biogeographic influences. Ecological Community Groups define natural communities at a relatively coarse scale that may be more appropriate for large-scale applications such as ecological modeling and vegetation mapping. In addition, they employ concepts and terminology that are communicable, familiar, and useful to a wide range of potential users.

The **Community Type** is the finest level of the classification system that is nested within the Ecological Community Group. Community Types are plant assemblages that exhibit similar total species composition and vegetation structure and that occur under similar habitat conditions, and, for the most part, repeat across the landscape. The Community Type level is equivalent to the Association level of the United States National Vegetation Classification System (USNVC) (Grossman *et al.* 1998, NatureServe 2010) and is a concept that has been used by most of the schools of floristic classification (Whittaker 1962, Braun-Blanquet 1965, Westhoff and van der Maarel 1973, Moravec 1993). The Community Type is the level at which community inventory and conservation action are aimed and, as such, it is the level at which community occurrences are tracked and for which conservation status ranks are assigned.

Relationship to the USNVC and NatureServe's Ecological System Classification

The United States National Vegetation Classification (USNVC) is a jurisdictional subset of the larger International Vegetation Classification of Ecological Communities (IVC). The USNVC is a hierarchical system that classifies vegetation using physiognomic (structural) features at the highest levels of the hierarchy and floristic features at the lower levels (Grossman et al 1997, FGDC 2008, Jennings et al 2009). Over the past twenty years, the USNVC has been developed and implemented by The Nature Conservancy (TNC), the network of Natural Heritage Programs, and, since 2001, NatureServe. NatureServe is the organization that currently maintains and updates the USNVC via the *NatureServe Explorer* website (NatureServe 2011) and on the usvnc.org website. Refinements to the floristic levels of the classification occur in the process of application, leading to ongoing proposed revisions that are reviewed both locally and nationally. DCR-DNH Ecologists work in partnership with NatureServe to develop the finest floristic level of the classification, the Association. USNVC Associations are equal in scale to Community Types in The Natural Communities of Virginia classification and, for the most part, have a one-to-one relationship to the Community Type. However, Community Types have Virginia-specific names and concepts, while Associations are named and defined based on the range-wide expression of the vegetation.

In 2003, NatureServe developed a classification of Ecological Systems (Comer et al 2003). Ecological Systems are not part of the USNVC hierarchy, but are vegetation-based, and can be linked to the USNVC at the middle levels of the hierarchy (Groups and Macrogroups) (Gawler et al 2008). The Ecological System classification is maintained by NatureServe and descriptions are available via the *NatureServe Explorer* website. Ecological Systems have been used as the basis for several national and regional scale classification and mapping efforts, including the Northeastern Terrestrial Wildlife Habitat Classification (Gawler et al 2008), LANDFIRE (The National Map Landfire 2007), and the Southeast GAP analysis project (USGS. National Gap Analysis Program 2008). Ecological Systems are recurring groups of biological communities (i.e. associations) that are found in similar physical environments and are influenced by similar dynamic ecological processes (Comer et al. 2003). Ecological Systems are defined based on biogeographic region, landscape scale, dominant cover type, and disturbance regime and, as such, are coarser in scale than the Association or Community Type. A single Association may occur in more than one Ecological System depending on the geographic regions in which it is found. In Virginia, a single Community Type may be split among several Ecological Systems that have been defined by geographic regions. The Ecological Group level in The Natural Communities of Virginia classification is similar in concept to Ecological System, but

the two classification units differ in geographic scale. Ecological Groups are defined within the constraints of the state of Virginia, while Ecological Systems are regional in scope, with divisions along physiographic provinces. To illustrate this relationship, a crosswalk of The Natural Communities of Virginia to Ecological Systems is provided on our website at http://www.dcr.virginia.gov/natural_heritage/documents/vaclass_system_xwalk_01302012.xls

Changes to Ecological Community Groups since Version 2.2 and Community Types since 2011
Development of the state classification is an iterative process of successive approximations. Since completion of the Second Approximation, version 2.2 (Fleming *et al.* 2006), analysis of several large, regional datasets and ongoing inventory of vegetation across the state have led to a number of changes to the Ecological Group Classification. These changes, as well as changes to Community Types since the publication of the 2011 list, are summarized in Appendix A of this document. In 2013, the nomenclature for vascular plant species used in the community type scientific name was changed to follow The Flora of Virginia (Weakley et al. 2012), resulting in the change of 104 community type names. These changes are not listed in this appendix.

Format of the List

The System and Ecological Class are listed at the top of each page.

Ecological Community Groups are organized into fourteen Ecological Classes.
Each Ecological Group is hyperlinked to a Group description on the DCR Natural Heritage Website

Community Types are listed in alphabetical order beneath each Ecological Community Group of which they are a member.

For each Community Type, the following information is provided:

Scientific Name - The scientific name (State Name) of the community type based on Latin names of dominant or characteristic plant species. Those species occurring in the same stratum are separated by a hyphen (-); those occurring in different strata are separated by a slash (/). Species found less consistently in all occurrences of a community type, are placed in parentheses. Names preceded by an asterisk are considered "provisional" and should be considered tentative. In most cases, these putative types are based on limited data and analysis, and are subject to reinterpretation or changes in concept as additional data become available. State Names are based on the occurrence of the community in Virginia, and species nomenclature follows the Flora of Virginia (Weakley et al. 2012), thus state names may differ from the Global scientific name assigned by NatureServe. Additionally, subspecies and varieties of nominal species are not included in the community type names unless they are explicitly diagnostic of the community.

Common Name – The common or colloquial name (State Common Name) of the community type. The common name is a unique name by which the community type may be more easily recognized or described. Common names are based on the occurrence of the community in Virginia, and may differ from the Global Common Name assigned by NatureServe.

Global Rank **–** Global conservation status ranks characterize the relative rarity or endangerment of the corresponding USNVC association (see below) range-wide and are assigned at NatureServe's Headquarters or by a designated lead office in the Heritage/Conservation Data Center Network. Definitions of global ranks are provided in Appendix B of this document. A table showing the number of classified community types by conservation rank is provided in Appendix C. of this document.

State Rank **–** State conservation status ranks characterize the relative rarity or endangerment of the community within Virginia. State ranks are assigned by the DCR-DNH and apply to a community only as it exists in each state, regardless of its range-wide status. Definitions of state ranks are provided in Appendix B of this document. A table showing the number of classified community types by conservation rank is provided in Appendix C. of this document

USNVC Code – Each community type is crosswalked to the equivalent (or nearest equivalent) unit (i.e. the "association") in the United States National Vegetation Classification (USNVC). The USNVC code is a unique identifier for the Association from USNVC databases (NatureServe 2012). Associations have a code that begins with the string "CEGL" (Community Element GLobal) followed by a unique 6-digit number. Community Types that are not defined in the USNVC are listed as "no equivalent" in this field. Each USNVC code in the list is hyperlinked to the corresponding association description on *NatureServe Explorer* website (NatureServe 2013). These descriptions contain detailed range-wide information for the associations. As of this writing, associations considered provisional in the USNVC are not served on NatureServe Explorer, thus these USNVC codes are hyperlinked to a provisonal description on the DCR-DNH website. On this list, each USNVC code is preceded by a symbol indicating the relationship Virginia Community Type to the USNVC Association. The symbols indicate equivalent (=), finer (<), broader (>), or intersects (x). In the infrequent case where a Virginia Community Type can be crosswalked to more than one USNVC Association, the association with the closest relationship to the state concept is listed.

Future Plans

The list of Ecological Community Groups and Community Types, with conservation status ranks, will be updated annually as new information becomes available. Over time, we will develop detailed descriptions of the Community Types. These descriptions will include information on the community's distribution, conservation status, management considerations, as well as key features that will help identify the community in the field. We plan to provide this information in a format that can be obtained via our website. In the meantime, more detailed information may be obtained by following the links provided in this list, and on the DCR-DNH website to the NatureServe Explorer treatments of the corresponding USNVC associations, many of which were authored by DCR-DNH ecologists.

Feedback

We welcome all comments and suggestions on the classification, particularly information about natural vegetation with which you are familiar that does not fit into this classification. We also appreciate information on high-quality examples of natural communities, as this will further our understanding of the conservation status of these communities, as well as provide data to help refine the classification. Comments and suggestions can be directed to Gary Fleming <gary.fleming@dcr.virginia.gov> or Karen Patterson <karen.patterson@dcr.virginia.gov>.

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Terrestrial - *High-Elevation Mountain Communities*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Spruce and Fir Forests				
Abies fraseri / Dryopteris campyloptera - Oxalis montana Forest	Fraser Fir Forest	G1	S1	= CEGL006049
Picea rubens - (Abies fraseri) / (Rhododendron catawbiense, Rhododendron maximum) Forest	Southern Appalachian Red Spruce Forest (Evergreen Shrub Type)	G1	S1	= CEGL007130
Picea rubens - Betula alleghaniensis / Rhododendron (maximum, catawbiense) Forest	Southern Appalachian Red Spruce - Northern Hardwood Forest (Evergreen Shrub Type)	G1?	S1	= CEGL004983
Picea rubens / Acer rubrum / Maianthemum canadense - (Lycopodium clavatum, Dendrolycopodium dendroideum) Forest	Central Appalachian Red Spruce Forest	G2	S1	= CEGL008501
Picea rubens / Viburnum lantanoides - Vaccinium erythrocarpum / Huperzia lucidula - Clintonia borealis Forest	Southern Appalachian Red Spruce Forest (Deciduous Shrub Type)	G2	S1	= CEGL007131
Southern Appalachian Shrub and Grass Balds				
Danthonia compressa - Carex brunnescens - Sibbaldia tridentata Herbaceous Vegetation	Southern Appalachian Grassy Bald	G1	S1	= CEGL004242
Kalmia latifolia - Rhododendron catawbiense - Gaylussacia baccata Shrubland	Southern Appalachian Mixed Heath Bald	G2G3	S1	= CEGL003814
Menziesia pilosa - Vaccinium (erythrocarpum, simulatum, corymbosum) - Sorbus americana Shrubland	Southern Appalachian Deciduous Heath Bald	GNR	S1	= CEGL004819
Rhododendron catawbiense Shrubland	Southern Appalachian Catawba Rhododendron Heath Bald	G2	S1	= CEGL003818
Northern Hardwood Forests				
Acer saccharum - Betula alleghaniensis - Fagus grandifolia - Aesculus flava / Ageratina altissima var. roanensis - Eurybia chlorolepis Forest	Southern Appalachian Northern Hardwood Forest	G3G4	S3	= CEGL007285
Betula alleghaniensis - Quercus rubra / Acer (pensylvanicum, spicatum) / Dryopteris intermedia - Oclemena acuminata Forest	Central Appalachian Northern Hardwood Forest (Yellow Birch - Northern Red Oak Type)	G3G4	S3	= CEGL008502
Fagus grandifolia - Tsuga canadensis / Dryopteris intermedia Forest	Allegheny Mountain Beech - Hemlock Forest	G4G5	S1	= CEGL006088
Prunus serotina - Acer saccharum - Fagus grandifolia / Carex digitalis - (Dennstaedtia punctilobula) Forest	Central Appalachian Northern Hardwood Forest (Sugar Maple - Beech - Black Cherry Type)	G4	S2	= CEGL006045
High-Elevation Boulderfield Forests and Woodlands				
Betula alleghaniensis / Acer spicatum / Viburnum lantanoides - Ribes glandulosum Forest	Southern Appalachian High-Elevation Boulderfield Forest / Woodland	G2G3	S1	= CEGL006124
Betula alleghaniensis / Sorbus americana - Acer spicatum / Polypodium appalachianum Forest	Central Appalachian High-Elevation Boulderfield Forest / Woodland	G2	S2	= CEGL008504
High-Elevation Cove Forests				
Acer saccharum - Aesculus flava - (Betula alleghaniensis, Fagus grandifolia) / Actaea podocarpa - Dryopteris intermedia Forest	Southern Appalachian High-Elevation Rich Cove Forest	G3	S2	= CEGL004973
Acer saccharum - Tilia americana - Fagus grandifolia / Caulophyllum thalictroides - Viola blanda - (Allium tricoccum) Forest	Northern Appalachian High-Elevation Rich Cove Forest	G4?	S1	= CEGL005008
Betula alleghaniensis - Tsuga canadensis / Rhododendron maximum Forest	High-Elevation Acidic Cove Forest	G3	S2	= CEGL007861

Terrestrial - *High-Elevation Mountain Communities*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Northern Red Oak Forests				
Quercus rubra - (Quercus alba) / Ilex montana / Dennstaedtia punctilobula - Lysimachia quadrifolia Forest	Central Appalachian Northern Red Oak Forest	G3G4	S3	= CEGL008506
Quercus rubra / Rhododendron (catawbiense, maximum) Forest	Southern Appalachian Northern Red Oak Forest (Evergreen Shrub Type)	G4	S2?	= CEGL007299
Quercus rubra / Rhododendron calendulaceum - Vaccinium simulatum - Vaccinium erythrocarpum / Parathelypteris noveboracensis Forest	Southern Appalachian Northern Red Oak Forest (Deciduous Shrub Type)	G4	S3	= CEGL007300
High-Elevation Outcrop Barrens				
Aronia melanocarpa - Gaylussacia baccata / Carex pensylvanica Shrubland	High-Elevation Outcrop Barren (Black Chokeberry Igneous / Metamorphic Type)	G1?	S1	= CEGL008508
Diervilla lonicera - Solidago randii - Avenella flexuosa - Hylotelephium telephioides - Hydatica petiolaris Herbaceous Vegetation	High-Elevation Greenstone Barren	G1	S1	= CEGL008536
Kalmia latifolia - Gaylussacia baccata - Vaccinium (angustifolium, pallidum) - Menziesia pilosa Shrubland	Central Appalachian High-Elevation Heath Barren / Pavement	G2	S1	= CEGL003939
Minuartia groenlandica - Paronychia argyrocoma - Hydatica petiolaris Herbaceous Vegetation	High-Elevation Outcrop Barren (Greenland Stitchwort Igneous / Metamorphic Type)	G1	S1	= CEGL008509
Salix occidentalis / Schizachyrium scoparium - Sibbaldia tridentata - Crocanthemum bicknellii - Rhynchospora globularis Shrub Herbaceous Vegetation	Southern Blue Ridge High-Elevation Mafic Barren	G1	S1	= CEGL004238

Terrestrial - *Low-Elevation Mesic Forests*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Rich Cove and Slope Forests				
Acer saccharum - Tilia americana / Caulophyllum thalictroides - Laportea canadensis - Osmorhiza claytonii Forest	Central Appalachian Rich Cove Forest (Sugar Maple - Basswood Type)	G4?	S3	= CEGL006237
Acer saccharum - Tilia americana var. heterophylla - Aesculus flava / Caulophyllum thalictroides - Hydrophyllum (canadense, macrophyllum) Forest	Southern Appalachian Rich Cove Forest (Sugar Maple - Buckeye Type)	G3G4	S3	= CEGL007695
Liriodendron tulipifera - Fraxinus americana - Tilia americana / Lindera benzoin / Actaea racemosa Forest	Appalachian Rich Cove Forest (Tuliptree - Mixed Hardwoods Type)	G4	S4	= CEGL007710
Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / Staphylea trifolia / Cystopteris bulbifera - Asarum canadense Forest	Southern Appalachian Limestone Rich Cove Forest	G3G4	S3	= CEGL006472
Basic Mesic Forests				
Acer (nigrum, saccharum) - Tilia americana / Asimina triloba / Jeffersonia diphylla - Caulophyllum thalictroides Forest	Central Appalachian / Piedmont Basic Mesic Forest (Twinleaf - Blue Cohosh Type)	G4G5	S4	= CEGL008412
Acer floridanum - Fagus grandifolia - Carya cordiformis / Aesculus sylvatica / Actaea racemosa Forest	Southern Piedmont Basic Mesic Forest	G3G4	S3	= CEGL008466
Fagus grandifolia - Acer floridanum - Quercus muehlenbergii / Sanguinaria canadensis Forest	Coastal Plain Calcareous Ravine Forest	G2?	S2	= CEGL007181
Fagus grandifolia - Liriodendron tulipifera - Carya cordiformis / Lindera benzoin / Podophyllum peltatum Forest	Coastal Plain / Outer Piedmont Basic Mesic Forest	G4?	S3	= CEGL006055
Liriodendron tulipifera - Quercus rubra - Fraxinus americana / Asimina triloba / Actaea racemosa - Uvularia perfoliata Forest	Inner Piedmont / Lower Blue Ridge Basic Mesic Forest	G4?	S4	= CEGL006186
Acidic Cove Forests				
Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum Forest	Southern Appalachian Acidic Cove Forest	G5	S4S5	= CEGL007543
Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus (rubra, alba) / Polystichum acrostichoides Forest	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)	G4?	S4	= CEGL006304
Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala Forest	Cumberland Mountain Acidic Cove Forest	G4	S1?	= CEGL008407
Tsuga canadensis - Quercus montana - Liriodendron tulipifera / Kalmia latifolia - (Rhododendron catawbiense) Forest	Central Appalachian Acidic Cove Forest (Hemlock - Chestnut Oak Type)	G4	S3	= CEGL008512
Mesic Mixed Hardwood Forests				
Fagus grandifolia - Quercus (alba, nigra, michauxii) / Symplocos tinctoria - (Stewartia malacodendron) Forest	Southern Coastal Plain Mesic Mixed Hardwood Forest	G3	S2S3	x CEGL007211
Fagus grandifolia - Quercus (alba, rubra) - Liriodendron tulipifera / (Ilex opaca) / Polystichum acrostichoides Forest	Northern Coastal Plain / Piedmont Mesic Mixed Hardwood Forest	G5	S5	= CEGL006075
Eastern Hemlock - Hardwood Forests				
Tsuga canadensis - (Betula alleghaniensis, Quercus rubra) / Ilex montana - Rhododendron catawbiense Forest	Central Appalachian Hemlock / Catawba Rhododendron Forest	G1?	S1	= CEGL008513
Tsuga canadensis - Betula alleghaniensis / Maianthemum canadense Forest	Appalachian Hemlock - Northern Hardwood Forest	G4?	S1	= CEGL006109
Tsuga canadensis - Fagus grandifolia - Quercus (montana, alba) Forest	Piedmont / Coastal Plain Hemlock - Hardwood Forest	G2G3	S1	= CEGL006474
Northern White-Cedar Slope Forests				
Thuja occidentalis - Pinus strobus - Tsuga canadensis / Carex eburnea Forest	Northern White-Cedar Slope Forest	G1G2	S1	= CEGL008426

Terrestrial - *Low-Elevation Dry and Dry-Mesic Forests and Woodlands*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Dry-Mesic Calcareous Forests				
Acer saccharum - Quercus rubra - Carya (glabra, ovata) / Ageratina altissima Forest	Dry-Mesic Calcareous Forest (Sugar Maple - Northern Red Oak Type)	G4	S4	= CEGL008517
Quercus (alba, rubra) - Carya ovalis - Liriodendron tulipifera / Cercis canadensis / Polystichum acrostichoides Forest	Dry-Mesic Calcareous Forest (Southern Ridge and Valley / Cumberlands Type)	G4	S3?	= CEGL007233
Quercus (muehlenbergii, alba, rubra) - Carya cordiformis / Lindera benzoin - Viburnum prunifolium Forest	Dry-Mesic Calcareous Forest (Chinquapin Oak - Mixed Hardwoods Type)	G3G4	S3S4	= CEGL004793
Basic Oak - Hickory Forests				
Quercus alba - Carya glabra - Fraxinus americana / Cercis canadensis / Muhlenbergia sobolifera - Elymus hystrix Forest	Northern Hardpan Basic Oak - Hickory Forest	G3	S3	= CEGL006216
Quercus alba - Quercus rubra - Carya (tomentosa, ovata) / Cercis canadensis Forest	Southern Piedmont Basic Oak - Hickory Forest	G3G4	S3?	= CEGL007232
Quercus rubra - Quercus montana - Carya ovalis / (Cercis canadensis) / Solidago (caesia, curtisii) Forest	Inner Piedmont / Lower Blue Ridge Basic Oak - Hickory Forest	G3G4	S3S4	= CEGL008514
Acidic Oak - Hickory Forests				
Quercus alba - Quercus montana - Carya glabra / Cornus florida / Vaccinium pallidum / Carex pensylvanica Forest	Central Appalachian Acidic Oak - Hickory Forest	G4	S4	= CEGL008515
Quercus alba - Quercus rubra - Carya tomentosa / Cornus florida / Vaccinium stamineum / Hylodesmum nudiflorum Forest	Piedmont Acidic Oak - Hickory Forest	G4G5	S4S5	= CEGL008475
Montane Mixed Oak and Oak - Hickory Forests				
Quercus alba - Quercus (rubra, montana) / Oxydendrum arboreum / Rhododendron calendulaceum / Zizia trifoliata Forest	Southern Appalachian Montane Mixed Oak Forest (White Oak Type)	G4G5	S3	= CEGL007230
Quercus montana - Quercus rubra / Hamamelis virginiana Forest	Central Appalachian Dry-Mesic Chestnut Oak - Northern Red Oak Forest	G5	S4	= CEGL006057
Quercus montana - Quercus velutina / Oxydendrum arboreum - Cornus florida Forest	Southern Appalachian Montane Mixed Oak Forest (Chestnut Oak - Black Oak Subxeric Type)	G4G5	S3S4	= CEGL007267
Quercus rubra - Carya (ovalis, ovata) - Fraxinus americana / Actaea racemosa - Hydrophyllum virginianum Forest	Central Appalachian Montane Oak - Hickory Forest (Rich Type)	G3G4	S3S4	= CEGL008518
Quercus rubra - Quercus (montana, alba) - Carya ovalis / Carex pensylvanica - (Calamagrostis porteri) Forest	Central Appalachian Montane Oak - Hickory Forest (Acidic Type)	G3G4	S3S4	= CEGL008516
Quercus rubra - Quercus montana - Magnolia (acuminata, fraseri) / Acer pensylvanicum Forest	Southern Appalachian Montane Mixed Oak Forest (Northern Red Oak - Chestnut Oak Submesic Type)	G4?	S3S4	= CEGL004817

Terrestrial - *Low-Elevation Dry and Dry-Mesic Forests and Woodlands*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Oak / Heath Forests				
Quercus (montana, alba) / Avenella flexuosa - Solidago bicolor Forest	Coastal Plain River-Bluff Xeric Oak Forest	GNR	S1	= CEGL006490
Quercus alba - Quercus (coccinea, velutina, montana) / Gaylussacia baccata Forest	Piedmont / Central Appalachian Mixed Oak / Heath Forest	G5	S5	= CEGL008521
Quercus alba - Quercus falcata - (Carya pallida) / Gaylussacia frondosa Forest	Coastal Plain Mixed Oak / Heath Forest	G4G5	S4	= CEGL006269
Quercus montana - (Quercus coccinea, Quercus rubra) / Kalmia latifolia / Vaccinium pallidum Forest	Central Appalachian / Inner Piedmont Chestnut Oak Forest	G5	S5	= CEGL006299
Quercus montana - Quercus coccinea / Kalmia latifolia - (Eubotrys recurva) / Galax urceolata Forest	Southern Appalachian Chestnut Oak Forest	G5	S4S5	= CEGL006271
Quercus montana - Quercus rubra / Kalmia latifolia / Vaccinium angustifolium Forest	Northern Appalachian Chestnut Oak Forest	G5	S3	= CEGL006282
Quercus montana - Quercus rubra / Rhododendron maximum / Galax urceolata Forest	Southern Appalachian Chestnut Oak - Northern Red Oak / Great Rhododendron Forest	G4	S3?	= CEGL006286
Quercus montana - Quercus rubra / Vaccinium pallidum - (Rhododendron periclymenoides) Forest	Central Appalachian Xeric Chestnut Oak - Northern Red Oak / Heath Forest	G3G4	S3S4	= CEGL008523
Quercus montana / Rhododendron catawbiense - Kalmia latifolia Forest	Chestnut Oak / Catawba Rhododendron Forest	G4	S3	= CEGL008524
Eastern White Pine - Hardwood Forests				
Pinus strobus - Quercus alba - Quercus montana / Vaccinium stamineum Forest	Central Appalachian / Piedmont White Pine - Oak Forest	G4	S4	= CEGL008539
Piedmont / Coastal Plain Oak - Beech / Heath Forests				
Fagus grandifolia - Quercus (alba, velutina, montana) / Kalmia latifolia Forest	Northern Coastal Plain / Piedmont Oak - Beech / Heath Forest	G4	S3	= CEGL006919
Fagus grandifolia - Quercus alba / Oxydendrum arboreum - Symplocos tinctoria / Kalmia latifolia / (Galax urceolata) Forest	Southern Coastal Plain Oak - Beech / Heath Forest	G2G3	S2?	= CEGL004539
Carolina Hemlock Forests				
Tsuga caroliniana / Kalmia latifolia - Rhododendron catawbiense Forest	Carolina Hemlock Forest	G2	S1	= CEGL007139
Pine - Oak / Heath Woodlands				
Pinus (pungens, rigida) - Quercus montana / (Quercus ilicifolia) / Gaylussacia baccata Woodland	Central Appalachian Pine - Oak / Heath Woodland	G4	S4	= CEGL004996
Pinus pungens - Pinus rigida - (Quercus montana) / Kalmia latifolia - Vaccinium pallidum Woodland	Southern Appalachian Pine - Oak / Heath Woodland	G3	S3?	= CEGL007097
Mountain / Piedmont Acidic Woodlands				
Pinus echinata - Quercus montana - Carya tomentosa / Sorghastrum nutans - Pityopsis graminifolia var. latifolia - Solidago odora Woodland	Cumberland Mountains Shortleaf Pine Woodland	G2?	S1	= CEGL004445
Pinus rigida - Quercus montana / Gaylussacia baccata / Carex pensylvanica Woodland	Appalachian Pitch Pine Pavement Woodland	GNR	S2?	= CEGL004821
Pinus virginiana - Juniperus virginiana - Quercus stellata / Amelanchier spicata / Danthonia spicata / Leucobryum glaucum Woodland	Riverside Bedrock Terrace Woodland	G1	S1	= CEGL008449
Quercus montana - Pinus virginiana - (Pinus pungens) / Schizachyrium scoparium - Dichanthelium depauperatum Woodland	Central Appalachian Xeric Chestnut Oak - Virginia Pine Woodland	G3?	S3	= CEGL008540

Terrestrial - *Low-Elevation Dry and Dry-Mesic Forests and Woodlands*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Mountain / Piedmont Basic Woodlands				
Carya glabra - Fraxinus americana - Quercus montana / Ostrya virginiana / Philadelphus hirsutus Woodland	Southern Blue Ridge Calcareous Shale Woodland	G2	S1	= CEGL007720
Fraxinus americana - Carya glabra / Muhlenbergia sobolifera - Helianthus divaricatus - Solidago ulmifolia Woodland	Central Appalachian Basic Ash - Hickory Woodland	G2	S2	= CEGL003683
Montane Dry Calcareous Forests and Woodlands				
Fraxinus americana - Carya ovata / Frangula caroliniana / Helianthus hirsutus - (Polymnia canadensis) Forest	Cumberland Mountains Dry Calcareous Forest	G1?	S1	= CEGL008458
Juniperus virginiana - Quercus muehlenbergii / Rhus aromatica / Pellaea atropurpurea Woodland	Central Appalachian Chinquapin Oak - Eastern Redcedar Woodland	G3G4	S2	= CEGL006231
Quercus muehlenbergii - Acer (nigrum, saccharum) / Ostrya virginiana / Erigeron pulchellus - Packera obovata Forest	Appalachian Sugar Maple - Chinquapin Oak Dry Calcareous Forest	G4?	S4?	= CEGL006017
Quercus muehlenbergii - Juniperus virginiana / Packera paupercula var. appalachiana - Parthenium auriculatum - Schizachyrium scoparium Woodland	Ridge and Valley Dolomite Woodland	G2	S2	= CEGL006030
Quercus shumardii - Quercus muehlenbergii / Juniperus virginiana - Viburnum rufidulum / Sanicula odorata - Bignonia capreolata Forest	Southern Ridge and Valley Dry Calcareous Forest	G3	S2?	= CEGL007699
Coastal Plain Dry Calcareous Forests and Woodlands				
Quercus muehlenbergii / Cercis canadensis / Dichanthelium boscii - Bromus pubescens - Erigeron pulchellus - Aquilegia canadensis Forest	Coastal Plain Dry Calcareous Forest	G1	S1	= CEGL007748
Oak - Hickory Woodlands and Savannas				
Quercus alba - Carya tomentosa / Schizachyrium scoparium - Chrysogonum virginianum - Ageratina aromatica - (Salvia urticifolia) Woodland	Basic Oak-Hickory Woodland / Savanna	G1?	S1	= CEGL003721
Quercus alba - Quercus falcata - Carya tomentosa / Schizachyrium scoparium - Lespedeza procumbens Woodland	Acidic Oak-Hickory Woodland / Savanna	G1?	S1	= CEGL003722
Piedmont Hardpan Forests				
Carya glabra - Quercus (rubra, montana) - Fraxinus americana / Viburnum rafinesqueanum / Piptochaetium avenaceum Forest	Potomac River Bedrock Terrace Hardpan Forest	G1G2	S1	= CEGL006209
Quercus phellos - Quercus stellata / Ilex decidua / Danthonia spicata Forest	Southern Piedmont Mixed Moisture Hardpan Forest	G2?	S1	= CEGL004037
Quercus stellata - Quercus alba - Carya glabra / Ulmus alata / Piptochaetium avenaceum - Scleria oligantha Forest	Southern Piedmont Hardpan Forest	G2G3	S2	= CEGL003714
Low-Elevation Boulderfield Forests and Woodlands				
Acer saccharum - Tilia americana / Staphylea trifolia / Dryopteris marginalis - (Impatiens pallida) Forest	Central Appalachian / Piedmont Low-Elevation Rich Boulderfield Forest	G3G4	S2S3	= CEGL006471
Betula lenta - Quercus montana / Parthenocissus quinquefolia Woodland	Central Appalachian Acidic Boulderfield Woodland	G4	S3S4	= CEGL006565
Tilia americana - Fraxinus americana / Acer pensylvanicum - Ostrya virginiana / Parthenocissus quinquefolia - Impatiens pallida Forest	Central Appalachian Montane Rich Boulderfield Forest	G3	S3	= CEGL008528

Terrestrial - *Low-Elevation Rock Outcrops and Barrens*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Low-Elevation Acidic Outcrop Barrens				
Hydatica petiolaris Herbaceous Vegetation	Appalachian Low-Elevation Acidic Outcrop Barren (Cliff Saxifrage Type)	G3?	S2?	= CEGL004524
Low-Elevation Basic Outcrop Barrens				
Fraxinus americana - Juniperus virginiana / (Rhus aromatica) / Schizachyrium scoparium - Carex pensylvanica - Cheilanthes lanosa Wooded Herbaceous Vegetation	Central Appalachian Mafic / Calcareous Barren (Low-Elevation Type)	G2	S2	< CEGL006037
Fraxinus americana - Juniperus virginiana / Opuntia humifusa - Phemeranthus teretifolius - Polygonum tenue Wooded Herbaceous Vegetation	Piedmont Mafic Barren	G1	S1	= CEGL006294
Fraxinus americana / Physocarpus opulifolius / Carex pensylvanica - Allium cernuum - (Phacelia dubia) Wooded Herbaceous Vegetation	Central Appalachian Mafic / Calcareous Barren (Mid-Elevation Type)	G2	S2	= CEGL008529
Juniperus virginiana / Chionanthus virginicus / Cheilanthes lanosa - Sedum glaucophyllum Woodland	Southern Piedmont Mafic / Calcareous Barren	G2	S1	= CEGL004443
Minuartia glabra - Phemeranthus teretifolius - Hydatica petiolaris - Primula meadia Herbaceous Vegetation	Southern Blue Ridge Low-Elevation Granitic Barren	G2	S1	= CEGL004991
Quercus stellata / Schizachyrium scoparium - Sorghastrum nutans - Pycnanthemum tenuifolium - Packera paupercula var. paupercula Wooded Herbaceous Vegetation	Southern Blue Ridge Low-Elevation Mafic Barren	G1	S1	= CEGL006215
Limestone and Dolomite Barrens				
Juniperus virginiana / Schizachyrium scoparium - Andropogon gerardii - Carex eburnea Wooded Herbaceous Vegetation	Limestone / Dolomite Barren (Ridge and Valley Hillslope Type)	G2	S1S2	= CEGL004738
Juniperus virginiana / Schizachyrium scoparium - Bouteloua curtipendula - Sisyrinchium albidum - Packera millefolium Wooded Herbaceous Vegetation	Limestone / Dolomite Barren (Southern Ridge and Valley Type)	G2G3	S1S2	= CEGL005131
Mountain / Piedmont Calcareous Cliffs				
(Hydrangea arborescens, Physocarpus opulifolius) / Heuchera villosa - Micranthes caroliniana Shrub Herbaceous Vegetation	Southern Appalachian Mesic Calcareous Cliff	G2	S1S2	= CEGL008435
Asplenium ruta-muraria - Pellaea atropurpurea Sparse Vegetation	Appalachian Xeric Calcareous Cliff	G3G4	SU	= CEGL004476
Hydrangea arborescens / Sedum ternatum - Polypodium virginianum Shrubland	Piedmont / Mountain Mafic / Calcareous Cliff	GNR	S1?	= CEGL006479
Thuja occidentalis / Carex eburnea - Sedum glaucophyllum Woodland	Northern White-Cedar Cliff Woodland	G2G3	S2	= CEGL002596
Mountain / Piedmont Acidic Cliffs				
Asplenium montanum - Heuchera parviflora - Silene rotundifolia Sparse Vegetation	Cumberland Mountains Xeric Sandstone Cliff	G3G4	S1?	= CEGL004392
Asplenium montanum Sparse Vegetation	Central Appalachian / Piedmont Acidic Cliff	GNR	SU	= CEGL004391

Terrestrial - *Low-Elevation Rock Outcrops and Barrens*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Central Appalachian Shale Barrens				
(Pinus virginiana, Juniperus virginiana) / Schizachyrium scoparium - Eriogonum allenii Wooded Herbaceous Vegetation	Central Appalachian Shale Barren (Shale Ridge Bald / Prairie Type)	G2	S2	= CEGL008530
Juniperus virginiana / Carex pensylvanica - Cheilanthes lanosa - Eriogonum allenii Woodland	Central Appalachian Calcareous Shale Barren	G2	S2	< CEGL006037
Pinus virginiana - Quercus montana - Carya glabra / Phlox subulata - Packera antennariifolia Woodland	Central Appalachian Shale Barren (Southern Type)	G3G4	S3S4	= CEGL006562
Pinus virginiana - Quercus montana - Quercus rubra / Avenella flexuosa - Paronychia montana - Packera antennariifolia Woodland	Central Appalachian Shale Barren (Northern Type)	G3	S3	= CEGL006288
Pinus virginiana - Quercus montana / Quercus ilicifolia / (Hieracium traillii) Woodland	Central Appalachian Xeric Shale Woodland (Virginia Pine / Sparse Herbs Type)	G3	S3	= CEGL008525
Quercus montana / Quercus ilicifolia / Danthonia spicata Woodland	Central Appalachian Xeric Shale Woodland (Chestnut Oak / Mixed Herbs Type)	G3?	S3	= CEGL008526
Granitic Flatrocks				
Phemeranthus teretifolius - Minuartia glabra - Diodia teres - Croton willdenowii Herbaceous Vegetation	Granitic Flatrock	G2	S2	= CEGL003857
Piedmont Prairies				
Schizachyrium scoparium - Sorghastrum nutans - Solidago juncea - Pycnanthemum tenuifolium Herbaceous Vegetation	Little Bluestem - Indian-Grass Piedmont Prairie	GNR	SU	= CEGL006572
Ultramafic Woodlands and Barrens				
Pinus strobus - Pinus rigida - Quercus stellata / Ceanothus americanus / Andropogon gerardii - Packera paupercula var. paupercula Woodland	Southern Blue Ridge Ultramafic Woodland	G1	S1	= CEGL004968
* *Pinus virginiana - Quercus stellata - Quercus marilandica / Schizachyrium scoparium* Woodland	Piedmont Ultramafic Woodland	n/a	SU	no equivalent
Schizachyrium scoparium - Packera paupercula var. appalachiana - Parthenium auriculatum - Phemeranthus piedmontanus Herbaceous Vegetation	Southern Piedmont Ultramafic Barren	G1	S1	= CEGL006084
Schizachyrium scoparium - Sorghastrum nutans - Aletris farinosa - Packera paupercula var. paupercula Herbaceous Vegetation	Southern Blue Ridge Ultramafic Barren	G1	S1	= CEGL004999
Riverside Outcrop Barrens				
(Hypericum prolificum, Eubotrys racemosa) / Schizachyrium scoparium - Solidago racemosa - Ionactis linariifolia Herbaceous Vegetation	Potomac Gorge Riverside Outcrop Barren	G2	S1	= CEGL006491
Lichen / Bryophyte Nonvascular Boulderfields and Outcrops				
Lasallia (papulosa, pensylvanica) - Dimelaena oreina - (Melanelia culbersonii) Nonvascular Vegetation	Central Appalachian Low-Elevation Acidic Lichen / Bryophyte Boulderfield	G5	S4	= CEGL004142
Lasallia papulosa - Stereocaulon glaucescens - Chrysothrix chlorina Nonvascular Vegetation	Central Appalachian Mafic Lichen / Bryophyte Boulderfield	G1?	S1	= CEGL004143
Umbilicaria mammulata Nonvascular Vegetation	Mountain / Piedmont Mesic Lichen / Bryophyte Cliff	G4?	S3?	= CEGL004387
Umbilicaria muehlenbergii - Lasallia papulosa - (Melanelia stygia) Nonvascular Vegetation	Central Appalachian High-Elevation Acidic Lichen / Bryophyte Boulderfield	G2?	S1	= CEGL004389

* provisional type

Terrestrial - *Maritime Zone Communities*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Maritime Dune Grasslands				
(Morella pensylvanica) / Schizachyrium littorale Shrub Herbaceous Vegetation	Xeric Backdune Grassland	G2	S2	= CEGL004240
Ammophila breviligulata - Panicum amarum Herbaceous Vegetation	North Atlantic Mixed Dune Grassland	G2	S2	= CEGL004043
Spartina patens - Panicum amarum - Solidago sempervirens Herbaceous Vegetation	Overwash Dune Grassland	G2G3	S2	= CEGL004097
Uniola paniculata - Ammophila breviligulata Herbaceous Vegetation	South Atlantic Mixed Dune Grassland	G3	S2	= CEGL004039
Maritime Dune Scrub				
Hudsonia tomentosa / Cyperus grayi Dwarf-Shrubland	Sand Heather Dwarf Dune Scrub	G2G3	S2?	= CEGL003950
Morella pensylvanica - (Prunus serotina, Diospyros virginiana) / Solidago sempervirens Shrubland	Northern Bayberry Dune Scrub	G2	S2?	= CEGL003881
Quercus virginiana - (Morella pensylvanica) Shrubland	Live Oak Dune Scrub	G3	S1	= CEGL003833
Maritime Dune Woodlands				
Juniperus virginiana / Morella pensylvanica Woodland	Maritime Eastern Redcedar Dune Woodland	G2	S1?	= CEGL006212
Pinus taeda / Hudsonia tomentosa Woodland	Loblolly Pine / Sand Heather Dune Woodland	G1G2	S1S2	= CEGL006052
Prunus serotina / Smilax rotundifolia / Schizachyrium littorale Woodland	Black Cherry Xeric Dune Woodland	G1G2	S1	< CEGL006319
Quercus virginiana - Quercus incana Woodland	Live Oak - Bluejack Oak Dune Woodland	G1	S1	= CEGL003750
Maritime Upland Forests				
Pinus taeda - (Quercus falcata, Prunus serotina) / Morella cerifera / Vitis rotundifolia Forest	Maritime Loblolly Pine Forest	G2	S2	= CEGL006040
Quercus nigra - Pinus taeda - Carya pallida - (Fagus grandifolia) / Symplocos tinctoria / Gelsemium sempervirens Forest	Maritime Mixed Deciduous Forest	G1	S1	= CEGL007540
Quercus virginiana - Pinus taeda Forest	Maritime Live Oak Forest	G2	S1	= CEGL007027

Terrestrial - *Sandy Woodlands of the Coastal Plain and Outer Piedmont*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Pine / Scrub Oak Sandhills				
Pinus palustris - (Pinus serotina) / Quercus laevis / Gaylussacia frondosa - Kalmia angustifolia - Vaccinium tenellum Woodland	Longleaf Pine / Scrub Oak Sandhill Woodland	G1	S1	> CEGL003592
Pinus taeda - Quercus falcata - Quercus nigra / Quercus margarettae / Cnidoscolus stimulosus Woodland	Loblolly Pine / Scrub Oak Sandhill Woodland	n/a	SU	no equivalent
Fluvial Terrace Woodlands				
Carya pallida / Quercus margarettae / Opuntia humifusa - Carex umbellata Woodland	Coastal Plain Xeric Fluvial Terrace Woodland	GNR	S1	x CEGL006354
Loblolly Pine Savannas				
Pinus taeda / Schizachyrium scoparium - Eupatorium hyssopifolium - Lespedeza stuevei - Symphyotrichum concolor Woodland	Loblolly Pine / Little Bluestem Woodland / Savanna	GNA	SU	= CEGL003620

Palustrine - *Alluvial Floodplain Communities*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Bald Cypress - Tupelo Swamps				
Nyssa biflora - (Taxodium distichum) / Clethra alnifolia - Viburnum nudum / Woodwardia areolata Forest	Coastal Plain Swamp Tupelo Blackwater Swamp	G3	S3?	= CEGL007054
Taxodium distichum - Nyssa (biflora, aquatica) / Itea virginica / Saururus cernuus Forest	Bald Cypress - Mixed Tupelo Intermediate Swamp	G3G4	S3S4	= CEGL007432
Taxodium distichum - Nyssa aquatica / Fraxinus caroliniana Forest	Bald Cypress - Water Tupelo Brownwater Swamp	G5?	S4	= CEGL007431
Floodplain Ponds and Pools				
Cephalanthus occidentalis - Decodon verticillatus Shrubland	Coastal Plain / Piedmont Oxbow Shrub Swamp	G4G5	SU	< CEGL006069
Nuphar advena - Nymphaea odorata Herbaceous Vegetation	Water-Lily Floodplain Pool / Pond	G4G5	SU	= CEGL002386
Peltandra virginica - Hibiscus moscheutos - Persicaria (punctata, hydropiperoides) Herbaceous Vegetation	Coastal Plain / Piedmont Oxbow Marsh	G3	S2?	= CEGL007696
Semipermanent Impoundments				
Alnus serrulata Swamp Shrubland	Smooth Alder Impoundment Swamp	G4G5	SU	= CEGL005082
* *Hottonia inflata - Ludwigia palustris - Callitriche heterophylla* Herbaceous Vegetation	Coastal Plain Featherfoil Impoundment Pond	GNR	SU	= CEGL006102
Juncus effusus Herbaceous Vegetation	Common Rush Impoundment Marsh	G5	SU	= CEGL004112
Nelumbo lutea Herbaceous Vegetation	American Lotus Aquatic Bed	G4?	SU	= CEGL004323
* *Peltandra virginica - Alisma subcordatum - Leersia oryzoides* Herbaceous Vegetation	Pickerelweed Impoundment Marsh	GNR	SU	< CEGL004291
* *Spirodela polyrrhiza - Landoltia punctata - Wolffia columbiana - Azolla caroliniana* Herbaceous Vegetation	Coastal Plain Impoundment Aquatic Bed	G5	SU	< CEGL003059
Taxodium distichum / Lemna minor Forest	Bald Cypress Semi-permanent Impoundment	G4G5	SU	< CEGL002420
Piedmont / Mountain Floodplain Forests				
Acer saccharinum - Acer negundo / Ageratina altissima - Laportea canadensis - (Elymus virginicus, Elymus macgregorii) Forest	Piedmont / Central Appalachian Silver Maple Forest	G4	S4	= CEGL006217
Acer saccharum - Fraxinus americana - Carya cordiformis / Erythronium americanum Forest	Piedmont / Central Appalachian High Terrace Floodplain Forest	G3?	S1	= CEGL006459
Betula nigra - Platanus occidentalis Forest	Piedmont / Central Appalachian River Birch - Sycamore Forest	G5	SU	= CEGL002086
Platanus occidentalis - Acer negundo - Juglans nigra / Asimina triloba / Mertensia virginica Forest	Piedmont / Central Appalachian Rich Floodplain Forest	G4	S3S4	= CEGL004073
* *Quercus rubra - Quercus shumardii - Fraxinus americana / Cercis canadensis* Forest	Potomac Gorge Bedrock Floodplain Oak Forest	GNR	SU	= CEGL006495
Piedmont / Mountain Swamp Forests				
Acer (rubrum, saccharinum) - Fraxinus pennsylvanica - Ulmus americana / Boehmeria cylindrica Forest	Piedmont / Central Appalachian Floodplain Swamp (Silver Maple - Green Ash Type)	G4	S2?	= CEGL006548
Quercus palustris - Quercus bicolor / Carex tribuloides - Carex radiata - (Carex squarrosa) Forest	Piedmont / Central Appalachian Floodplain Swamp (Pin Oak - Swamp White Oak Type)	G3G4	S3?	= CEGL006497

* provisional type

Palustrine - *Alluvial Floodplain Communities*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Sand / Gravel / Mud Bars and Shores				
Eragrostis hypnoides - Lindernia dubia - Ludwigia palustris - Cyperus squarrosus Herbaceous Vegetation	Piedmont / Central Appalachian Sand Bar / River Shore (Low Herbs Type)	G3	S3	= CEGL006483
Eragrostis hypnoides - Micranthemum umbrosum - Lipocarpha micrantha - (Juncus repens) Herbaceous Vegetation	Coastal Plain Sand Bar / River Shore	G2	S1	= CEGL004341
Eupatorium serotinum - Persicaria (lapathifolia, punctata, pensylvanica) Herbaceous Vegetation	Piedmont / Central Appalachian Sand Bar / River Shore (Tall Herbs Type)	GNR	S2S3	= CEGL006481
Rocky Bars and Shores				
* *Alnus serrulata / Xanthorhiza simplicissima* Shrubland	Alder / Yellowroot Rocky Bar and Shore	G3G4	SU	= CEGL003895
Carex torta - Dichanthelium clandestinum - Persicaria sagittata Herbaceous Vegetation	Twisted Sedge Rocky Bar and Shore	G3G4	S3	= CEGL004103
Carpinus caroliniana - Ilex decidua Shrubland	Piedmont River-Scour Shrubland	G1?	S1	= CEGL006484
Justicia americana Herbaceous Vegetation	Water-Willow Rocky Bar and Shore	G4G5	S4	= CEGL004286
Platanus occidentalis - Acer saccharinum - Betula nigra - Fraxinus pennsylvanica / Boehmeria cylindrica - Carex emoryi Woodland	Piedmont / Central Appalachian Bedrock Floodplain Scour Woodland	G2?	S1	= CEGL006476
Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra) / Apocynum sibiricum Woodland	Piedmont / Central Appalachian Sycamore - River Birch Scour Woodland	G4G5	S3	= CEGL003896
Riverside Prairies				
* *Carex trichocarpa* Herbaceous Vegetation	Hairy-Fruited Sedge Riverside Prairie	G4?	SU	x CEGL006447
Fraxinus americana / Andropogon gerardii - Sorghastrum nutans - Schizachyrium scoparium - Pycnanthemum tenuifolium Herbaceous Vegetation	Piedmont / Central Appalachian Riverside Outcrop Prairie	G1	S1	= CEGL006478
Fraxinus pennsylvanica / Andropogon gerardii - Panicum virgatum - Baptisia australis Wooded Herbaceous Vegetation	Piedmont / Central Appalachian Bedrock Floodplain Prairie	G3	S2	= CEGL006283
Panicum virgatum - Andropogon gerardii Herbaceous Vegetation	Ridge and Valley Gravel-Wash Riverside Prairie	G2G3	S2	= CEGL006477
Coastal Plain / Piedmont Bottomland Forests				
Acer rubrum - Fraxinus pennsylvanica / Saururus cernuus Forest	Coastal Plain / Piedmont Floodplain Swamp (Green Ash - Red Maple Type)	G3G4	S3S4	= CEGL006606
Fagus grandifolia - Carya cordiformis - (Quercus michauxii, Quercus shumardii) / Ilex opaca / Podophyllum peltatum Forest	Northern Coastal Plain Beech - Mixed Hardwood Floodplain Forest	GNR	S1?	= CEGL006493
Liquidambar styraciflua - Liriodendron tulipifera / Lindera benzoin / Arisaema triphyllum Forest	Coastal Plain / Piedmont Small-Stream Floodplain Forest	G4	S4	= CEGL004418
Liquidambar styraciflua - Quercus (michauxii, shumardii) - Carya cordiformis / Ilex decidua / Carex amphibola Forest	Southern Piedmont / Inner Coastal Plain Floodplain Terrace Forest	G3G4	S3	= CEGL007006
Platanus occidentalis - Celtis occidentalis - Ulmus americana - Fraxinus pennsylvanica / Acer negundo / Chasmanthium latifolium Forest	Piedmont / Inner Coastal Plain Floodplain Levee Forest	G3G4	S3	= CEGL007013
Quercus (phellos, palustris, michauxii) - Liquidambar styraciflua / Cinna arundinacea Forest	Northern Coastal Plain / Inner Piedmont Mixed Oak Floodplain Swamp	G3G4	S3?	= CEGL006605
Quercus lyrata - Fraxinus pennsylvanica - (Carya aquatica, Quercus laurifolia) / Carex louisianica - Leersia lenticularis Forest	Coastal Plain Bottomland Forest (Brownwater Low Terrace Type)	G4G5	S3?	< CEGL007397
Quercus michauxii - Quercus pagoda - Carya ovata / Carpinus caroliniana / Carex abscondita Forest	Coastal Plain Bottomland Forest (Brownwater High Terrace Type)	G3G4	S3?	= CEGL004678
Quercus phellos - Quercus (palustris, lyrata) / Ilex decidua / Carex typhina - (Carex grayi) Forest	Southern Piedmont / Inner Coastal Plain Mixed Oak Floodplain Swamp	G3?	S3	= CEGL006498

* provisional type

Palustrine - *Alluvial Floodplain Communities*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Piedmont / Mountain Small-Stream Alluvial Forests				
* *Betula alleghaniensis / (Rhododendron maximum) / Parathelypteris noveboracensis - Viola macloskeyi - Scutellaria lateriflora* Forest	High Allegheny Montane Alluvial Forest	n/a	SU	no equivalent
Liriodendron tulipifera - Acer (rubrum, negundo) - (Platanus occidentalis) / Carpinus caroliniana / Persicaria virginiana Forest	Northern Piedmont Small-Stream Floodplain Forest	G4	S3?	= CEGL006492
Liriodendron tulipifera - Pinus strobus - (Tsuga canadensis) / Carpinus caroliniana / Amphicarpaea bracteata Forest	Central Appalachian Montane Alluvial Forest (Tuliptree - White Pine Type)	G3	S3	= CEGL008405
Liriodendron tulipifera - Platanus occidentalis - Betula lenta / Lindera benzoin / Circaea canadensis Forest	Northern Blue Ridge Montane Alluvial Forest	G3?	S3	= CEGL006255

* provisional type

Palustrine - *Non-Alluvial Wetlands of the Mountains*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Mountain / Piedmont Basic Seepage Swamps				
Acer rubrum - Fraxinus americana - Fraxinus nigra - (Betula alleghaniensis) / Veratrum viride - Carex bromoides Forest	Central Appalachian Basic Seepage Swamp	G3	S3	= CEGL008416
Mountain / Piedmont Acidic Seepage Swamps				
Acer rubrum - Nyssa sylvatica / Ilex verticillata - Vaccinium fuscatum / Osmundastrum cinnamomeum Forest	Central Appalachian Low-Elevation Acidic Seepage Swamp	G2	S2	= CEGL007853
High-Elevation Seepage Swamps				
Acer rubrum - (Betula alleghaniensis, Tsuga canadensis) / Rhododendron maximum / Osmundastrum cinnamomeum Forest	Southern Appalachian High-Elevation Seepage Swamp	G2	S1	= CEGL007565
Picea rubens - Tsuga canadensis - Acer rubrum / Glyceria melicaria Forest	Central Appalachian High-Elevation Seepage Swamp (Red Spruce Type)	G3	S1	= CEGL006556
Tsuga canadensis - Betula alleghaniensis / Veratrum viride - Carex scabrata - Oclemena acuminata Forest	Central Appalachian High-Elevation Seepage Swamp (Hemlock - Yellow Birch Type)	G2	S1	= CEGL008533
Appalachian Bogs				
Carex echinata - Solidago uliginosa / Sphagnum spp. Herbaceous Vegetation	Central Appalachian / High Allegheny Seepage Bog	G2?	S1	= CEGL008534
Carex gynandra - Scirpus cyperinus - Eriophorum virginicum - Osmundastrum cinnamomeum Herbaceous Vegetation	Cumberland Mountains Streamside Bog	G2	S1?	= CEGL007771
Pinus rigida / Osmundastrum cinnamomeum - Carex stricta - Eriophorum virginicum / Sphagnum spp. Woodland	Central Appalachian Pitch Pine Bog	G1	S1	= CEGL007056
Rhododendron (catawbiense, maximum) - Vaccinium simulatum / Carex trisperma - Eriophorum virginicum - Juncus subcaudatus Shrubland	Southern Appalachian High-Elevation Shrub Bog	G1	S1	= CEGL003913
Sparganium americanum - (Sparganium emersum) - Epilobium leptophyllum Herbaceous Vegetation	Southern Appalachian / High Allegheny Beaver Marsh	G3?	SU	= CEGL004510
Vaccinium macrocarpon / Pogonia ophioglossoides Dwarf-Shrubland	Cranberry Peatland Bog	G2	S1	= CEGL007856
Montane Woodland Seeps				
* *Caltha palustris - Impatiens pallida - Viola cucullata* Herbaceous Vegetation	Central Appalachian Woodland Seep	GNR	SU	= CEGL006258
Carex scabrata - Viola cucullata / Plagiomnium ciliare Herbaceous Vegetation	High Allegheny Woodland Seep	G3	SU	= CEGL006597
Diphylleia cymosa - Micranthes micranthidifolia - Laportea canadensis Herbaceous Vegetation	Southern Appalachian High-Elevation Seep (Umbrella-Leaf - Lettuce Saxifrage Type)	G3	SU	= CEGL004296
Impatiens (capensis, pallida) - Monarda didyma - Rudbeckia laciniata var. humilis Herbaceous Vegetation	Southern Appalachian High-Elevation Seep (Jewelweed - Scarlett BeebalmType)	G3	SU	= CEGL004293

* provisional type

Palustrine - *Non-Alluvial Wetlands of the Mountains*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Montane Depression Wetlands				
(Cephalanthus occidentalis) / Dulichium arundinaceum - (Persicaria hydropiperoides, Glyceria acutiflora, Proserpinaca palustris) Shrub Herbaceous Vegetation	Central Appalachian Mountain Pond (Threeway Sedge - Buttonbush Type)	G1	S1	= CEGL003746
(Quercus palustris) / Coleataenia rigidula - Panicum verrucosum - Eleocharis acicularis Herbaceous Vegetation	Shenandoah Valley Sinkhole Pond (Typic Type)	G1	S1	= CEGL007858
Acer rubrum - Nyssa sylvatica - Quercus palustris / Woodwardia virginica Forest	Central Appalachian Depression Forest (Low-Elevation Type)	n/a	S2?	no equivalent
Carex aquatilis - Dulichium arundinaceum Herbaceous Vegetation	Central Appalachian Mountain Pond (Water Sedge Type)	G1?	S1	= CEGL008542
Carex barrattii Herbaceous Vegetation	Shenandoah Valley Sinkhole Pond (Barratt's Sedge Type)	G1	S1	= CEGL007857
Nyssa sylvatica - Acer rubrum / Vaccinium erythrocarpum / Osmundastrum cinnamomeum Forest	Central Appalachian Depression Forest (High-Elevation Type)	GNR	S1?	< CEGL006132
Orontium aquaticum - Schoenoplectus subterminalis - Eriocaulon aquaticum Herbaceous Vegetation	Shenandoah Valley Sinkhole Pond (Golden Club Type)	G1	S1	= CEGL007859
* *Quercus alba / Persicaria hydropiperoides - Lysimachia lanceolata* Wooded Herbaceous Vegetation	Central Appalachian Mountain Pond (White Oak Type)	GNR	SU	= CEGL008473
Calcareous Fens				
Alnus serrulata / Osmunda spectabilis - Carex tetanica - Carex leptalea Shrubland	Central Appalachian Calcareous Shrub Fen / Seep	G1?	S1	= CEGL008408
Carex (tetanica, prairea) - Eleocharis erythropoda - Lysimachia quadriflora Herbaceous Vegetation	Shenandoah Valley Prairie Fen	G1Q	S1	= CEGL006170
Packera aurea - Carex interior - Carex hystericina - Parnassia grandifolia Herbaceous Vegetation	Ridge and Valley Calcareous Sedge Fen / Seep	n/a	S1	no equivalent
Mesic and Wet-Mesic Prairies				
Andropogon gerardii - Sorghastrum nutans - Pycnanthemum virginianum Herbaceous Vegetation	Appalachian Wet-Mesic Tall-Grass Prairie	G2?	S2	= CEGL006039
Calcareous Spring Marshes and Muck Fens				
Carex utriculata - Sparganium americanum Herbaceous Vegetation	Ridge and Valley Calcareous Spring Marsh (Beaked Sedge - American Bur-Reed Type)	G4G5	S1	< CEGL002257
Peltandra virginica - Persicaria amphibia - Carex stricta - Impatiens capensis Herbaceous Vegetation	Ridge and Valley Calcareous Spring Marsh (Arrow-Arum - Water Smartweed Type)	G1	S1	= CEGL006244
Typha latifolia - Caltha palustris Herbaceous Vegetation	Ridge and Valley Calcareous Spring Marsh (Common Cattail - Marsh Marigold Type)	G1	S1	= CEGL006245
Mafic Fens and Seeps				
Acer rubrum - Pinus strobus / Alnus serrulata - Physocarpus opulifolius / Solidago patula - Parnassia grandifolia Woodland	Southern Blue Ridge Mafic Woodland Seep	G1	S1	= CEGL004994
Alnus serrulata - Lyonia ligustrina - Spiraea tomentosa / Calamagrostis canadensis - Sanguisorba canadensis - Scirpus expansus Shrubland	Southern Blue Ridge Mafic Fen (Tall Shrub Type)	G1	S1	= CEGL004252
Alnus serrulata / Sanguisorba canadensis - Helenium brevifolium - Parnassia grandifolia - Eleocharis tenuis Shrubland	Southern Blue Ridge Mafic Fen (Low Herb Type)	G1	S1	= CEGL003917
Spiraea latifolia - Cornus racemosa / Calamagrostis canadensis - Sanguisorba canadensis - Carex scoparia Shrub Herbaceous Vegetation	Northern Blue Ridge Mafic Fen	G1	S1	= CEGL006249

* provisional type

Palustrine - *Non-Alluvial Wetlands of the Mountains*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Spray Cliffs				
* Appalachian Spray Cliff Herbaceous Vegetation	Appalachian Spray Cliff	n/a	S1?	no equivalent
Inland Salt Marshes				
Juncus gerardii - Bolboschoenus robustus - Hibiscus moscheutos Herbaceous Vegetation	Ridge and Valley Inland Salt Marsh	G1	S1	= CEGL006234

* provisional type

Palustrine - *Non-Alluvial Wetlands of the Coastal Plain and Piedmont*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Coastal Plain Depression Wetlands				
Cephalanthus occidentalis - (Decodon verticillatus) / Panicum verrucosum - Dulichium arundinaceum - (Torreyochloa pallida) Shrub Herbaceous Vegetation	Coastal Plain Seasonal Buttonbush Pond	G3?	S2	< CEGL006242
* *Eragrostis hypnoides - Ludwigia sphaerocarpa - Persicaria hydropiperoides* Herbaceous Vegetation	Coastal Plain Seasonal Pond (Creeping Lovegrass Type)	GNR	SU	= CEGL006608
Nyssa biflora - (Quercus lyrata) / Eubotrys racemosa / Carex joorii Forest	Coastal Plain Seasonal Pond (Swamp Tupelo - Overcup Oak Type)	G1G2	S1S2	= CEGL006223
* *Persicaria hydropiperoides - Dulichium arundinaceum - Juncus repens* Herbaceous Vegetation	Coastal Plain Seasonal Pond (Mild Water-Pepper - Three-Way Sedge Type)	G3?	SU	< CEGL006242
Quercus phellos - Acer rubrum - Liquidambar styraciflua / Vaccinium (formosum, fuscatum) Forest	Coastal Plain Depression Swamp (Willow Oak - Red Maple - Sweetgum Type)	G3	S2	= CEGL006110
Saccharum baldwinii - Carex (joorii, glaucescens) - Coleataenia rigidula Herbaceous Vegetation	Coastal Plain Seasonal Pond (Narrow Plumegrass Type)	G2G3	SU	= CEGL007745
* *Saccharum giganteum - Ludwigia sphaerocarpa - Panicum verrucosum* Herbaceous Vegetation	Coastal Plain Seasonal Pond (Giant Plumegrass - Globe-Fruited Seedbox Type)	G2G3	SU	= CEGL007744
Taxodium distichum / Cephalanthus occidentalis / Juncus repens Woodland	Bald Cypress Seasonal Pond / Lake Shore	G1?	S1	= CEGL004653
Coastal Plain / Piedmont Seepage Bogs				
Alnus serrulata - Magnolia virginiana / Andropogon glomeratus - Eupatorium pilosum - Rhynchospora gracilenta - Xyris torta Shrubland	Coastal Plain / Outer Piedmont Seepage Bog	GNR	S1	= CEGL006499
Nyssa sylvatica - Magnolia virginiana - (Pinus rigida) / Rhododendron viscosum - Toxicodendron vernix / Smilax pseudochina Woodland	Northern Coastal Plain Terrace Gravel Bog	G1	S1	= CEGL006219
Coastal Plain / Piedmont Acidic Seepage Swamps				
Acer rubrum - Nyssa sylvatica - Magnolia virginiana / Viburnum nudum / Osmundastrum cinnamomeum - Woodwardia areolata Forest	Coastal Plain / Outer Piedmont Acidic Seepage Swamp	G3?	S3	= CEGL006238
Coastal Plain / Piedmont Basic Seepage Swamps				
Acer rubrum - Fraxinus (pennsylvanica, americana) / Lindera benzoin / Symplocarpus foetidus Forest	Piedmont / Northern Coastal Plain Basic Seepage Swamp	G4G5	S2?	= CEGL006406
Acer rubrum - Fraxinus pennsylvanica / Packera aurea - Carex bromoides - Pilea fontana - Bidens laevis Forest	Coastal Plain Calcareous Seepage Swamp	G2	S2	= CEGL006413
Upland Depression Swamps				
Quercus palustris - Acer rubrum - Liquidambar styraciflua / Vaccinium (fuscatum, formosum) Forest	Outer Piedmont / Inner Coastal Plain Upland Depression Swamp (Pin Oak / Highbush Blueberry Type)	GNR	S1	= CEGL006240
Quercus palustris - Quercus bicolor / Viburnum prunifolium / Leersia virginica - Impatiens capensis Forest	Piedmont Upland Depression Swamp (Pin Oak - Swamp White Oak Type)	G2	S1	= CEGL004643
Quercus phellos / Smilax rotundifolia / Carex (albolutescens, festucacea) Forest	Piedmont Upland Depression Swamp (Willow Oak Type)	G2G3	S2	= CEGL007403

* provisional type

Palustrine - *Non-Alluvial Wetlands of the Coastal Plain and Piedmont*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Non-Riverine Flatwoods and Swamps				
Nyssa biflora - Acer rubrum - Magnolia virginiana - Chamaecyparis thyoides / Lyonia lucida - Clethra alnifolia Forest	Non-Riverine Swamp Forest (Mixed Evergreen Type)	G2G3	S1	= CEGL007558
Nyssa biflora - Taxodium distichum - Acer rubrum / (Persea palustris) / Clethra alnifolia / Woodwardia virginica Forest	Non-Riverine Swamp Forest (Tupelo - Bald Cypress Type)	G2G3	S1S2	= CEGL004429
Quercus (michauxii, pagoda, laurifolia) / Carpinus caroliniana / (Leucothoe axillaris) - Arundinaria tecta Forest	Non-Riverine Wet Hardwood Forest (Southern Coastal Plain Type)	G2	S1	= CEGL007449
Quercus (phellos, pagoda, michauxii) / Ilex opaca - Clethra alnifolia / Woodwardia areolata Forest	Non-Riverine Wet Hardwood Forest (Northern Coastal Plain Type)	G2?	S2	= CEGL004644

Palustrine - *Saturated Peatlands of the Coastal Plain*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Pond Pine Woodlands and Pocosins				
Pinus serotina / Arundinaria tecta Woodland	Canebrake Woodland	G1	SX	= CEGL004433
Pinus serotina / Smilax laurifolia - Ilex glabra / Woodwardia virginica Woodland	Pond Pine Woodland / Pocosin	G2?	S1	= CEGL004652
Peatland Atlantic White-Cedar Forests				
Chamaecyparis thyoides / Lyonia lucida - Ilex coriacea / Osmundastrum cinnamomeum Forest	Peatland Atlantic White-Cedar Forest	G2	S1	= CEGL006146

Palustrine - *Non-Tidal Maritime Wetlands*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Sea-Level Fens				
Cladium mariscoides - Drosera intermedia - Eleocharis rostellata Herbaceous Vegetation	Sea-Level Fen	G1	S1	= CEGL006310
Maritime Swamps				
Acer rubrum - Nyssa (biflora, sylvatica) / Morella cerifera / Leersia (oryzoides, virginica) Forest	Maritime Swamp Forest (Red Maple - Tupelo Type)	G2	S2	= CEGL004082
Morella cerifera - Toxicodendron radicans / Hydrocotyle verticillata Shrubland	Wax Myrtle Maritime Shrub Swamp	G2G3	S2?	= CEGL003840
Pinus taeda / Morella cerifera / Osmunda spectabilis Forest	Maritime Wet Loblolly Pine Forest	G3	S2?	= CEGL006137
Salix nigra Forest	Maritime Swamp Forest (Black Willow Type)	G2G3	SU	= CEGL006348
Taxodium distichum / Cephalanthus occidentalis / Boehmeria cylindrica - Ceratophyllum echinatum Forest	Maritime Swamp Forest (Bald Cypress Type)	G1	S1	= CEGL004079
Interdune Swales and Ponds				
Bacopa monnieri - Eleocharis albida Herbaceous Vegetation	Interdune Pond (Coastal Water-Hyssop - White Spikerush Oligohaline Type)	G1Q	S1	= CEGL006350
Juncus scirpoides - Eupatorium hyssopifolium - Euthamia caroliniana - Xyris jupicai Herbaceous Vegetation	Interdune Swale (Mixed Rush Type)	G2G3	S1?	= CEGL004111
Morella cerifera - Baccharis halimifolia / Spartina patens Shrubland	Wax Myrtle Interdune Shrubland	G3G4	S2S3	= CEGL003839
Panicum virgatum - Schoenoplectus pungens Herbaceous Vegetation	Interdune Swale / Pond (Switchgrass Type)	G2G4	S2?	= CEGL004129
Spartina patens - (Bolboschoenus robustus) Herbaceous Vegetation	Interdune Swale (Saltmeadow Cordgrass Brackish Type)	GNR	S2?	= CEGL006342
Spartina patens - Fimbristylis (castanea, caroliniana) - Cyperus filicinus - (Schoenoplectus pungens) Herbaceous Vegetation	Interdune Swale (Northern Mixed Grassland Type)	G1G2	S1?	= CEGL004117
Spartina patens - Schoenoplectus pungens - Thelypteris palustris - Centella erecta Herbaceous Vegetation	Interdune Swale (Southern Mixed Grassland Type)	n/a	S2	no equivalent
* *Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation	Interdune Pond (Narrow-Leaf Cattail - Swamp Rose-Mallow Type)	n/a	SU	no equivalent

* provisional type

Riverine - *[Riverine Vegetation]*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Riverine Aquatic Beds				
Podostemum ceratophyllum Herbaceous Vegetation	Riverine Aquatic Bed (Horn-Leaf Riverweed Type)	G3G5	SU	= CEGL004331
Vallisneria americana - *Heteranthera dubia* Riverine Herbaceous Vegetation	Riverine Aquatic Bed (Tapegrass Type)	G3G4	S3?	= CEGL004333

Estuarine - *Tidal Wetlands*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Tidal Freshwater Marshes				
* *Acorus calamus* Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (Sweetflag Type)	GNR	SU	= CEGL006833
* *Eleocharis palustris - Orontium aquaticum* Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (Common Spikerush - Golden Club Type)	n/a	SU	no equivalent
Impatiens capensis - Persicaria arifolia - Peltandra virginica - (Typha angustifolia) Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (Mixed High Marsh Type)	GNR	S4?	= CEGL006325
Nelumbo lutea Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (American Lotus Mud Flat Type)	GNR	S2?	= CEGL006913
Nuphar advena - Peltandra virginica Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (Common Spatterdock - Arrow-Arum Mud Flat Type)	G3G4	S3S4	< CEGL004706
Nuphar advena Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (Common Spatterdock Mudflat Type)	G4G5	S3	= CEGL004472
Peltandra virginica - (Pontederia cordata) Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (Arrow-Arum - Pickerelweed Type)	G3G4	S3S4	< CEGL004706
Zizania aquatica - Pontederia cordata - Peltandra virginica - Persicaria punctata Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (Wild Rice - Mixed Forbs Type)	G4?	S4?	= CEGL004202
Zizaniopsis miliacea Tidal Herbaceous Vegetation	Tidal Freshwater Marsh (Southern Wild Rice Type)	G3G5	S3?	= CEGL004705
Tidal Oligohaline Marshes				
* *Carex hyalinolepis* Tidal Herbaceous Vegetation	Tidal Oligohaline Marsh (Shoreline Sedge Type)	GNR	SU	= CEGL006177
Eleocharis rostellata - Spartina patens Tidal Herbaceous Vegetation	Tidal Oligohaline Marsh (Beaked Spikerush - Saltmeadow Cordgrass Estuarine Fringe Type)	GNR	S1?	= CEGL006611
Hibiscus moscheutos - Persicaria punctata - Peltandra virginica - (Typha angustifolia, Spartina cynosuroides) Tidal Herbaceous Vegetation	Tidal Oligohaline Marsh (Mixed Forbs Type)	GNR	S4	= CEGL006181
Schoenoplectus americanus - Spartina patens Tidal Herbaceous Vegetation	Tidal Oligohaline Marsh (Saltmeadow Cordgrass - Olney Three-Square Low Interior Marsh Type)	GNR	S3?	= CEGL006612
Spartina cynosuroides Tidal Herbaceous Vegetation	Tidal Oligohaline Marsh (Big Cordgrass Type)	G4	S4	= CEGL004195
Typha angustifolia - Hibiscus moscheutos Tidal Herbaceous Vegetation	Tidal Oligohaline Marsh (Narrow-Leaf Cattail - Swamp Rose-Mallow Type)	G4G5	S3?	= CEGL004201
Wind-Tidal Oligohaline Marshes				
Eleocharis fallax - Sagittaria lancifolia - Persicaria punctata Tidal Herbaceous Vegetation	Wind-Tidal Oligohaline Marsh (Creeping Spikerush - Bull-Tongue Arrowhead Type)	G1G2	S1	< CEGL004628
Eleocharis rostellata - (Eleocharis fallax) Tidal Herbaceous Vegetation	Wind-Tidal Oligohaline Marsh (Beaked Spikerush Type)	G1G2	S1	< CEGL004628
Juncus roemerianus - Eleocharis fallax Tidal Herbaceous Vegetation	Wind-Tidal Oligohaline Marsh (Black Needlerush Type)	G2G3	S2S3	= CEGL004660
Sagittaria lancifolia - Osmunda spectabilis - Cladium (mariscoides, jamaicense) Tidal Herbaceous Vegetation	Wind-Tidal Oligohaline Marsh (Mixed Type)	G1G2	S1	< CEGL004628
Spartina cynosuroides - Schoenoplectus americanus - Persicaria hydropiperoides Tidal Herbaceous Vegetation	Wind-Tidal Oligohaline Marsh (Big Cordgrass Type)	G2G3	S2	= CEGL007741

* provisional type

Estuarine - *Tidal Wetlands*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Tidal Mesohaline and Polyhaline Marshes				
Bolboschoenus robustus - Spartina alterniflora Tidal Herbaceous Vegetation	Riverine Salt Marsh (Saltmarsh Bulrush - Saltmarsh Cordgrass Type)	GNR	S3?	= CEGL006416
Juncus roemerianus Tidal Herbaceous Vegetation	Black Needlerush Salt Marsh	G5	S4	= CEGL004186
Spartina alterniflora - Distichlis spicata Tidal Herbaceous Vegetation	Low Salt Marsh (Saltmarsh Cordgrass - Salt Grass Type)	GNR	S4?	= CEGL006586
Spartina alterniflora - Spartina cynosuroides Tidal Herbaceous Vegetation	Riverine Salt Marsh (Saltmarsh Cordgrass - Big Cordgrass Type)	GNR	S3?	= CEGL006418
Spartina alterniflora - Spartina patens Tidal Herbaceous Vegetation	Low Salt Marsh (Salt Panne Type)	G5	S3?	< CEGL004192
Spartina alterniflora Tidal Herbaceous Vegetation	Low Salt Marsh (Saltmarsh Cordgrass Type)	G5	S5	< CEGL004192
Spartina patens - Distichlis spicata Tidal Herbaceous Vegetation	High Salt Marsh	G4G5	S4S5	= CEGL004197
Tidal Shrub Swamps				
Alnus serrulata - Salix nigra / Pilea (fontana, pumila) Tidal Shrubland	Freshwater Tidal Shrub Swamp	GNR	SU	= CEGL006843
Iva frutescens / Spartina cynosuroides Tidal Shrubland	Mesohaline Tidal Shrub Swamp (Riverine Type)	GNR	SU	= CEGL006847
Iva frutescens / Spartina patens - Distichlis spicata Tidal Shrubland	Mesohaline Tidal Shrub Swamp (High Salt Marsh Type)	G5	SU	= CEGL006848
Morella cerifera - Rosa palustris / Osmunda spectabilis - Thelypteris palustris Tidal Shrubland	Oligohaline Tidal Shrub Swamp	G4	S3	= CEGL004656
Tidal Bald Cypress Forests and Woodlands				
Taxodium distichum - Nyssa biflora - (Pinus taeda) / Morella cerifera / Osmunda spectabilis Tidal Forest	Wind-Tidal Bald Cypress - Tupelo Swamp	G2?	S2	= CEGL004651
Taxodium distichum - Nyssa biflora - Fraxinus profunda / Peltandra virginica - (Bignonia capreolata) Tidal Forest	Northern Coastal Plain Tidal Bald Cypress Forest	G3	S2	= CEGL006850
Taxodium distichum / Carex hyalinolepis Tidal Woodland	Tidal Bald Cypress Woodland (Shoreline Sedge Type)	G2?	S1	= CEGL004654
* *Taxodium distichum / Zizania aquatica - Carex canescens* Tidal Woodland	Wind-Tidal Bald Cypress Woodland	G1Q	SU	= CEGL004655
Tidal Hardwood Swamps				
* *(Fraxinus profunda, Nyssa biflora) / Agalinis purpurea - Rhynchospora macrostachya* Tidal Wooded Herbaceous Vegetation	Freshwater Tidal Marsh Woodland (Mixed Forbs Type)	n/a	SU	no equivalent
Fraxinus profunda - Nyssa biflora - (Fraxinus pennsylvanica) / Ilex verticillata / Persicaria arifolia Tidal Forest	Freshwater Tidal Hardwood Swamp	G3	S3	= CEGL006287
* *Nyssa biflora / Alnus serrulata - Cephalanthus occidentalis* Tidal Woodland	Freshwater Tidal Marsh Woodland (Mixed Shrubs Type)	n/a	SU	no equivalent

* provisional type

Estuarine - *Tidal Wetlands*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Tidal Freshwater and Oligohaline Aquatic Beds				
Ceratophyllum demersum - Utricularia macrorhiza - (Nymphaea odorata) Semipermanently Flooded Tidal Herbaceous Vegetation	Tidal Freshwater / Oligohaline Aquatic Bed (Common Hornwort Type)	G3?	SU	= CEGL004661
Nuphar sagittifolia Permanently Flooded Tidal Herbaceous Vegetation	Tidal Freshwater / Oligohaline Aquatic Bed (Narrow-Leaved Spatterdock Type)	G1G2	S1	= CEGL006094
* *Nymphaea odorata* Semipermanently Flooded Tidal Herbaceous Vegetation	Tidal Freshwater / Oligohaline Aquatic Bed (White Water-Lily Type)	GNR	SU	< CEGL006048
* *Vallisneria americana - Myriophyllum spicatum* Semipermanently Flooded Tidal Herbaceous Vegetation	Tidal Freshwater / Oligohaline Aquatic Bed Tapegrass Type)	GNR	SU	< CEGL006048
Tidal Mesohaline and Polyhaline Aquatic Beds				
Ruppia maritima Semipermanently Flooded Tidal Herbaceous Vegetation	Tidal Mesohaline / Polyhaline Aquatic Bed (Wigeon-Grass Type)	GNR	SU	= CEGL006167
Zostera marina Semipermanently Flooded Tidal Herbaceous Vegetation	Tidal Mesohaline / Polyhaline Aquatic Bed (Eelgrass Type)	G4G5	SU	= CEGL004336
Salt Flats				
(Salicornia virginica, Salicornia bigelovii, Sarcocornia pacifica) Herbaceous Vegetation	Glasswort Salt Flat	G5	S3	= CEGL004308
Salt Scrub				
Baccharis halimifolia - Iva frutescens / Spartina patens Shrubland	Salt Scrub	G5	S4	= CEGL003921
High-Energy Tidal River Shores				
* *Eriocaulon parkeri - Persicaria punctata* Tidal Herbaceous Vegetation	High-Energy Tidal River Shore (Parker's Pipewort Freshwater Type)	G2	SU	= CEGL006352
* *Isoetes riparia* Tidal Herbaceous Vegetation	High-Energy Tidal River Shore (Shore Quillwort Freshwater Type)	GNR	SU	= CEGL006058
* *Justicia americana* Tidal Herbaceous Vegetation	High-Energy Tidal River Shore (Water-Willow Type)	GNR	SU	= CEGL006579
Peltandra virginica - Schoenoplectus (pungens, tabernaemontani) Tidal Herbaceous Vegetation	High-Energy Tidal River Shore (Arrow-Arum - Bulrush Mud Flat Type)	GNR	S3?	= CEGL006578
Schoenoplectus pungens Tidal Herbaceous Vegetation	High-Energy Tidal River Shore (Common Threesquare / Northern Type)	GNR	S1?	= CEGL004188

* provisional type

Marine - *[Marine Vegetation]*

Scientific Name	Common Name	Global Rank	State Rank	USNVC Code
Upper Beaches and Overwash Flats				
Cakile edentula - *Salsola kali* Herbaceous Vegetation	North Atlantic Upper Beach / Overwash Flat	G4G5	S3	= CEGL004400

APPENDICES

Appendix A. Changes to Ecological Groups and Community Types

Development of the state classification is an iterative process of successive approximations. Since completion of the Second Approximation, version 2.2 (Fleming *et al.* 2006), analysis of several large, regional datasets and ongoing inventory of vegetation across the state have led to a number of changes to the Ecological Group Classification. Changes to Ecological Groups since 2006 are listed below. Changes to Community Types since the publication of the 2011 list are listed in a third and fourth table. In 2013, the nomenclature for vascular plant species used in the community type scientific name was changed to follow The Flora of Virginia (Weakley et al. 2012), resulting in the change of 104 community type names. These changes are not listed in this appendix.

Changes to Ecological Community Groups 2006 - 2010

Second Approximation (ver. 2.2)	Second Approximation (ver. 2.3)
SOUTHERN APPALACHIAN NORTHERN HARDWOOD FORESTS	merged with the following group into a new NORTHERN HARDWOOD FORESTS group
CENTRAL APPALACHIAN NORTHERN HARDWOOD FORESTS	merged with the preceding group into a new NORTHERN HARDWOOD FORESTS group
ULTRAMAFIC WOODLANDS	merged with the Ultramafic Barrens group into a new ULTRAMAFIC WOODLANDS AND BARRENS group
ULTRAMAFIC BARRENS	merged with the Ultramafic Woodlands group into a new ULTRAMAFIC WOODLANDS AND BARRENS group
MOSS / LICHEN BOULDERFIELDS	name changed to LICHEN / BRYOPHYTE NONVASCULAR BOULDERFIELDS AND OUTCROPS
CALCAREOUS FENS AND SEEPS	merged with the following group into a new CALCAREOUS FENS group
WET PRAIRIES AND PRAIRIE FENS	merged with the preceding group into a new CALCAREOUS FENS group
NON-RIVERINE PINE-HARDWOOD FORESTS	merged with the following two groups into a new NON-RIVERINE FLATWOODS AND SWAMPS group
NON-RIVERINE WET HARDWOOD FORESTS	merged with the preceding and following groups into a new NON-RIVERINE FLATWOODS AND SWAMPS group
NON-RIVERINE SWAMP FORESTS	merged with the preceding two groups into a new NON-RIVERINE FLATWOODS AND SWAMPS group
MARITIME WET PINE FOREST	moved to new group MARITIME SWAMP FORESTS
INTERDUNE WET PINE WOODLANDS	merged into the MARITIME SWAMP FORESTS group
ESTUARINE FRINGE PINE FORESTS	merged into the MARITIME SWAMP FORESTS group
ESTUARINE FRINGE SWAMP FORESTS	merged into the TIDAL BALDCYPRESS FORESTS AND WOODLANDS group
(not represented)	a new HIGH-ENERGY TIDAL SHORES group was added to represent vegetation previously included in the Tidal Freshwater Marshes group

Changes to Ecological Community Groups 2010 - 2011

Second Approximation (ver. 2.3)	Second Approximation (ver. 2.4)
COASTAL PLAIN / PIEDMONT FLOODPLAIN FOREST	Changed name to COASTAL PLAIN PIEDMONT BOTTOMLAND FOREST
COASTAL PLAIN / PIEDMONT SWAMP FOREST	Merged into COASTAL PLAIN PIEDMONT BOTTOMLAND FOREST
PIEDMONT / MOUNTAIN ALLUVIAL FOREST	Changed name to PIEDMONT / MOUNTAIN SMALL-STREAM ALLUVIAL FOREST
STREAMHEAD POCOSIN	Merged into NON-RIVERINE FLATWOOD / SWAMP

Changes to Ecological Community Groups 2011 - 2012

Second Approximation (ver. 2.4)	Second Approximation (ver. 2.5)
MARITIME SHRUB SWAMP	Merged into a new MARITIME SWAMP group
MARITIME SWAMP FOREST	Merged into a new MARITIME SWAMP group
INTERDUNE POND	Merged into a new INTERDUNE SWALES AND PONDS group
MARITIME WET GRASSLAND	Merged into a new INTERDUNE SWALES AND PONDS group

Changes to Community Types 2011 -2012

2011 Community List	2012 Community List
APPALACHIAN BOG: *Pinus rigida / Hypericum densiflorum / Osmunda cinnamomea - Carex atlantica ssp. atlantica - Eriophorum virginicum - Drosera rotundifolia* Woodland	Name changed to: *Pinus rigida / Osmunda cinnamomea - Carex stricta - Eriophorum virginicum / Sphagnum* spp. Woodland
BALD CYPRESS – TUPELO SWAMP: *Nyssa biflora - (Taxodium distichum) / Itea virginica - Viburnum nudum / Woodwardia areolata* Forest	Name changed to: *Nyssa biflora - (Taxodium distichum) / Clethra alnifolia - Viburnum nudum / Woodwardia areolata* Forest
COASTAL PLAIN / PIEDMONT BOTTOMLAND FOREST: *Fraxinus pennsylvanica - Celtis occidentalis - Ulmus (americana, alata) / Carpinus caroliniana / Carex grayi* Forest [Coastal Plain Bottomland Forest (Brownwater Low Ridge/Levee Type)]	Name changed to: *Platanus occidentalis - Celtis occidentalis - Ulmus americana - Fraxinus pennsylvanica / Acer negundo / Chasmanthium latifolium* Forest [Piedmont / Inner Coastal Plain Floodplain Levee Forest]
COASTAL PLAIN / PIEDMONT BOTTOMLAND FOREST: *Platanus occidentalis - Liquidambar styraciflua - Celtis occidentalis / Carpinus caroliniana - Asimina triloba / Carex amphibola* Forest [Southern Piedmont / Inner Coastal Plain Large-Stream Floodplain Forest]	Name changed to: *Liquidambar styraciflua - Quercus (michauxii, shumardii) - Carya cordiformis / Ilex decidua / Carex amphibola* Forest [Southern Piedmont / Inner Coastal Plain Floodplain Terrace Forest]
FLOODPLAIN PONDS AND POOLS: **Cephalanthus occidentalis* Shrubland	Name changed to: *Cephalanthus occidentalis - Decodon verticillatus* Shrubland
FLOODPLAIN PONDS AND POOLS: **Fraxinus pennsylvanica / Cephalanthus occidentalis / Penthorum sedoides - Bidens discoidea* Woodland [Southern Piedmont Oxbow Woodland]	Merged into: *Acer rubrum - Fraxinus pennsylvanica / Saururus cernuus* Forest in the Group: COASTAL PLAIN / PIEDMONT BOTTOMLAND FOREST
INTERDUNE POND: (*Myrica cerifera) - Panicum virgatum - Spartina patens* Herbaceous Vegetation [Interdune Pond (Switchgrass Freshwater Type)]	Name changed to: *Panicum virgatum - Schoenoplectus pungens* Herbaceous Vegetation [Interdune Swale / Pond (Switchgrass Type)] and moved to new Group: INTERDUNE SWALES AND PONDS
MARITIME DUNE GRASSLAND: *Myrica pensylvanica / Schizachyrium littorale* Shrub Herbaceous Vegetation	Name changed to: (*Myrica pensylvanica) / Schizachyrium littorale* Shrub Herbaceous Vegetation
MARITIME DUNE GRASSLAND: *Spartina patens - Schoenoplectus pungens - Solidago sempervirens* Herbaceous Vegetation	Name changed to: *Spartina patens - Panicum amarum (ssp. amarum, spp. amarulum) - Solidago sempervirens* Herbaceous Vegetation
MARITIME DUNE GRASSLAND: *Uniola paniculata - Schizachyrium littorale - Panicum amarum var. amarum* Herbaceous Vegetation	Named changed to *Uniola paniculata - Ammophila breviligulata* Herbaceous Vegetation
MARITIME DUNE SCRUB: *Hudsonia tomentosa / Panicum amarum var. amarulum* Dwarf-Shrubland	Name changed to: *Hudsonia tomentosa / Cyperus grayi* Dwarf-shrubland
MARITIME DUNE SCRUB: *Myrica pensylvanica / Diodia teres* Shrubland	Named changed to: *Myrica pensylvanica - (Prunus serotina, Diospyros virginiana) / Solidago sempervirens* Shrubland
MARITIME DUNE SCRUB: *Quercus virginiana - (Ilex vomitoria*) Shrubland	Name changed to: *Quercus virginiana - (Myrica pensylvanica)* Shrubland
MARITIME SHRUB SWAMP: *Myrica cerifera / Hydrocotyle verticillata* Shrubland	Name changed to: *Myrica cerifiera - Toxicodendron radicans / Hydrocotyle verticillata* Shrubland

Changes to Community Types 2011 -2012 (continued)

MARITIME WET GRASSLAND: *Juncus (dichotomous, scirpoides) - Drosera intermedia* Herbaceous Vegetation	Name changed to: *Juncus scirpoides - Eupatorium hyssopifolium - Euthamia caroliniana - Xyris jupicai* Herbaceous Vegetation and moved to the new Group: INTERDUNE SWALES AND PONDS
MARITIME WET GRASSLAND: *Schoenoplectus pungens - Fimbristylis (castanea, caroliniana) Herbaceous* Vegetation [Interdune Swale (Mixed Sedge Type)]	Name changed to: *Spartina patens - Fimbristylis (castanea, caroliniana) - Cyperus filicinus - (Schoenoplectus pungens)* Herbaceous Vegetation [Interdune Swale (Northern Mixed Grassland Type)] and moved to the new Group: INTERDUNE SWALES AND PONDS
MARITIME WET GRASSLAND: *Spartina patens - Eleocharis parvula* Herbaceous Vegetation [Interdune Swale (Saltmeadow Cordgrass Type)]	Named changed to: *Spartina patens - (Schoenoplectus robustus)* Herbaceous Vegetation [Interdune Swale (Saltmeadow Cordgrass Brackish Type)] and moved to the new Group: INTERDUNE SWALES AND PONDS
MESIC MIXED HARDWOOD FOREST: *Fagus grandifolia - Quercus (alba, falcata, pagoda) / Symplocos tinctoria - Stewartia malacodendron* Forest	Name changed to: *Fagus grandifolia - Quercus (alba, nigra, michauxii) / Symplocos tinctoria - (Stewartia malacodendron*) Forest
(not represented)	NEW COMMUNITY TYPE: *Myrica cerifera - Baccharis halimifolia / Spartina patens* Shrubland [Southern Bayberry Interdune Shrubland] in the new Group: INTERDUNE SWALES AND PONDS
(not represented)	NEW COMMUNITY TYPE: *Spartina patens - Schoenoplectus pungens - Thelypteris palustris var. pubescens - Centella erecta* Herbaceous Vegetation [Interdune Swale (Southern Mixed Grassland Type)] in the new Group: INTERDUNE SWALES AND PONDS
SALT SCRUB: *Iva frutescens - Baccharis halimifolia / Spartina patens - Panicum virgatum* Tidal Shrubland	Name changed to: *Baccharis halimifolia - Iva frutescens / Spartina patens* Shrubland
TIDAL BALD CYPRESS FOREST / WOODLAND: *Taxodium distichum / Pontederia cordata - Peltandra virginica* Tidal Woodland [Tidal Bald Cypress Woodland (Mixed Forbs Type)]	Name changed to: *Taxodium distichum - Nyssa biflora - Fraxinus profunda / Peltandra virginica - (Bignonia capreolata)* Tidal Forest [Northern Coastal Plain Tidal Bald Cypress Forest]
TIDAL MESOHALINE AND POLYHALINE MARSHES: *Spartina patens - Distichlis spicata - Sarcocornia perennis - Limonium carolinianum* Tidal Herbaceous Vegetation [Salt Meadow]	Merged into *(Salicornia virginica, Salicornia bigelovii, Sarcocornia perennis)* Herbaceous Vegetation [Glasswort Salt Flat] in the Group: SALT FLAT
UPPER BEACH / OVERWASH FLAT: *Cakile edentula ssp. edentula - Chamaesyce polygonifolia* Sparse Vegetation	Named changed to: *Cakile edentula ssp. edentula - Salsola caroliniana* Herbaceous Vegetation

Changes to Community Types 2012 – 2013

2012 Community List	2013 Community List
(not represented)	NEW COMMUNITY TYPE: *Quercus phellos - Quercus stellata / Ilex decidua / Danthonia spicata* Forest [Southern Piedmont Mixed Moisture Hardpan Forest] in the Group: PIEDMONT HARDPAN FOREST
(not represented)	NEW COMMUNITY TYPE: *(Hydrangea arborescens, Physocarpus opulifolius) / Heuchera villosa - Micranthes caroliniana* Shrub Herbaceous Vegetation [Southern Appalachian Mesic Calcareous Cliff] in the Group: MOUNTAIN / PIEDMONT CALCAREOUS CLIFF
(not represented)	NEW COMMUNITY TYPE: *Picea rubens - Betula alleghaniensis / Rhododendron (maximum, catawbiense) Forest* [Southern Appalachian Red Spruce - Northern Hardwood Forest (Evergreen Shrub Type)] in the Group: SPRUCE / FIR FOREST
(not represented)	NEW COMMUNITY TYPE*: Taxodium distichum / Lemna minor* Forest [Bald Cypress Semi-permanent Impoundment] in the Group: SEMIPERMANENT IMPOUNDMENT
(not represented)	NEW COMMUNITY TYPE: *Pinus serotina / Arundinaria tecta* Woodland [Canebrake Woodland] in the Group: POND PINE WOODLANDS AND POCOSINS

Appendix B. Definitions of global and subnational (state) conservation status ranks.

NatureServe and the Network of Natural Heritage Programs and Conservation Data Centers work together to assign conservation status ranks to elements of biodiversity (plants, animals, and ecological communities). These ranks have been developed using range-wide data collected by the Natural Heritage Network for nearly three decades and are critical in setting conservation priorities. Community types are ranked on a global (G), national (N), and subnational (S) scale of 1 to 5, with 1 indicating critical imperilment due to rarity, endemism, and/or threats, and 5 indicating little or no risk of extirpation or elimination.

The primary ranking factors used in assessing the appropriate conservation status rank for an ecological community element are: (1) the total number of occurrences, and (2) the total area (acreage) of the element. Secondary ranking factors, such as the geographic range over which the element occurs, the threats to the occurrences, and the viability of the occurrences, also affect the rank.

Additional factors that have been used in arriving at an assessment of a community's range-wide (global) rank include the geographic range over which the type occurs, the long term decline of the type across this range, the degree of site specificity exhibited by the type, and the rarity across the range based on state ranks assigned by state Natural Heritage Programs.

To learn more about Natural Heritage Methodology, go to:
http://www.natureserve.org/publications/ConsStatusAssess_RankMethodology.jsp

Global Rank Codes and Definitions

Global ranks (i.e. range-wide conservation status ranks) are assigned at NatureServe's Headquarters or by a designated lead office in the Heritage/Conservation Data Center Network.

GX - Extirpated - Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic taxa and or elimination of the sites and ecological processes on which the type depends.

GH - Possibly Extinct (Historical) - Presumed eliminated throughout its range, with no, or virtually no, likelihood that it will be rediscovered, but with potential for restoration (e.g., *Castanea dentata* Forest).

G1 - Critically Imperiled - Critically imperiled globally. At very high risk of elimination due to extreme rarity, very steep declines, or other factors.

G2 - Imperiled - Imperiled globally. At high risk of elimination due to very restricted range, very few occurrences, steep declines, or other factors.

G3 - Vulnerable - Rare or uncommon. At moderate risk of extinction or elimination due to a restricted range, relatively few occurrences, recent and widespread declines, or other factors.

G4 - Apparently Secure - Uncommon but not rare. Apparently secure, but with cause for long-term concern. May be quite rare in parts of its range, especially at the periphery; apparently not vulnerable in most of its range

G5 - Secure - Demonstrably widespread, abundant, and secure. Common, widespread, and abundant, although it may be quite rare in parts of its range, especially at the periphery; not vulnerable in most of its range.

GNA - Rank not applicable - Common cultural, ruderal, planted, modified, managed, invasive, and/or non-natural type that is not a suitable target for conservation activities.

GNR - Not Yet Ranked - Status has not yet been assessed.

GU - Unrankable - Status cannot be determined at this time or due to lack of information or due to substantially conflicting information about status or trends.

G#G# - Rank Range - The actual rank of the element is within the range specified by the numbers; however, the exact status of the rarity of the element is uncertain. For example, G2G3 indicates that the rank may be either G2 or G3.

State Rank Codes and Definitions

State ranks are assigned by the Virginia Division of Natural Heritage and apply to an element only as it exists in the state, regardless of its range-wide status.

SX - Extirpated - Presumed extirpated from the state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

SH - Historical - Possibly extirpated (Historical). Historically known from the state, but not verified for an extended period, usually >15 years; this rank is used primarily when inventory has been attempted recently.

S1 - Critically Imperiled - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state; generally with 5 or fewer occurrences state-wide, and/or covering less than 50 ha (124 ac) in aggregate; or covering a larger area but highly threatened with destruction or modification.

S2 - Imperiled - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Generally with 6–20 occurrences state-wide, and/or covering less than 250 ha (618 ac) in aggregate; or covering a larger area but threatened with destruction or modification.

S3 - Vulnerable - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Generally with 21–100 occurrences state-wide; or with a larger number of occurrences subject to relatively high levels of threat; may be of relatively frequent occurrence in specific localities or geographic parts of the state.

S4 - Apparently Secure - Uncommon but not rare, and usually widespread in the state. Some cause for long-term concern due to declines or other factors.

S5 - Secure - Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions.

SNA - Rank not applicable - Common cultural, ruderal, planted, modified, managed, invasive, and/or non-natural type that is not a suitable target for conservation activities.

SNR - Not Ranked - Status has not yet been assessed. As the state classification is further revised by additional information, the SNR will be changed to a numeric rank based on available data.

SU - **Unrankable -** Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

S#S# - Rank Range - The actual rank of the element is within the range specified by the numbers; however, the exact status of the rarity of the element is uncertain. For example, S1S3 indicates that the rank may be either S1, S2, or S3.

Global and State Rank Qualifiers

? - Inexact or Uncertain - A question mark added to a rank expresses an uncertainty about the rank in the range of 1 in either way on the 1-5 scale; for example, a G2? rank indicates that the rank is thought to be G2, but could be G1 or G3

Q - **Questionable taxonomy** - A "Q" added to a rank denotes questionable taxonomy that may reduce conservation priority; it modifies the degree of imperilment and is only used in cases where the type would have

a less imperiled rank if it were not recognized as a valid type (i.e., if it were combined with a more common type); a GUQ rank often indicates that the type is unrankable because of daunting taxonomic questions.

Appendix C. Number of Classified Community Types by Conservation Status Rank.

The following table shows the number of community types that have been assigned various conservation status ranks. Range ranks were rounded up to the highest whole rank. Ranks with modifiers were counted as the base rank. Percentage of types is the percentage of the total number of classified natural community types in The Natural Communities of Virginia classification.

Global Conservation Rank			State Conservation Rank		
	# of types	% of types*		# of types	% of types*
G1 -Critically imperiled	58	18%	S1 - Critically imperiled	111	35%
G2 – Imperiled	68	21%	S2 – Imperiled	56	18%
G3 – Vulnerable	67	21%	S3 – Vulnerable	68	21%
G4 - Apparently secure	56	18%	S4 - Apparently secure	27	9%
G5 – Secure	18	6%	S5 – Secure	4	1%
GNR - not yet ranked	39	12%	SU – currently unrankable	50	16%
No Global equivalent	11	3%	SX – Extirpated	1	<1%

* Percentage of the total number of natural community types in the classification.

Appendix H

Agricultural Outlease Program

Enclosure 1 Agricultural Outlease Agreements
Enclosure 2 Soil and Water Conservation Plans
Enclosure 3 NALFF Nutrient Management Plan Spray Fields

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Enclosure 1. Agricultural Outlease Agreements

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10498
CONTRACT NUMBER:
N40085-15-RP-00014

LEASE BETWEEN Guy A. Newman
(HEREINAFTER CALLED "**LESSEE**") AND THE **UNITED STATES OF AMERICA** HEREINAFTER CALLED THE "**GOVERNMENT**",

THE GOVERNMENT HEREBY LEASES TO LESSEE THE PROPERTY DESCRIBED BELOW UNDER THE TERMS, CONDITIONS, GENERAL PROVISIONS AND SPECIAL PROVISIONS SET FORTH ON THIS PAGE AND SUBSEQUENT PAGES OF THIS LEASE FORM.

1. **LEASED PROPERTY:** ALL THAT PORTION OF THE NAVAL ACTIVITY IDENTIFIED IN ARTICLE 9, WHICH PORTION IS HEREINAFTER CALLED THE "PREMISES" AND DESCRIBED AS FOLLOWS: Approximately 329.7 acres, more or less, at the Naval Air Station, Oceana, Virginia Beach, Virginia, identified as Unit 02 in the Soil and Water Conservation Plan attached hereto and made a part hereof as Exhibit "A."

2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.
LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM: *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF five (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $19,621.61, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $6,841.25 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $5,939.11, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $6,841.25 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $27,365.00, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $6,841.25 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ N/A

6. **EXECUTION BY LESSEE**

NAME OF LESSEE Guy A. Newman

BY Guy A Newman (SIGNATURE) Leslee Newman (WITNESS)

(TITLE) 04-08-2015. (DATE)

7. **CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE**
I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) (SIGNATURE) (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY (CONTRACTING OFFICER) 4/13/15 (DATE) Scott Allen (WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY Naval Air Station, Oceana Virginia Beach, Virginia	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE 717 London Bridge Road Virginia Beach, VA Phone: 757-635-1305 or 757-340-8019	

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10498
CONTRACT NUMBER:
N40085-15-RP-00014

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AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $27,365.00, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $6,841.25 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

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5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ ____N/A_____

6. **EXECUTION BY LESSEE**

NAME OF LESSEE_____Guy A. Newman_____

BY_____

_____ _____
(SIGNATURE) (WITNESS)

_____ _____
(TITLE) (DATE)

7. CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE
I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) _____ (SIGNATURE) _____ (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY_____ _____ _____
(CONTRACTING OFFICER) (DATE) (WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY Naval Air Station, Oceana Virginia Beach, Virginia	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE 717 London Bridge Road Virginia Beach, VA Phone: 757-635-1305 or 757-340-8019	

10. GENERAL PROVISIONS

A. REPRESENTATIONS

The property under this lease is provided as is, where is. The term "as-is, where is" means that the Government is leasing the subject property in whatever condition it presently exists, and that the lessee is accepting the subject property with all faults, whether or not they could be ascertained by an inspection of the property or review of any due diligence material available. LESSEE has examined, knows and accepts the condition and state of repair of the Premises and all appurtenances thereto and acknowledges that the Government has made no representation concerning such condition and state of repair, nor any agreement or promise to alter, improve, adapt, repair or keep in repair such Premises and appurtenances, or any item thereof, which has not been fully set forth on this lease which contains all the agreements made and entered into between Lessee and the Government.

B. PROHIBITION OF FEDERAL SUBSIDY PARTICIPATION

Notwithstanding the uses permitted to it in Article 4 of this lease, Lessee shall at no time during the term of this lease, or any extension thereof, use the Premises or its interest therein in any manner which shall constitute direct participation in any subsidy program of the Federal Government relative to either the use or abstention from use of the Premises.

C. SUBJECTION TO GOVERNMENT SOIL & WATER CONSERVATION PLAN

During the term of this lease the Lessee shall apply the conservation measures and use the Premises in accordance with the conservation plan attached hereto and made a part hereof. Lessee shall in no manner substantially change the contour or condition of the land constituting any part of the Premises except for such changes as shall be reasonably required to effect soil and water conservation measures. (Soil and Water Conservation Plan is attached as Exhibit "A")

D. INSTALLATIONS AND REMOVALS

Subject to the prior written approval of the Government, Lessee shall have the right to erect, at its own expense, such temporary structures on the Premises as may be necessary or incidental to its use under this lease. All such structures shall remain the property of Lessee and Lessee shall remove any erected structures from the Premises prior to the expiration of the term of this lease. In the event the Government terminates this lease, Lessee shall be given thirty (30) days to accomplish such removal. All property not so removed shall be deemed abandoned by Lessee and may be used or disposed of by the Government in any manner whatsoever without any liability to account to the Government. Any such abandonment shall not reduce Lessee's obligation to restore the Premises.

E. SUBJECTION TO EXISTING AND FUTURE EASEMENTS AND RIGHTS-OF-WAY

This lease is subject to all outstanding easements and rights of way for location of any type of facility over, across, in and upon the Premises. In addition, the Government reserves the right to grant such additional easements as it shall determine to be in the public interest. The Government also reserves all mineral rights in the Premises, together with such rights of access and use of the surface as may be necessary for the mining and saving of any mineral deposits located thereon or thereunder. The Government reserves the right to allow ingress and egress to workers officially engaged in the construction, installation, maintenance, operation, repair or replacement of facilities located thereon, and to any Federal, State or local officials.

F. RESTORATION OF PREMISES

Before the expiration of this lease or the prior termination thereof, Lessee shall, if required to do so by the Government, restore the Premises to the condition existing at the time of its entrance thereon under this lease, or to such improved condition as they may have been placed in by the Government or the Lessee during the term of this lease, reasonable wear and tear and damage by the elements or from other causes over which Lessee had no control excepted; *Provided,* in the event the Government shall terminate this lease upon less than thirty (30) days notice Lessee shall have thirty (30) days from receipt of notice of termination to accomplish such restoration.

G. LIENS

Lessee shall promptly discharge or cause to be discharged any valid lien, *right in rem*, claim or demand of any kind, except one in favor of the

Government, which at any time may arise or exist with respect to the Premises or materials or equipment furnished therefor, or any part thereof, and if the same shall not be promptly discharged by Lessee, the Government may discharge, or cause to be discharged, the same at the expense of the Lessee.

H. TERMINATION BY GOVERNMENT

The Government shall have the right to terminate this lease, in whole or in part, at any time, without prior notice, and regardless of any lack of breach by Lessee of any of the terms and conditions of this lease. In the event of termination for any reason not involving a breach by Lessee of the terms and conditions of the lease the Government shall make an equitable adjustment of any advance rentals paid by Lessee hereunder and, if the Government's use of the Premises does not require immediate possession thereof, Lessee shall be permitted, within such time as the Local Government Representative shall prescribe, to harvest, gather and remove from the Premises such crops as can be so harvested and removed, but if the Government's requirements necessitate immediate repossession of the Premises, so as to require immediate removal of Lessee's livestock, and/or, to preclude Lessee from such harvesting and removal of any growing or matured crops, Lessee hereby specifically releases, remises, and forever discharges the Government from any and all liability or claims for loss or damage of any nature arising out of such termination and repossession, including, but not limited to, destruction of diminution in value of, or inability to harvest any growing crops, and/or death or diminution of value of any livestock of Lessee.

In the event that the Government shall elect to terminate this lease on account of the breach by the Lessee of any of the terms and conditions hereof no adjustment in advance rentals paid by Lessee shall be made, and the Government shall be entitled to recover and Lessee shall pay to the Government:

(1) The costs incurred in resuming possession of the Premises.

(2) The costs incurred in performing any obligation on the part of Lessee to be performed hereunder.

(3) An amount equal to the aggregate of all rents and charges assumed hereunder and not theretofore paid, less the net rentals, if any, collected by the Government on the re-letting of the Premises, which amounts shall be due and payable at the time when the rent reserved under this lease would become due and payable.

The Government may, at its option, attach any livestock or crops of Lessee on the Premises in full or partial satisfaction of Lessee's obligations under this Article.

I. SURRENDER

Upon the expiration of this lease or its prior termination, in whole or in part, Lessee shall quietly, and peacefully remove itself and its property from the Premises, or part thereof as to which this lease shall be terminated, and surrender the possession thereof to the Government. Upon failure or neglect of Lessee to so remove, the Government and its officers or agents may enter the Premises and cause the removal of all persons and property therefrom without recourse to any action or proceeding at law or in equity. Lessee hereby expressly waives any provision of law requiring notice to quit possession of the Premises. Such removal shall be at the sole cost and expense of Lessee and Lessee shall indemnify and save and hold harmless the Government, its officer, agents and employees for and from any and all liability or claims for damages of any nature whatsoever which may arise out of or be attributable to such removal.

J. DAMAGE TO GOVERNMENT PROPERTY

In the event of the destruction of or damage to any Government property located on or adjacent to the Premises by Lessee, or any of its officers, agents, servants, employees, subtenants, licensee or invitees, Lessee shall promptly repair or replace such property to the satisfaction of the Government, or pay to the Government an amount of money sufficient to compensate it for the loss or damage sustained, as the Government shall elect.

K. NON-LIABILITY OF GOVERNMENT

Lessee covenants that it will indemnify and save and hold harmless the Government, its officers, agents and employees for and from any and all liability or claims for loss of or damage to any property owned by or in the custody of Lessee, its officers, agents, servants, employees, subtenants, licensees or invitees, or for the death of or injury to any of the same which may arise out of or be attributable to the condition, state of repair or Lessee's use and occupancy of the Premises, or the furnishings of any utilities or services (including supply of water from wells or other sources), or any interruption therein or failure thereof, whether or not the same shall be occasioned by the negligence or

lack of diligence of Lessee, its officers, agents, servants or employees.

L. UTILITIES AND SERVICES

In the event that the Government shall furnish Lessee with any utilities and services maintained by the Government which Lessee may require in connection with its use of the Premises, Lessee shall pay the Government the charges therefor in addition to the cash rent required under this lease. Such charges and the method of payment thereof shall be determined by the Local Government Representative in accordance with applicable laws and regulations, on such basis as the Local Government Representative may establish, which may include a requirement for the installation of adequate connecting and metering equipment at the sole cost and expense of Lessee. It is expressly agreed and understood that the Government in no way warrants the continued maintenance or adequacy of any utilities or services furnished by it to Lessee.

M. ACCESS

The Government shall have access to the Premises at all reasonable times for any purposes not inconsistent with the quiet use and enjoyment thereof by Lessee, including, but not limited to, the purpose of inspection.

N. COVENANT AGAINST CONTINGENT FEES

Lessee warrants that no person or agency has been employed or retained to solicit or secure this lease upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, excepting bona fide employees or bona fide established commercial agencies maintained by Lessee for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this lease without liability or in its discretion to require Lessee to pay, in addition to the rental or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

O. STATE AND LOCAL TAXES

In the event that as a result of any future Act of Congress, subjecting Government-owned property to taxation, any taxes, assessments or similar charges are imposed by State or local authorities upon the Premises (other than upon Lessee's possessory interest therein), Lessee shall pay the same when due and payable and this lease shall be renegotiated so as to accomplish an equitable reduction in the rental provided for herein, which reduction shall in no event exceed the amount of such taxes, assessments, or similar charges; *Provided,* in event the parties hereto are unable to agree within ninety (90) days from the date of the imposition of such taxes, assessments, or similar charges, upon a rental which in the opinion of the Local Government Representative constitutes a reasonable return to the Government on the Premises, then in such event the Local Government Representative shall have the right to determine the amount of the rental, which determination shall be binding on Lessee, subject to appeal as a dispute in accordance with the provisions of paragraph P of this Article 10.

P. DISPUTES

1.1 This lease is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613) (the Act).

1.2 Except as provided in the Act, all disputes arising under or relating to this lease shall be resolved under this clause.

1.3 "Claim," as used in this clause, means a written demand or written assertion by the Lessee or the Government seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of lease terms, or other relief arising under or relating to this lease. A claim arising under this lease, unlike a claim relating to this lease, is a claim that can be resolved under a lease clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Lessee seeking the payment of money exceeding $100,000 is not a claim under the Act until certified as required by subparagraph 1.4(2) below. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

1.4(1) A claim by the Lessee shall be made in writing and submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, for a written decision. A claim by the Government against the Lessee shall be subject to a written decision by the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

1.4(2)(a)The Lessee shall provide the certification specified in subparagraph 1.4(2)(c) of this clause when submitting any claim ---

(A) Exceeding $100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

1.4(2)(b) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

1.4(2)(c)The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Lessee believes the Government liable; and that I am duly authorized to certify the claim on behalf of the Lessee."

1.4(3) The certification may be executed by any person duly authorized to bind the Lessee with respect to the claim.

1.5 For Lessee claim of $100,000 or less, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, if requested in writing by the Lessee, render a decision within sixty (60) days of the request. For Lessee-certified claims over $100,000, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, within sixty (60) days, decide the claim or notify the Lessee of the date by which the decision will be made.

1.6 The Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, decision shall be final unless the Lessee appeals or files a suit as provided in the Act.

1.7 At the time a claim by the Lessee is submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, or a claim by the Government is presented to the Lessee, the parties, by mutual consent, may agree to use ADR. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in paragraph 1.4(2)(c) of this clause, and executed in accordance with paragraph 1.4(3) of this clause.

1.8 The Government shall pay interest on the amount found due and unpaid by the Government from (1) the date the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim (properly certified if required), or (2) the date of payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in FAR 33.201, interest shall be paid from the date that the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury, as provided in the Act, which is applicable to the period during which the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

1.9 The Lessee shall proceed diligently with the performance of the lease, pending, final resolution of any request for relief, claim, appeal, or action arising under the lease, and comply with any decision of the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

Q. OFFICIALS NOT TO BENEFIT

No Member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share of part of this lease, or to any benefit to arise therefrom but this provision shall not be construed to extend to this lease if made with a corporation for its general benefit.

R. LABOR PROVISION

(1) Equal Opportunity

During the term of this lease the Lessee agrees as follows:

(a) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their

race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Government setting forth the provisions of this nondiscrimination clause.

(b) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding a notice to be provided by the Government, advising the labor union or worker's representative of the Lessee's commitments under this Equal Opportunity clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Lessee will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Lessee will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor or pursuant thereto, and will permit access to his books, records, and accounts by the Government and the Secretary of Labor for purposes of investigating to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Lessee will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each sublessee or vendor. The Lessee will take such action with respect to any sublessee or purchase order as the Government may direct as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with sublessee or vendor as a result of such direction by the Government, the Lessee may request the United States to enter into such litigation to protect the interests of the United States.

(2) Convict Labor

In connection with the performance of work required by this lease, Lessee agrees not to employ any person undergoing a sentence of imprisonment at hard labor.

(3) Contract Work Hours Standards Act (40 U.S. Code 327-330)

This lease, to the extent that it is a contract of a character specified in the Contract Work Hours Standards Act (40 U.S.C. 327-330) and is not covered by the Walsh-Healy Public Contracts Act (41 U.S.C. 35-45), is subject to the following provisions and exceptions of said Contract Work Hours Standards Act and to all other provisions and exceptions of said law:

(a) The Lessee shall not require or permit any laborer or mechanic in any workweek in which he is employed on any work under this contract to work in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek on work subject to the provisions of the Contract Work Hours Standards Act unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek, whichever is the greater number of overtime hours. The "basic rate of pay," as used in this clause, shall be the amount paid per hour, exclusive of the Lessee's contribution or cost for fringe benefits and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained in the wage determination, whichever is greater.

(b) In the event of any violation of the provisions of paragraph (a), the Lessee shall be liable to any affected employee for any amounts due and to the United States for liquidated damages. Such

liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions of paragraph (a) in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of 8 hours or in excess of the standard workweek of 40 hours without payment of the overtime wages required by paragraph (a).

S. NOTICES

No notice, order, direction, determination, requirement, consent, or approval under this lease shall be of any effect unless in writing. All notices required under this lease shall be addressed to Lessee, or to the Local Government Representative, as may be appropriate, at the address thereof specified in Article 9 of this lease or at such other address as may from time to time be agreed upon by the parties hereto.

T. FAILURE OF GOVERNMENT TO INSIST ON COMPLIANCE

The failure of the Government to insist, in any one or more instances, upon performances of any of the terms, covenants or conditions of this lease shall not be construed as a waiver or relinquishment of the Government's right to the future performance of any such terms, covenants or conditions and Lessee's obligations in respect to such future performance shall continue in full force and effect.

U. ASSIGNMENT OR SUBLETTING

Lessee shall not transfer or assign this lease or any interest therein nor sublet or otherwise make available to any third party or parties any portion of the Premises or rights therein without prior written consent of the Government. Under any assignment made, with or without consent, the assignee shall be deemed to have assumed all the obligations of Lessee hereunder, but no assignment shall relieve the assignor of any of Lessee's obligations hereunder except for an extension of the lease term beginning after such assignment, and then only if the Government shall have consented thereto.

V. GOVERNMENT RULES AND REGULATIONS

Lessee shall comply with such rules and regulations regarding station security, ingress, egress, safety and sanitation as may be prescribed, from time to time, by the Local Government Representative, or by the Commanding Officer of the Naval activity of which the Premises forms a part.

W. PAYMENTS

All payments to the Government required under this lease shall be made by check or postal money order made payable to the U.S. Treasurer and mailed to Commander Naval Facilities Engineering command, Atlantic, Attn: FM, 6506 Hampton Blvd., Norfolk, VA 23508.

X. INTEREST

Notwithstanding any other provision of this lease, unless paid within thirty (30) days, all amounts that become payable by the Lessee to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code) shall bear interest from the date due until paid and shall be subject to adjustments as provided by Part 6 of Appendix E of the Armed Services Procurement Regulation, as in effect on the date of this lease. The interest rate per annum shall be the interest rate in effect which has been established by the Secretary of the Treasury pursuant to Public Law 92-41; 85 STAT 97 for the Renegotiation Board, as of the date the amount becomes due as herein provided. Amounts shall be due upon the earliest one of (i) the date fixed pursuant to this contract; (ii) the date of the first written demand for payment, consistent with this lease, including demand consequent upon default termination; or (iii) the date of transmittal by the Government to the Lessee of a proposed supplemental agreement to confirm completed negotiations fixing the amount.

Y. ADMINISTRATION

The local Government Representative specified in Article 9 of this lease shall, under the direction of the Commander, Naval Facilities Engineering Command, Mid-Atlantic, have complete charge of the administration of this lease, and shall exercise full supervision and general direction thereof insofar as the interest of the Department are affected.

Z. INDEMNIFICATION

The Lessee accepts responsibility for all liability related to, or arising under, Lessee's use of the property. Further, Lessee shall release and hold harmless the Government, its officers, agents, and employees from all liability, suits, claims, actions, or demands in any way related to, or arising under, Lessee's use of the property. This includes, but is not limited to, all environmental suits, claims, and enforcement actions, arising during Lessee's construction on, or use of, the property, or after such construction, or use, has ended. Further, Lessee shall reimburse the Government for all expenditures incurred if the Government voluntarily chooses to undertake any remedial action to address contamination on the premises or facilities resulting from the acts or omissions of the Lessee.

11. SPECIAL PROVISIONS

The following specified additional provisions, which shall control in the event of any conflict with the General Provisions of Article 10, are hereby incorporated into this lease by attachment hereto.

A. RESTRICTIONS:

a. No substance shall be released into the air from the leased lands that could impair visibility including, without limitation, emissions such as steam, dust and smoke.

b. No lights shall be constructed, maintained, directed or allowed to shine from the said leased lands, which could interfere with or impair pilot vision. All light emissions must be shielded to prevent them from being used as geographic reference pints by aircraft personnel.

c. No electrical emissions shall be emitted from sources situated on said leased lands which could interfere in any way with aircraft communications systems, ordnance or navigational equipment now in existence or hereinafter invented.

d. No garbage shall be dumped or placed and no feeding stations or other facilities attractive to birds shall be constructed or maintained on said leased lands. All trash, debris and empty pesticide containers shall be removed from Government property and properly disposed of each day at Lessee's expense.

e. Relic hunting, or antique hunting or recovery is prohibited.

f. Aerial crop dusting, unless specifically authorized by permit, is prohibited

g. Hunting and horseback riding on the leased land is permitted. The Station is responsible for coordinating the hunting program with the Lessee. Excessive damage by these activities must be reported immediately to the Naval Air Station, Oceana, Natural Resources Specialist at (757) 341-0495.

h. A cultivation regimen of cutting, no-till seed drilling and discing to a depth no greater than 16 cm (6.4 inches) below the surface shall be followed.

B. REIMBURSABLE WORK

If at any time during the lease it is determined that work not identified in the Soil and Water Conservation Plan, as Non-Reimbursable work is necessary, the procedures below will be followed:

The NAVFAC Mid-Atlantic Natural Resource Specialist will prepare a Scope of Work and Government Cost Estimate. Scope of Work will include what work is to be done and identify how or what method should be used to complete the work. It will also include a time schedule in which the work must be completed.

The NAVFAC Mid-Atlantic Natural Resource Specialist will forward the Scope of Work and Government Cost Estimate to the Real Estate Contracting Officer.

The Real Estate Contracting Officer will forward the Scope of Work to the Lessee and request a cost proposal.

The Lessee will send a cost proposal to the Real Estate Contracting Officer. This proposal may be based on Lessee having a third party perform the work. The Lessee may at this time inform the Government that he is incapable of performing the work.

If the Lessee submits a proposal and is acceptable, the Real Estate Contracting Officer will either; (1) issue a letter of authorization to proceed, advising a modification to the lease will be forthcoming or (2) forward a modification to the Lessee reflecting changes. Work should not begin until a letter or authorization or a modification has been received.

If the proposal is unacceptable, the Government will negotiate with the Lessee or determine alternative means of completing the required work.

When work is completed, Lessee and Navy Representatives will perform a joint inspection. If work is acceptable and within the time frame allotted, terms of the modification will be activated; i.e., rent reduction granted.

If it is determined during a joint inspection that the work was not completed properly or done within the required time frame, the Navy may, at its option, allow the Lessee additional time, not to exceed 25% of original time allotted, to complete the work or the Navy will have the work completed and charge the Lessee.

C. ENVIRONMENTAL/INDEMNIFICATION

In accordance with 10 U.S.C. 2692, the Lessee may not allow the treatment, storage or disposal of any Toxic or Hazardous materials on the leased premises. For the purposes of this provision, the terms "storage" and "Toxic or Hazardous Materials" are defined as provided in 48 CFR 252.223-7006.

The Lessee will reimburse the Lessor for all expenditures incurred if the Lessor is required by any regulatory authority or voluntarily chooses to undertake any Remedial Action to address Contamination on the leased premises resulting from the acts or omissions of the Lessee or its contractors. The Lessor shall contact the Lessee before taking any Remedial Action and give the Lessee a reasonable opportunity to undertake such Remedial Action if the Lessor believes that the Lessee has the capability to do so. Notwithstanding the above, the Lessee may immediately take any Remedial Action required of the Lessee by law.

During the term of this Lease, if the Lessee becomes aware that a Release of Toxic or Hazardous Materials has occurred that has resulted in Contamination of the leased premises, the Lessee will provide oral notice to the Lessor within 24 hours of becoming aware of such Contamination, providing all relevant facts and circumstances. The Lessor may request from the Lessee a more detailed written description of these facts and circumstances within a time period specified by the Lessor. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws relating to such Release, including reporting the occurrence to the appropriate Federal, State, or local regulatory authority or taking required Remedial Action, related to addressing the Contamination and to minimize the impacts of such Release. The Lessee will provide all information requested by the Lessor regarding such actions.

The Lessee, at its sole expense, will promptly take all action necessary to comply with Applicable Environmental Laws pertaining to a Release described in the preceding paragraph, including but not limited to: one, report the occurrence to appropriate Federal, State, or local regulatory authorities, if so directed by the Government; tow, take timely and effective steps to minimize the Release and its impact on human health and the environment; and three, take Remedial Action. The Government may direct the Lessee to provide all information requested by the Government regarding such actions within a time certain.

During the term of this Lease, the Lessee will ensure that all activities conducted by the Lessee or its contractors on the leased premises are carried out in compliance with Applicable Environmental Laws. The Lessee will provide oral notice to the Lessor within 24 hours of receiving any complaint, order, directive, claim, citation, or notice by any Governmental authority or any other person or entity with respect to a violation of Applicable Environmental Laws resulting from the activities of the Lessee or its contractors on the leased premises. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws as directed by any Federal, State, or local regulatory authority. The Lessor may request a more detailed written description of the events or circumstances leading to this event within a time specified by the Lessor. Without limitation of the foregoing, the Lessor may, but will not be obligated to, enter onto the leased premises and take any Remedial Action as it deems necessary or advisable to address any Contamination of the leased premises by Toxic or Hazardous Materials or to ensure compliance with Applicable Environmental Laws.

At any time, the Lessor or its representatives may conduct inspections on the leased premises to ensure compliance with Applicable Environmental Laws. To assist in this evaluation, the Lessee will provide to the Lessor or the Lessor's representative, any and all books, records, or documents in their possession, or in the possession of their agents or contractors, related to the activities or operations on the leased premises, which the Lessor or its representatives may examine, copy, or make extracts from.

As the Lessor deems appropriate, the Lessor may require that the Lessee, from time to time, promptly conduct such tests and procedures for the purpose of ensuring that the leased premises are in compliance with Applicable Environmental Laws and of having the leased premises certified to the Lessor as such. Such tests and procedures shall be conducted by recognized professionals to be approved by the Lessor and in a manner that is satisfactory to the Lessor. When requesting such tests and procedures, the Lessor will work with the Lessee to establish accepted timeframes, appropriate parties to perform the required activities, and schedules for performance. If an agreement cannot be reached regarding any of the foregoing, the Lessor or its representatives may undertake such tests and procedures, with the Lessee being obligated to reimburse the Lessor for all costs incurred.

For the purposes of this provision, the terms used above are defined as follows:

"Toxic or Hazardous Materials" means any hazardous, harmful, odorous, radioactive, toxic or dangerous waste, substance or material, including, without limitation, asbestos, polychlorinated biphenyls ("PCBs") and petroleum products, and any hazardous or toxic substance, material or waste, or any pollutant or contaminant defined as such in, or for the purposes of, any environmental laws as are now or in the future may be in effect. The Lessee's obligation under this provision shall extend to any and all such Toxic or Hazardous Materials whether or not such substance was defined, recognized, known, or suspected of being hazardous, toxic, dangerous, or wasteful at the time of any act or omission giving rise to the Lessee's obligation.

"Contamination" means a level of Toxic or Hazardous Materials in the air, in or on soil, in the surfacewater, or in the groundwater that exceeds levels allowed by Applicable Environmental Laws.

"Applicable Environmental Laws" means:

one, any Federal, State, or local statute, law, ordinance, rule, regulation, or order (whether voluntary or not) that govern the activities or operations of the leased premises, or the persons carrying out those activities or operations, relating to the environment, natural resources, or human health and safety.

two, Executive Orders of the President of the United States;

three, decisions of courts and administrative tribunals of competent jurisdiction;

four, administrative orders of regulatory agencies of competent jurisdiction (involuntary or on consent); and

five, regulations and directives of the Department of Defense, the Department of the Navy, and the U.S. Marine Corps (for Marine Corps installations only),

which pertain to the human environment (as defined in the National Environmental Policy act of 1969); transportation of hazardous material; and human health and safety (including occupational safety).

Applicable Environmental Laws include, without limitation the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. § 9601 *et seq*.), the Hazardous Material Transportation Act (49 U.S.C. § 1801 *et seq*.), the Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq*.), the Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq*.), the Clean Air Act (42 U.S.C. § 7401 *et seq*.), the Toxic Substances Control Act (15 U.S.C. § 2601 *et seq*.), and the Occupational Safety and Health Act (29 U.S.C. § 651 *et seq*.), Superfund Amendments and Reauthorization Act Title III (SARA) Emergency Planning and Community Right-to-Know Act (EPCRA) reporting requirements (40 CFR 355, 40 CFR 370, 40 CFR 372 and 29 CFR 1910.1200), as such laws have been amended or supplemented now or in the future.

"Release" means any release, spill, emission, leaking, pumping, injection, deposit, disposal, leaching, or migration into the environment, whether accidental or otherwise, resulting from the act or omissions of the Lessee, its contractors, or by natural conditions.

"Remedial Action" means any investigation or monitoring of the condition of the leased premises or any cleanup, remedial, removal, or restoration work required or performed on the leased premises because of the presence, suspected presence, release, or suspected release of Toxic or Hazardous Materials.

The Lessor shall not be responsible for damages to property or injuries to persons which may arise from or be incident to the use and occupation of the leased premises by the Lessee, nor for damages to the property or injuries to the person of the Lessor's officers, agents, servants, or employees, or others who may be on the leased premises at their invitation or the invitation of any one of them arising from or incident to governmental activities except as permitted under the Federal Torts Claim Act, 28 U.S.C. 2671 et seq.

F. APPLICABLE STATE AND CITY LAWS, CODES, AND ORDINANCES

The Lessee agrees to comply with all applicable State and City laws, codes and ordinances applicable to use of the leased premises at Lessee's expense. Lessee further agrees to obtain all necessary permits and related items at Lessee's expense.

G. INSURANCE REQUIREMENTS

Prior to award of the Lease, the LESSEE shall submit a certificate of insurance meeting the following requirements. Public Liability and Property Damage shall meet the following requirements at a minimum:

$50,000	Third Party Property Damage
$500,000	Third Party Personal Injury Per Person
$1,000,000	Third Party Personal Injury Per Accident

The policy/certificate of insurance shall contain an endorsement reading as follows:

a. Loss, if any under this policy shall be adjusted with (name of LESSEE) and the proceeds, at the election of the GOVERNMENT, shall be payable to (name of LESSEE); any proceeds not paid to (name of LESSEE) shall be payable to the Treasurer of the United States of America.

b. The insurer waives any right of subrogation against the United States of America which might arise by reason of any payment made under this policy.

c. The GOVERNMENT shall be given thirty (30) days written notice prior to making any material change in or the cancellation of the policy. Please strike out (and initial) any clauses that state "…failure to make such notice imposes no obligation or liability of any kind upon the company, etc …"

d. The United States of America (Department of the Navy) is added as an additional insured in operations of the policyholder at or from the premises leased at Naval Station Oceana, Virginia Beach, Virginia, identified as Unit 01.

e. This insurance certificate is for use of premises known as **329.7acres more or less, at Naval Station Oceana, Virginia Beach, Virginia, identified as Unit 02, Contract number N40085-15-RP-00014 or LO10498**.

If, at any time, the GOVERNMENT determines that the insurance maintained by the LESSEE does not in fact adequately protect the GOVERNMENT, LESSEE may be required to carry such other insurance in such form, for such amounts and for such periods of time, and with such insurers as the GOVERNMENT may from time to time require or approve.

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10499
CONTRACT NUMBER:
N40085-15-RP-00015

LEASE BETWEEN Guy A. Newman

(HEREINAFTER CALLED "LESSEE") AND THE UNITED STATES OF AMERICA HEREINAFTER CALLED THE "GOVERNMENT",

THE GOVERNMENT HEREBY LEASES TO LESSEE THE PROPERTY DESCRIBED BELOW UNDER THE TERMS, CONDITIONS, GENERAL PROVISIONS AND SPECIAL PROVISIONS SET FORTH ON THIS PAGE AND SUBSEQUENT PAGES OF THIS LEASE FORM.

1. **LEASED PROPERTY:** ALL THAT PORTION OF THE NAVAL ACTIVITY IDENTIFIED IN ARTICLE 9, WHICH PORTION IS HEREINAFTER CALLED THE "PREMISES" AND DESCRIBED AS FOLLOWS: Approximately 314.8 acres, more or less, at the Naval Air Station, Oceana, Virginia Beach, Virginia, identified as Unit 01 in the Soil and Water Conservation Plan attached hereto and made a part hereof as Exhibit "A."

2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.

LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM; *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF FIVE (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $23,249.79, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,106.25 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $7,037.29, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $8,106.25 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $32,425.00, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,106.25 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ N/A

6. **EXECUTION BY LESSEE**

NAME OF LESSEE Guy A. Newman

BY Guy A Newman (SIGNATURE) Hector Nunez (WITNESS)

(TITLE) 04 08 2015 (DATE)

7. **CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE**
I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) (SIGNATURE) (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY (CONTRACTING OFFICER) 4/13/15 (DATE) Scott Alcock (WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS
Naval Air Station, Oceana Virginia Beach, Virginia ADDRESS OF LESSEE 717 London Bridge Road Virginia Beach, VA 23454 Phone: 757-635-1305 or 757-340 8019	Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10499
CONTRACT NUMBER:
N40085-15-RP-00015

LEASE BETWEEN Guy A. Newman

(HEREINAFTER CALLED "**LESSEE**") AND THE **UNITED STATES OF AMERICA** HEREINAFTER CALLED THE "**GOVERNMENT**",

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2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.

LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM; *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF FIVE (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $23,249.79, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,106.25 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $7,037.29, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $8,106.25 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $32,425.00, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,106.25 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ N/A

6. **EXECUTION BY LESSEE**

NAME OF LESSEE Guy A. Newman

BY _____

_____ (SIGNATURE)

_____ (WITNESS)

_____ (TITLE)

_____ (DATE)

7. CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE

I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL)

_____ (SIGNATURE)

_____ (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY _____ (CONTRACTING OFFICER)

_____ (DATE)

_____ (WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS
Naval Air Station, Oceana Virginia Beach, Virginia	Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE 717 London Bridge Road Virginia Beach, VA 23454 Phone: 757-635-1305 or 757-340-8019	

10. GENERAL PROVISIONS

A. REPRESENTATIONS

The property under this lease is provided as is, where is. The term "as-is, where is" means that the Government is leasing the subject property in whatever condition it presently exists, and that the lessee is accepting the subject property with all faults, whether or not they could be ascertained by an inspection of the property or review of any due diligence material available. LESSEE has examined, knows and accepts the condition and state of repair of the Premises and all appurtenances thereto and acknowledges that the Government has made no representation concerning such condition and state of repair, nor any agreement or promise to alter, improve, adapt, repair or keep in repair such Premises and appurtenances, or any item thereof, which has not been fully set forth on this lease which contains all the agreements made and entered into between Lessee and the Government.

B. PROHIBITION OF FEDERAL SUBSIDY PARTICIPATION

Notwithstanding the uses permitted to it in Article 4 of this lease, Lessee shall at no time during the term of this lease, or any extension thereof, use the Premises or its interest therein in any manner which shall constitute direct participation in any subsidy program of the Federal Government relative to either the use or abstention from use of the Premises.

C. SUBJECTION TO GOVERNMENT SOIL & WATER CONSERVATION PLAN

During the term of this lease the Lessee shall apply the conservation measures and use the Premises in accordance with the conservation plan attached hereto and made a part hereof. Lessee shall in no manner substantially change the contour or condition of the land constituting any part of the Premises except for such changes as shall be reasonably required to effect soil and water conservation measures. (Soil and Water Conservation Plan is attached as Exhibit "A")

D. INSTALLATIONS AND REMOVALS

Subject to the prior written approval of the Government, Lessee shall have the right to erect, at its own expense, such temporary structures on the Premises as may be necessary or incidental to its use under this lease. All such structures shall remain the property of Lessee and Lessee shall remove any erected structures from the Premises prior to the expiration of the term of this lease. In the event the Government terminates this lease, Lessee shall be given thirty (30) days to accomplish such removal. All property not so removed shall be deemed abandoned by Lessee and may be used or disposed of by the Government in any manner whatsoever without any liability to account to the Government. Any such abandonment shall not reduce Lessee's obligation to restore the Premises.

E. SUBJECTION TO EXISTING AND FUTURE EASEMENTS AND RIGHTS-OF-WAY

This lease is subject to all outstanding easements and rights of way for location of any type of facility over, across, in and upon the Premises. In addition, the Government reserves the right to grant such additional easements as it shall determine to be in the public interest. The Government also reserves all mineral rights in the Premises, together with such rights of access and use of the surface as may be necessary for the mining and saving of any mineral deposits located thereon or thereunder. The Government reserves the right to allow ingress and egress to workers officially engaged in the construction, installation, maintenance, operation, repair or replacement of facilities located thereon, and to any Federal, State or local officials.

F. RESTORATION OF PREMISES

Before the expiration of this lease or the prior termination thereof, Lessee shall, if required to do so by the Government, restore the Premises to the condition existing at the time of its entrance thereon under this lease, or to such improved condition as they may have been placed in by the Government or the Lessee during the term of this lease, reasonable wear and tear and damage by the elements or from other causes over which Lessee had no control excepted; *Provided,* in the event the Government shall terminate this lease upon less than thirty (30) days notice Lessee shall have thirty (30) days from receipt of notice of termination to accomplish such restoration.

G. LIENS

Lessee shall promptly discharge or cause to be discharged any valid lien, *right in rem*, claim or demand of any kind, except one in favor of the

Government, which at any time may arise or exist with respect to the Premises or materials or equipment furnished therefor, or any part thereof, and if the same shall not be promptly discharged by Lessee, the Government may discharge, or cause to be discharged, the same at the expense of the Lessee.

H. TERMINATION BY GOVERNMENT

The Government shall have the right to terminate this lease, in whole or in part, at any time, without prior notice, and regardless of any lack of breach by Lessee of any of the terms and conditions of this lease. In the event of termination for any reason not involving a breach by Lessee of the terms and conditions of the lease the Government shall make an equitable adjustment of any advance rentals paid by Lessee hereunder and, if the Government's use of the Premises does not require immediate possession thereof, Lessee shall be permitted, within such time as the Local Government Representative shall prescribe, to harvest, gather and remove from the Premises such crops as can be so harvested and removed, but if the Government's requirements necessitate immediate repossession of the Premises, so as to require immediate removal of Lessee's livestock, and/or, to preclude Lessee from such harvesting and removal of any growing or matured crops, Lessee hereby specifically releases, remises, and forever discharges the Government from any and all liability or claims for loss or damage of any nature arising out of such termination and repossession, including, but not limited to, destruction of diminution in value of, or inability to harvest any growing crops, and/or death or diminution of value of any livestock of Lessee.

In the event that the Government shall elect to terminate this lease on account of the breach by the Lessee of any of the terms and conditions hereof no adjustment in advance rentals paid by Lessee shall be made, and the Government shall be entitled to recover and Lessee shall pay to the Government:

(1) The costs incurred in resuming possession of the Premises.

(2) The costs incurred in performing any obligation on the part of Lessee to be performed hereunder.

(3) An amount equal to the aggregate of all rents and charges assumed hereunder and not theretofore paid, less the net rentals, if any, collected by the Government on the re-letting of the Premises, which amounts shall be due and payable at the time when the rent reserved under this lease would become due and payable.

The Government may, at its option, attach any livestock or crops of Lessee on the Premises in full or partial satisfaction of Lessee's obligations under this Article.

I. SURRENDER

Upon the expiration of this lease or its prior termination, in whole or in part, Lessee shall quietly, and peacefully remove itself and its property from the Premises, or part thereof as to which this lease shall be terminated, and surrender the possession thereof to the Government. Upon failure or neglect of Lessee to so remove, the Government and its officers or agents may enter the Premises and cause the removal of all persons and property therefrom without recourse to any action or proceeding at law or in equity. Lessee hereby expressly waives any provision of law requiring notice to quit possession of the Premises. Such removal shall be at the sole cost and expense of Lessee and Lessee shall indemnify and save and hold harmless the Government, its officer, agents and employees for and from any and all liability or claims for damages of any nature whatsoever which may arise out of or be attributable to such removal.

J. DAMAGE TO GOVERNMENT PROPERTY

In the event of the destruction of or damage to any Government property located on or adjacent to the Premises by Lessee, or any of its officers, agents, servants, employees, subtenants, licensee or invitees, Lessee shall promptly repair or replace such property to the satisfaction of the Government, or pay to the Government an amount of money sufficient to compensate it for the loss or damage sustained, as the Government shall elect.

K. NON-LIABILITY OF GOVERNMENT

Lessee covenants that it will indemnify and save and hold harmless the Government, its officers, agents and employees for and from any and all liability or claims for loss of or damage to any property owned by or in the custody of Lessee, its officers, agents, servants, employees, subtenants, licensees or invitees, or for the death of or injury to any of the same which may arise out of or be attributable to the condition, state of repair or Lessee's use and occupancy of the Premises, or the furnishings of any utilities or services (including supply of water from wells or other sources), or any interruption therein or failure thereof, whether or not the same shall be occasioned by the negligence or

lack of diligence of Lessee, its officers, agents, servants or employees.

L. UTILITIES AND SERVICES

In the event that the Government shall furnish Lessee with any utilities and services maintained by the Government which Lessee may require in connection with its use of the Premises, Lessee shall pay the Government the charges therefor in addition to the cash rent required under this lease. Such charges and the method of payment thereof shall be determined by the Local Government Representative in accordance with applicable laws and regulations, on such basis as the Local Government Representative may establish, which may include a requirement for the installation of adequate connecting and metering equipment at the sole cost and expense of Lessee. It is expressly agreed and understood that the Government in no way warrants the continued maintenance or adequacy of any utilities or services furnished by it to Lessee.

M. ACCESS

The Government shall have access to the Premises at all reasonable times for any purposes not inconsistent with the quiet use and enjoyment thereof by Lessee, including, but not limited to, the purpose of inspection.

N. COVENANT AGAINST CONTINGENT FEES

Lessee warrants that no person or agency has been employed or retained to solicit or secure this lease upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, excepting bona fide employees or bona fide established commercial agencies maintained by Lessee for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this lease without liability or in its discretion to require Lessee to pay, in addition to the rental or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

O. STATE AND LOCAL TAXES

In the event that as a result of any future Act of Congress, subjecting Government-owned property to taxation, any taxes, assessments or similar charges are imposed by State or local authorities upon the Premises (other than upon Lessee's possessory interest therein), Lessee shall pay the same when due and payable and this lease shall be renegotiated so as to accomplish an equitable reduction in the rental provided for herein, which reduction shall in no event exceed the amount of such taxes, assessments, or similar charges; *Provided,* in event the parties hereto are unable to agree within ninety (90) days from the date of the imposition of such taxes, assessments, or similar charges, upon a rental which in the opinion of the Local Government Representative constitutes a reasonable return to the Government on the Premises, then in such event the Local Government Representative shall have the right to determine the amount of the rental, which determination shall be binding on Lessee, subject to appeal as a dispute in accordance with the provisions of paragraph P of this Article 10.

P. DISPUTES

1.1 This lease is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613) (the Act).

1.2 Except as provided in the Act, all disputes arising under or relating to this lease shall be resolved under this clause.

1.3 "Claim," as used in this clause, means a written demand or written assertion by the Lessee or the Government seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of lease terms, or other relief arising under or relating to this lease. A claim arising under this lease, unlike a claim relating to this lease, is a claim that can be resolved under a lease clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Lessee seeking the payment of money exceeding $100,000 is not a claim under the Act until certified as required by subparagraph 1.4(2) below. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

1.4(1) A claim by the Lessee shall be made in writing and submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, for a written decision. A claim by the Government against the Lessee shall be subject to a written decision by the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

1.4(2)(a)The Lessee shall provide the certification specified in subparagraph 1.4(2)(c) of this clause when submitting any claim ---

(A) Exceeding $100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

1.4(2)(b) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

1.4(2)(c)The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Lessee believes the Government liable; and that I am duly authorized to certify the claim on behalf of the Lessee."

1.4(3) The certification may be executed by any person duly authorized to bind the Lessee with respect to the claim.

1.5 For Lessee claim of $100,000 or less, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, if requested in writing by the Lessee, render a decision within sixty (60) days of the request. For Lessee-certified claims over $100,000, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, within sixty (60) days, decide the claim or notify the Lessee of the date by which the decision will be made.

1.6 The Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, decision shall be final unless the Lessee appeals or files a suit as provided in the Act.

1.7 At the time a claim by the Lessee is submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, or a claim by the Government is presented to the Lessee, the parties, by mutual consent, may agree to use ADR. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in paragraph 1.4(2)(c) of this clause, and executed in accordance with paragraph 1.4(3) of this clause.

1.8 The Government shall pay interest on the amount found due and unpaid by the Government from (1) the date the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim (properly certified if required), or (2) the date of payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in FAR 33.201, interest shall be paid from the date that the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury, as provided in the Act, which is applicable to the period during which the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

1.9 The Lessee shall proceed diligently with the performance of the lease, pending, final resolution of any request for relief, claim, appeal, or action arising under the lease, and comply with any decision of the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

Q. OFFICIALS NOT TO BENEFIT

No Member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share of part of this lease, or to any benefit to arise therefrom but this provision shall not be construed to extend to this lease if made with a corporation for its general benefit.

R. LABOR PROVISION

(1) Equal Opportunity

During the term of this lease the Lessee agrees as follows:

(a) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their

race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Government setting forth the provisions of this nondiscrimination clause.

(b) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding a notice to be provided by the Government, advising the labor union or worker's representative of the Lessee's commitments under this Equal Opportunity clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Lessee will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Lessee will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor or pursuant thereto, and will permit access to his books, records, and accounts by the Government and the Secretary of Labor for purposes of investigating to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Lessee will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each sublessee or vendor. The Lessee will take such action with respect to any sublessee or purchase order as the Government may direct as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with sublessee or vendor as a result of such direction by the Government, the Lessee may request the United States to enter into such litigation to protect the interests of the United States.

(2) Convict Labor

In connection with the performance of work required by this lease, Lessee agrees not to employ any person undergoing a sentence of imprisonment at hard labor.

(3) Contract Work Hours Standards Act (40 U.S. Code 327-330)

This lease, to the extent that it is a contract of a character specified in the Contract Work Hours Standards Act (40 U.S.C. 327-330) and is not covered by the Walsh-Healy Public Contracts Act (41 U.S.C. 35-45), is subject to the following provisions and exceptions of said Contract Work Hours Standards Act and to all other provisions and exceptions of said law:

(a) The Lessee shall not require or permit any laborer or mechanic in any workweek in which he is employed on any work under this contract to work in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek on work subject to the provisions of the Contract Work Hours Standards Act unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek, whichever is the greater number of overtime hours. The "basic rate of pay," as used in this clause, shall be the amount paid per hour, exclusive of the Lessee's contribution or cost for fringe benefits and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained in the wage determination, whichever is greater.

(b) In the event of any violation of the provisions of paragraph (a), the Lessee shall be liable to any affected employee for any amounts due and to the United States for liquidated damages. Such

liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions of paragraph (a) in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of 8 hours or in excess of the standard workweek of 40 hours without payment of the overtime wages required by paragraph (a).

S. NOTICES

No notice, order, direction, determination, requirement, consent, or approval under this lease shall be of any effect unless in writing. All notices required under this lease shall be addressed to Lessee, or to the Local Government Representative, as may be appropriate, at the address thereof specified in Article 9 of this lease or at such other address as may from time to time be agreed upon by the parties hereto.

T. FAILURE OF GOVERNMENT TO INSIST ON COMPLIANCE

The failure of the Government to insist, in any one or more instances, upon performances of any of the terms, covenants or conditions of this lease shall not be construed as a waiver or relinquishment of the Government's right to the future performance of any such terms, covenants or conditions and Lessee's obligations in respect to such future performance shall continue in full force and effect.

U. ASSIGNMENT OR SUBLETTING

Lessee shall not transfer or assign this lease or any interest therein nor sublet or otherwise make available to any third party or parties any portion of the Premises or rights therein without prior written consent of the Government. Under any assignment made, with or without consent, the assignee shall be deemed to have assumed all the obligations of Lessee hereunder, but no assignment shall relieve the assignor of any of Lessee's obligations hereunder except for an extension of the lease term beginning after such assignment, and then only if the Government shall have consented thereto.

V. GOVERNMENT RULES AND REGULATIONS

Lessee shall comply with such rules and regulations regarding station security, ingress, egress, safety and sanitation as may be prescribed, from time to time, by the Local Government Representative, or by the Commanding Officer of the Naval activity of which the Premises forms a part.

W. PAYMENTS

All payments to the Government required under this lease shall be made by check or postal money order made payable to the U.S. Treasurer and mailed to Commander Naval Facilities Engineering Command, Atlantic, Attn: FM, 6506 Hampton Blvd., Norfolk, VA 23508.

X. INTEREST

Notwithstanding any other provision of this lease, unless paid within thirty (30) days, all amounts that become payable by the Lessee to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code) shall bear interest from the date due until paid and shall be subject to adjustments as provided by Part 6 of Appendix E of the Armed Services Procurement Regulation, as in effect on the date of this lease. The interest rate per annum shall be the interest rate in effect which has been established by the Secretary of the Treasury pursuant to Public Law 92-41; 85 STAT 97 for the Renegotiation Board, as of the date the amount becomes due as herein provided. Amounts shall be due upon the earliest one of (i) the date fixed pursuant to this contract; (ii) the date of the first written demand for payment, consistent with this lease, including demand consequent upon default termination; or (iii) the date of transmittal by the Government to the Lessee of a proposed supplemental agreement to confirm completed negotiations fixing the amount.

Y. ADMINISTRATION

The local Government Representative specified in Article 9 of this lease shall, under the direction of the Commander, Naval Facilities Engineering Command, Mid-Atlantic, have complete charge of the administration of this lease, and shall exercise full supervision and general direction thereof insofar as the interest of the Department are affected.

Z. INDEMNIFICATION

The Lessee accepts responsibility for all liability related to, or arising under, Lessee's use of the property. Further, Lessee shall release and hold harmless the Government, its officers, agents, and employees from all liability, suits, claims, actions, or demands in any way related to, or arising under, Lessee's use of the property. This includes, but is not limited to, all environmental suits, claims, and enforcement actions, arising during Lessee's construction on, or use of, the property, or after such construction, or use, has ended. Further, Lessee shall reimburse the Government for all expenditures incurred if the Government voluntarily chooses to undertake any remedial action to address contamination on the premises or facilities resulting from the acts or omissions of the Lessee.

11. SPECIAL PROVISIONS

The following specified additional provisions, which shall control in the event of any conflict with the General Provisions of Article 10, are hereby incorporated into this lease by attachment hereto.

A. RESTRICTIONS:

a. No substance shall be released into the air from the leased lands that could impair visibility including, without limitation, emissions such as steam, dust and smoke.

b. No lights shall be constructed, maintained, directed or allowed to shine from the said leased lands, which could interfere with or impair pilot vision. All light emissions must be shielded to prevent them from being used as geographic reference pints by aircraft personnel.

c. No electrical emissions shall be emitted from sources situated on said leased lands which could interfere in any way with aircraft communications systems, ordnance or navigational equipment now in existence or hereinafter invented.

d. No garbage shall be dumped or placed and no feeding stations or other facilities attractive to birds shall be constructed or maintained on said leased lands. All trash, debris and empty pesticide containers shall be removed from Government property and properly disposed of each day at Lessee's expense.

e. Relic hunting, or antique hunting or recovery is prohibited.

f. Aerial crop dusting, unless specifically authorized by permit, is prohibited

g. Hunting and horseback riding on the leased land is permitted. The Station is responsible for coordinating the hunting program with the Lessee. Excessive damage by these activities must be reported immediately to the Naval Air Station, Oceana, Natural Resources Specialist at (757) 341-0495.

h. A cultivation regimen of cutting, no-till seed drilling and discing to a depth no greater than 16 cm (6.4 inches) below the surface shall be followed.

B. REIMBURSABLE WORK

If at any time during the lease it is determined that work not identified in the Soil and Water Conservation Plan, as Non-Reimbursable work is necessary, the procedures below will be followed:

The NAVFAC Mid-Atlantic Natural Resource Specialist will prepare a Scope of Work and Government Cost Estimate. Scope of Work will include what work is to be done and identify how or what method should be used to complete the work. It will also include a time schedule in which the work must be completed.

The NAVFAC Mid-Atlantic Natural Resource Specialist will forward the Scope of Work and Government Cost Estimate to the Real Estate Contracting Officer.

The Real Estate Contracting Officer will forward the Scope of Work to the Lessee and request a cost proposal.

The Lessee will send a cost proposal to the Real Estate Contracting Officer. This proposal may be based on Lessee having a third party perform the work. The Lessee may at this time inform the Government that he is incapable of performing the work.

If the Lessee submits a proposal and is acceptable, the Real Estate Contracting Officer will either; (1) issue a letter of authorization to proceed, advising a modification to the lease will be forthcoming or (2) forward a modification to the Lessee reflecting changes. Work should not begin until a letter or authorization or a modification has been received.

If the proposal is unacceptable, the Government will negotiate with the Lessee or determine alternative means of completing the required work.

When work is completed, Lessee and Navy Representatives will perform a joint inspection. If work is acceptable and within the time frame allotted, terms of the modification will be activated; i.e., rent reduction granted.

If it is determined during a joint inspection that the work was not completed properly or done within the required time frame, the Navy may, at its option, allow the Lessee additional time, not to exceed 25% of original time allotted, to complete the work or the Navy will have the work completed and charge the Lessee.

C. ENVIRONMENTAL/INDEMNIFICATION

In accordance with 10 U.S.C. 2692, the Lessee may not allow the treatment, storage or disposal of any Toxic or Hazardous materials on the leased premises. For the purposes of this provision, the terms "storage" and "Toxic or Hazardous Materials" are defined as provided in 48 CFR 252.223-7006.

The Lessee will reimburse the Lessor for all expenditures incurred if the Lessor is required by any regulatory authority or voluntarily chooses to undertake any Remedial Action to address Contamination on the leased premises resulting from the acts or omissions of the Lessee or its contractors. The Lessor shall contact the Lessee before taking any Remedial Action and give the Lessee a reasonable opportunity to undertake such Remedial Action if the Lessor believes that the Lessee has the capability to do so. Notwithstanding the above, the Lessee may immediately take any Remedial Action required of the Lessee by law.

During the term of this Lease, if the Lessee becomes aware that a Release of Toxic or Hazardous Materials has occurred that has resulted in Contamination of the leased premises, the Lessee will provide oral notice to the Lessor within 24 hours of becoming aware of such Contamination, providing all relevant facts and circumstances. The Lessor may request from the Lessee a more detailed written description of these facts and circumstances within a time period specified by the Lessor. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws relating to such Release, including reporting the occurrence to the appropriate Federal, State, or local regulatory authority or taking required Remedial Action, related to addressing the Contamination and to minimize the impacts of such Release. The Lessee will provide all information requested by the Lessor regarding such actions.

The Lessee, at its sole expense, will promptly take all action necessary to comply with Applicable Environmental Laws pertaining to a Release described in the preceding paragraph, including but not limited to: one, report the occurrence to appropriate Federal, State, or local regulatory authorities, if so directed by the Government; tow, take timely and effective steps to minimize the Release and its impact on human health and the environment; and three, take Remedial Action. The Government may direct the Lessee to provide all information requested by the Government regarding such actions within a time certain.

During the term of this Lease, the Lessee will ensure that all activities conducted by the Lessee or its contractors on the leased premises are carried out in compliance with Applicable Environmental Laws. The Lessee will provide oral notice to the Lessor within 24 hours of receiving any complaint, order, directive, claim, citation, or notice by any Governmental authority or any other person or entity with respect to a violation of Applicable Environmental Laws resulting from the activities of the Lessee or its contractors on the leased premises. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws as directed by any Federal, State, or local regulatory authority. The Lessor may request a more detailed written description of the events or circumstances leading to this event within a time specified by the Lessor. Without limitation of the foregoing, the Lessor may, but will not be obligated to, enter onto the leased premises and take any Remedial Action as it deems necessary or advisable to address any Contamination of the leased premises by Toxic or Hazardous Materials or to ensure compliance with Applicable Environmental Laws.

At any time, the Lessor or its representatives may conduct inspections on the leased premises to ensure compliance with Applicable Environmental Laws. To assist in this evaluation, the Lessee will provide to the Lessor or the Lessor's representative, any and all books, records, or documents in their possession, or in the possession of their agents or contractors, related to the activities or operations on the leased premises, which the Lessor or its representatives may examine, copy, or make extracts from.

As the Lessor deems appropriate, the Lessor may require that the Lessee, from time to time, promptly conduct such tests and procedures for the purpose of ensuring that the leased premises are in compliance with Applicable Environmental Laws and of having the leased premises certified to the Lessor as such. Such tests and procedures shall be conducted by recognized professionals to be approved by the Lessor and in a manner that is satisfactory to the Lessor. When requesting such tests and procedures, the Lessor will work with the Lessee to establish accepted timeframes, appropriate parties to perform the required activities, and schedules for performance. If an agreement cannot be reached regarding any of the foregoing, the Lessor or its representatives may undertake such tests and procedures, with the Lessee being obligated to reimburse the Lessor for all costs incurred.

For the purposes of this provision, the terms used above are defined as follows:

"Toxic or Hazardous Materials" means any hazardous, harmful, odorous, radioactive, toxic or dangerous waste, substance or material, including, without limitation, asbestos, polychlorinated biphenyls ("PCBs") and petroleum products, and any hazardous or toxic substance, material or waste, or any pollutant or contaminant defined as such in, or for the purposes of, any environmental laws as are now or in the future may be in effect. The Lessee's obligation under this provision shall extend to any and all such Toxic or Hazardous Materials whether or not such substance was defined, recognized, known, or suspected of being hazardous, toxic, dangerous, or wasteful at the time of any act or omission giving rise to the Lessee's obligation.

"Contamination" means a level of Toxic or Hazardous Materials in the air, in or on soil, in the surfacewater, or in the groundwater that exceeds levels allowed by Applicable Environmental Laws.

"Applicable Environmental Laws" means:

one, any Federal, State, or local statute, law, ordinance, rule, regulation, or order (whether voluntary or not) that govern the activities or operations of the leased premises, or the persons carrying out those activities or operations, relating to the environment, natural resources, or human health and safety.

two, Executive Orders of the President of the United States;

three, decisions of courts and administrative tribunals of competent jurisdiction;

four, administrative orders of regulatory agencies of competent jurisdiction (involuntary or on consent); and

five, regulations and directives of the Department of Defense, the Department of the Navy, and the U.S. Marine Corps (for Marine Corps installations only),

which pertain to the human environment (as defined in the National Environmental Policy act of 1969); transportation of hazardous material; and human health and safety (including occupational safety).

Applicable Environmental Laws include, without limitation the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. § 9601 *et seq*.), the Hazardous Material Transportation Act (49 U.S.C. § 1801 *et seq*.), the Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq*.), the Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq*.), the Clean Air Act (42 U.S.C. § 7401 *et seq*.), the Toxic Substances Control Act (15 U.S.C. § 2601 *et seq*.), and the Occupational Safety and Health Act (29 U.S.C. § 651 *et seq*.), Superfund Amendments and Reauthorization Act Title III (SARA) Emergency Planning and Community Right-to-Know Act (EPCRA) reporting requirements (40 CFR 355, 40 CFR 370, 40 CFR 372 and 29 CFR 1910.1200), as such laws have been amended or supplemented now or in the future.

"Release" means any release, spill, emission, leaking, pumping, injection, deposit, disposal, leaching, or migration into the environment, whether accidental or otherwise, resulting from the act or omissions of the Lessee, its contractors, or by natural conditions.

"Remedial Action" means any investigation or monitoring of the condition of the leased premises or any cleanup, remedial, removal, or restoration work required or performed on the leased premises because of the presence, suspected presence, release, or suspected release of Toxic or Hazardous Materials.

The Lessor shall not be responsible for damages to property or injuries to persons which may arise from or be incident to the use and occupation of the leased premises by the Lessee, nor for damages to the property or injuries to the person of the Lessor's officers, agents, servants, or employees, or others who may be on the leased premises at their invitation or the invitation of any one of them arising from or incident to governmental activities except as permitted under the Federal Torts Claim Act, 28 U.S.C. 2671 et seq.

F. APPLICABLE STATE AND CITY LAWS, CODES, AND ORDINANCES

The Lessee agrees to comply with all applicable State and City laws, codes and ordinances applicable to use of the leased premises at Lessee's expense. Lessee further agrees to obtain all necessary permits and related items at Lessee's expense.

G. INSURANCE REQUIREMENTS

Prior to award of the Lease, the LESSEE shall submit a certificate of insurance meeting the following requirements. Public Liability and Property Damage shall meet the following requirements at a minimum:

$50,000	Third Party Property Damage
$500,000	Third Party Personal Injury Per Person
$1,000,000	Third Party Personal Injury Per Accident

The policy/certificate of insurance shall contain an endorsement reading as follows:

a. Loss, if any under this policy shall be adjusted with (name of LESSEE) and the proceeds, at the election of the GOVERNMENT, shall be payable to (name of LESSEE); any proceeds not paid to (name of LESSEE) shall be payable to the Treasurer of the United States of America.

b. The insurer waives any right of subrogation against the United States of America which might arise by reason of any payment made under this policy.

c. The GOVERNMENT shall be given thirty (30) days written notice prior to making any material change in or the cancellation of the policy. Please strike out (and initial) any clauses that state "…failure to make such notice imposes no obligation or liability of any kind upon the company, etc …"

d. The United States of America (Department of the Navy) is added as an additional insured in operations of the policyholder at or from the premises leased at Naval Station Oceana, Virginia Beach, Virginia, identified as Unit 01.

e. This insurance certificate is for use of premises known as **314.8 acres more or less, at Naval Station Oceana, Virginia Beach, Virginia, identified as Unit 01, Contract number N40085-15-RP-00015 or LO10499**.

If, at any time, the GOVERNMENT determines that the insurance maintained by the LESSEE does not in fact adequately protect the GOVERNMENT, LESSEE may be required to carry such other insurance in such form, for such amounts and for such periods of time, and with such insurers as the GOVERNMENT may from time to time require or approve.

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10500
CONTRACT NUMBER:
N40085-15-RP-00016

LEASE BETWEEN Glenn Scott Weatherly

(HEREINAFTER CALLED "LESSEE") AND THE UNITED STATES OF AMERICA HEREINAFTER CALLED THE "GOVERNMENT".

THE GOVERNMENT HEREBY LEASES TO LESSEE THE PROPERTY DESCRIBED BELOW UNDER THE TERMS, CONDITIONS, GENERAL PROVISIONS AND SPECIAL PROVISIONS SET FORTH ON THIS PAGE AND SUBSEQUENT PAGES OF THIS LEASE FORM.

1. **LEASED PROPERTY:** ALL THAT PORTION OF THE NAVAL ACTIVITY IDENTIFIED IN ARTICLE 9, WHICH PORTION IS HEREINAFTER CALLED THE "PREMISES" AND DESCRIBED AS FOLLOWS: Approximately 339 acres, more or less, at the Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F1 in the Soil and Water Conservation Plan attached hereto and made a part hereof as Exhibit "A."

2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.

LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM; *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF FIVE (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $24,594.23, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,575.00 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $7,444.23, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $8,575.00 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $34,300.00, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,575.00 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ N/A

6. **EXECUTION BY LESSEE**

NAME OF LESSEE Glenn Scott Weatherly

BY Glenn Scott Weatherly
(SIGNATURE)

Lisa Powers
(WITNESS)

Owner
(TITLE)

4/13/15
(DATE)

7. **CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE**

I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) (SIGNATURE) (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT THE UNITED STATES OF AMERICA**

BY
(CONTRACTING OFFICER)

4/13/15
(DATE)

(WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS
Naval Air Station, Oceana Virginia Beach, Virginia	Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE 1953 Long Ridge Road Chesapeake, VA 23322 Phone: 757-439-7688	

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10500
CONTRACT NUMBER:
N40085-15-RP-00016

LEASE BETWEEN Glenn Scott Weatherly

(HEREINAFTER CALLED "**LESSEE**") AND THE **UNITED STATES OF AMERICA** HEREINAFTER CALLED THE "**GOVERNMENT**",

THE GOVERNMENT HEREBY LEASES TO LESSEE THE PROPERTY DESCRIBED BELOW UNDER THE TERMS, CONDITIONS, GENERAL PROVISIONS AND SPECIAL PROVISIONS SET FORTH ON THIS PAGE AND SUBSEQUENT PAGES OF THIS LEASE FORM.

1**. LEASED PROPERTY**: ALL THAT PORTION OF THE NAVAL ACTIVITY IDENTIFIED IN ARTICLE 9, WHICH PORTION IS HEREINAFTER CALLED THE "PREMISES" AND DESCRIBED AS FOLLOWS: Approximately 339 acres, more or less, at the Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F1 in the Soil and Water Conservation Plan attached hereto and made a part hereof as Exhibit "A."

2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.

LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM; *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF FIVE (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $24,594.23, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,575.00 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $7,444.23, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $8,575.00 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $34,300.00, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,575.00 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ N/A

6. **EXECUTION BY LESSEE**

NAME OF LESSEE Glenn Scott Weatherly

BY _____

_____ _____
(SIGNATURE) (WITNESS)

_____ _____
(TITLE) (DATE)

7. CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE

I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) _____ (SIGNATURE) _____ (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY _____ _____ _____
(CONTRACTING OFFICER) (DATE) (WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS
Naval Air Station, Oceana Virginia Beach, Virginia	Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE 1953 Long Ridge Road Chesapeake, VA 23322 Phone: 757-439-7688	

10. GENERAL PROVISIONS

A. REPRESENTATIONS

The property under this lease is provided as is, where is. The term "as-is, where is" means that the Government is leasing the subject property in whatever condition it presently exists, and that the lessee is accepting the subject property with all faults, whether or not they could be ascertained by an inspection of the property or review of any due diligence material available. LESSEE has examined, knows and accepts the condition and state of repair of the Premises and all appurtenances thereto and acknowledges that the Government has made no representation concerning such condition and state of repair, nor any agreement or promise to alter, improve, adapt, repair or keep in repair such Premises and appurtenances, or any item thereof, which has not been fully set forth on this lease which contains all the agreements made and entered into between Lessee and the Government.

B. PROHIBITION OF FEDERAL SUBSIDY PARTICIPATION

Notwithstanding the uses permitted to it in Article 4 of this lease, Lessee shall at no time during the term of this lease, or any extension thereof, use the Premises or its interest therein in any manner which shall constitute direct participation in any subsidy program of the Federal Government relative to either the use or abstention from use of the Premises.

C. SUBJECTION TO GOVERNMENT SOIL & WATER CONSERVATION PLAN

During the term of this lease the Lessee shall apply the conservation measures and use the Premises in accordance with the conservation plan attached hereto and made a part hereof. Lessee shall in no manner substantially change the contour or condition of the land constituting any part of the Premises except for such changes as shall be reasonably required to effect soil and water conservation measures. (Soil and Water Conservation Plan is attached as Exhibit "A")

D. INSTALLATIONS AND REMOVALS

Subject to the prior written approval of the Government, Lessee shall have the right to erect, at its own expense, such temporary structures on the Premises as may be necessary or incidental to its use under this lease. All such structures shall remain the property of Lessee and Lessee shall remove any erected structures from the Premises prior to the expiration of the term of this lease. In the event the Government terminates this lease, Lessee shall be given thirty (30) days to accomplish such removal. All property not so removed shall be deemed abandoned by Lessee and may be used or disposed of by the Government in any manner whatsoever without any liability to account to the Government. Any such abandonment shall not reduce Lessee's obligation to restore the Premises.

E. SUBJECTION TO EXISTING AND FUTURE EASEMENTS AND RIGHTS-OF-WAY

This lease is subject to all outstanding easements and rights of way for location of any type of facility over, across, in and upon the Premises. In addition, the Government reserves the right to grant such additional easements as it shall determine to be in the public interest. The Government also reserves all mineral rights in the Premises, together with such rights of access and use of the surface as may be necessary for the mining and saving of any mineral deposits located thereon or thereunder. The Government reserves the right to allow ingress and egress to workers officially engaged in the construction, installation, maintenance, operation, repair or replacement of facilities located thereon, and to any Federal, State or local officials.

F. RESTORATION OF PREMISES

Before the expiration of this lease or the prior termination thereof, Lessee shall, if required to do so by the Government, restore the Premises to the condition existing at the time of its entrance thereon under this lease, or to such improved condition as they may have been placed in by the Government or the Lessee during the term of this lease, reasonable wear and tear and damage by the elements or from other causes over which Lessee had no control excepted; *Provided,* in the event the Government shall terminate this lease upon less than thirty (30) days notice Lessee shall have thirty (30) days from receipt of notice of termination to accomplish such restoration.

G. LIENS

Lessee shall promptly discharge or cause to be discharged any valid lien, *right in rem*, claim or demand of any kind, except one in favor of the

Government, which at any time may arise or exist with respect to the Premises or materials or equipment furnished therefor, or any part thereof, and if the same shall not be promptly discharged by Lessee, the Government may discharge, or cause to be discharged, the same at the expense of the Lessee.

H. TERMINATION BY GOVERNMENT

The Government shall have the right to terminate this lease, in whole or in part, at any time, without prior notice, and regardless of any lack of breach by Lessee of any of the terms and conditions of this lease. In the event of termination for any reason not involving a breach by Lessee of the terms and conditions of the lease the Government shall make an equitable adjustment of any advance rentals paid by Lessee hereunder and, if the Government's use of the Premises does not require immediate possession thereof, Lessee shall be permitted, within such time as the Local Government Representative shall prescribe, to harvest, gather and remove from the Premises such crops as can be so harvested and removed, but if the Government's requirements necessitate immediate repossession of the Premises, so as to require immediate removal of Lessee's livestock, and/or, to preclude Lessee from such harvesting and removal of any growing or matured crops, Lessee hereby specifically releases, remises, and forever discharges the Government from any and all liability or claims for loss or damage of any nature arising out of such termination and repossession, including, but not limited to, destruction of diminution in value of, or inability to harvest any growing crops, and/or death or diminution of value of any livestock of Lessee.

In the event that the Government shall elect to terminate this lease on account of the breach by the Lessee of any of the terms and conditions hereof no adjustment in advance rentals paid by Lessee shall be made, and the Government shall be entitled to recover and Lessee shall pay to the Government:

(1) The costs incurred in resuming possession of the Premises.

(2) The costs incurred in performing any obligation on the part of Lessee to be performed hereunder.

(3) An amount equal to the aggregate of all rents and charges assumed hereunder and not theretofore paid, less the net rentals, if any, collected by the Government on the re-letting of the Premises, which amounts shall be due and payable at the time when the rent reserved under this lease would become due and payable.

The Government may, at its option, attach any livestock or crops of Lessee on the Premises in full or partial satisfaction of Lessee's obligations under this Article.

I. SURRENDER

Upon the expiration of this lease or its prior termination, in whole or in part, Lessee shall quietly, and peacefully remove itself and its property from the Premises, or part thereof as to which this lease shall be terminated, and surrender the possession thereof to the Government. Upon failure or neglect of Lessee to so remove, the Government and its officers or agents may enter the Premises and cause the removal of all persons and property therefrom without recourse to any action or proceeding at law or in equity. Lessee hereby expressly waives any provision of law requiring notice to quit possession of the Premises. Such removal shall be at the sole cost and expense of Lessee and Lessee shall indemnify and save and hold harmless the Government, its officer, agents and employees for and from any and all liability or claims for damages of any nature whatsoever which may arise out of or be attributable to such removal.

J. DAMAGE TO GOVERNMENT PROPERTY

In the event of the destruction of or damage to any Government property located on or adjacent to the Premises by Lessee, or any of its officers, agents, servants, employees, subtenants, licensee or invitees, Lessee shall promptly repair or replace such property to the satisfaction of the Government, or pay to the Government an amount of money sufficient to compensate it for the loss or damage sustained, as the Government shall elect.

K. NON-LIABILITY OF GOVERNMENT

Lessee covenants that it will indemnify and save and hold harmless the Government, its officers, agents and employees for and from any and all liability or claims for loss of or damage to any property owned by or in the custody of Lessee, its officers, agents, servants, employees, subtenants, licensees or invitees, or for the death of or injury to any of the same which may arise out of or be attributable to the condition, state of repair or Lessee's use and occupancy of the Premises, or the furnishings of any utilities or services (including supply of water from wells or other sources), or any interruption therein or failure thereof, whether or not the same shall be occasioned by the negligence or

lack of diligence of Lessee, its officers, agents, servants or employees.

L. UTILITIES AND SERVICES

In the event that the Government shall furnish Lessee with any utilities and services maintained by the Government which Lessee may require in connection with its use of the Premises, Lessee shall pay the Government the charges therefor in addition to the cash rent required under this lease. Such charges and the method of payment thereof shall be determined by the Local Government Representative in accordance with applicable laws and regulations, on such basis as the Local Government Representative may establish, which may include a requirement for the installation of adequate connecting and metering equipment at the sole cost and expense of Lessee. It is expressly agreed and understood that the Government in no way warrants the continued maintenance or adequacy of any utilities or services furnished by it to Lessee.

M. ACCESS

The Government shall have access to the Premises at all reasonable times for any purposes not inconsistent with the quiet use and enjoyment thereof by Lessee, including, but not limited to, the purpose of inspection.

N. COVENANT AGAINST CONTINGENT FEES

Lessee warrants that no person or agency has been employed or retained to solicit or secure this lease upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, excepting bona fide employees or bona fide established commercial agencies maintained by Lessee for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this lease without liability or in its discretion to require Lessee to pay, in addition to the rental or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

O. STATE AND LOCAL TAXES

In the event that as a result of any future Act of Congress, subjecting Government-owned property to taxation, any taxes, assessments or similar charges are imposed by State or local authorities upon the Premises (other than upon Lessee's possessory interest therein), Lessee shall pay the same when due and payable and this lease shall be renegotiated so as to accomplish an equitable reduction in the rental provided for herein, which reduction shall in no event exceed the amount of such taxes, assessments, or similar charges; *Provided,* in event the parties hereto are unable to agree within ninety (90) days from the date of the imposition of such taxes, assessments, or similar charges, upon a rental which in the opinion of the Local Government Representative constitutes a reasonable return to the Government on the Premises, then in such event the Local Government Representative shall have the right to determine the amount of the rental, which determination shall be binding on Lessee, subject to appeal as a dispute in accordance with the provisions of paragraph P of this Article 10.

P. DISPUTES

1.1 This lease is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613) (the Act).

1.2 Except as provided in the Act, all disputes arising under or relating to this lease shall be resolved under this clause.

1.3 "Claim," as used in this clause, means a written demand or written assertion by the Lessee or the Government seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of lease terms, or other relief arising under or relating to this lease. A claim arising under this lease, unlike a claim relating to this lease, is a claim that can be resolved under a lease clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Lessee seeking the payment of money exceeding $100,000 is not a claim under the Act until certified as required by subparagraph 1.4(2) below. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

1.4(1) A claim by the Lessee shall be made in writing and submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, for a written decision. A claim by the Government against the Lessee shall be subject to a written decision by the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

1.4(2)(a)The Lessee shall provide the certification specified in subparagraph 1.4(2)(c) of this clause when submitting any claim ---

(A) Exceeding $100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

1.4(2)(b) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

1.4(2)(c)The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Lessee believes the Government liable; and that I am duly authorized to certify the claim on behalf of the Lessee."

1.4(3) The certification may be executed by any person duly authorized to bind the Lessee with respect to the claim.

1.5 For Lessee claim of $100,000 or less, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, if requested in writing by the Lessee, render a decision within sixty (60) days of the request. For Lessee-certified claims over $100,000, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, within sixty (60) days, decide the claim or notify the Lessee of the date by which the decision will be made.

1.6 The Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, decision shall be final unless the Lessee appeals or files a suit as provided in the Act.

1.7 At the time a claim by the Lessee is submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, or a claim by the Government is presented to the Lessee, the parties, by mutual consent, may agree to use ADR. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in paragraph 1.4(2)(c) of this clause, and executed in accordance with paragraph 1.4(3) of this clause.

1.8 The Government shall pay interest on the amount found due and unpaid by the Government from (1) the date the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim (properly certified if required), or (2) the date of payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in FAR 33.201, interest shall be paid from the date that the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury, as provided in the Act, which is applicable to the period during which the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

1.9 The Lessee shall proceed diligently with the performance of the lease, pending, final resolution of any request for relief, claim, appeal, or action arising under the lease, and comply with any decision of the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

Q. OFFICIALS NOT TO BENEFIT

No Member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share of part of this lease, or to any benefit to arise therefrom but this provision shall not be construed to extend to this lease if made with a corporation for its general benefit.

R. LABOR PROVISION

(1) Equal Opportunity

During the term of this lease the Lessee agrees as follows:

(a) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their

race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Government setting forth the provisions of this nondiscrimination clause.

(b) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding a notice to be provided by the Government, advising the labor union or worker's representative of the Lessee's commitments under this Equal Opportunity clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Lessee will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Lessee will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor or pursuant thereto, and will permit access to his books, records, and accounts by the Government and the Secretary of Labor for purposes of investigating to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Lessee will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each sublessee or vendor. The Lessee will take such action with respect to any sublessee or purchase order as the Government may direct as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with sublessee or vendor as a result of such direction by the Government, the Lessee may request the United States to enter into such litigation to protect the interests of the United States.

(2) Convict Labor

In connection with the performance of work required by this lease, Lessee agrees not to employ any person undergoing a sentence of imprisonment at hard labor.

(3) Contract Work Hours Standards Act (40 U.S. Code 327-330)

This lease, to the extent that it is a contract of a character specified in the Contract Work Hours Standards Act (40 U.S.C. 327-330) and is not covered by the Walsh-Healy Public Contracts Act (41 U.S.C. 35-45), is subject to the following provisions and exceptions of said Contract Work Hours Standards Act and to all other provisions and exceptions of said law:

(a) The Lessee shall not require or permit any laborer or mechanic in any workweek in which he is employed on any work under this contract to work in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek on work subject to the provisions of the Contract Work Hours Standards Act unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek, whichever is the greater number of overtime hours. The "basic rate of pay," as used in this clause, shall be the amount paid per hour, exclusive of the Lessee's contribution or cost for fringe benefits and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained in the wage determination, whichever is greater.

(b) In the event of any violation of the provisions of paragraph (a), the Lessee shall be liable to any affected employee for any amounts due and to the United States for liquidated damages. Such

liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions of paragraph (a) in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of 8 hours or in excess of the standard workweek of 40 hours without payment of the overtime wages required by paragraph (a).

S. NOTICES

No notice, order, direction, determination, requirement, consent, or approval under this lease shall be of any effect unless in writing. All notices required under this lease shall be addressed to Lessee, or to the Local Government Representative, as may be appropriate, at the address thereof specified in Article 9 of this lease or at such other address as may from time to time be agreed upon by the parties hereto.

T. FAILURE OF GOVERNMENT TO INSIST ON COMPLIANCE

The failure of the Government to insist, in any one or more instances, upon performances of any of the terms, covenants or conditions of this lease shall not be construed as a waiver or relinquishment of the Government's right to the future performance of any such terms, covenants or conditions and Lessee's obligations in respect to such future performance shall continue in full force and effect.

U. ASSIGNMENT OR SUBLETTING

Lessee shall not transfer or assign this lease or any interest therein nor sublet or otherwise make available to any third party or parties any portion of the Premises or rights therein without prior written consent of the Government. Under any assignment made, with or without consent, the assignee shall be deemed to have assumed all the obligations of Lessee hereunder, but no assignment shall relieve the assignor of any of Lessee's obligations hereunder except for an extension of the lease term beginning after such assignment, and then only if the Government shall have consented thereto.

V. GOVERNMENT RULES AND REGULATIONS

Lessee shall comply with such rules and regulations regarding station security, ingress, egress, safety and sanitation as may be prescribed, from time to time, by the Local Government Representative, or by the Commanding Officer of the Naval activity of which the Premises forms a part.

W. PAYMENTS

All payments to the Government required under this lease shall be made by check or postal money order made payable to the U.S. Treasurer and mailed to Commander Naval Facilities Engineering Command, Atlantic, Attn: FM, 6506 Hampton Blvd., Norfolk, VA 23508.

X. INTEREST

Notwithstanding any other provision of this lease, unless paid within thirty (30) days, all amounts that become payable by the Lessee to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code) shall bear interest from the date due until paid and shall be subject to adjustments as provided by Part 6 of Appendix E of the Armed Services Procurement Regulation, as in effect on the date of this lease. The interest rate per annum shall be the interest rate in effect which has been established by the Secretary of the Treasury pursuant to Public Law 92-41; 85 STAT 97 for the Renegotiation Board, as of the date the amount becomes due as herein provided. Amounts shall be due upon the earliest one of (i) the date fixed pursuant to this contract; (ii) the date of the first written demand for payment, consistent with this lease, including demand consequent upon default termination; or (iii) the date of transmittal by the Government to the Lessee of a proposed supplemental agreement to confirm completed negotiations fixing the amount.

Y. ADMINISTRATION

The local Government Representative specified in Article 9 of this lease shall, under the direction of the Commander, Naval Facilities Engineering Command, Mid-Atlantic, have complete charge of the administration of this lease, and shall exercise full supervision and general direction thereof insofar as the interest of the Department are affected.

Z. INDEMNIFICATION

The Lessee accepts responsibility for all liability related to, or arising under, Lessee's use of the property. Further, Lessee shall release and hold harmless the Government, its officers, agents, and employees from all liability, suits, claims, actions, or demands in any way related to, or arising under, Lessee's use of the property. This includes, but is not limited to, all environmental suits, claims, and enforcement actions, arising during Lessee's construction on, or use of, the property, or after such construction, or use, has ended. Further, Lessee shall reimburse the Government for all expenditures incurred if the Government voluntarily chooses to undertake any remedial action to address contamination on the premises or facilities resulting from the acts or omissions of the Lessee.

11. SPECIAL PROVISIONS

The following specified additional provisions, which shall control in the event of any conflict with the General Provisions of Article 10, are hereby incorporated into this lease by attachment hereto.

A. RESTRICTIONS:

a. No substance shall be released into the air from the leased lands that could impair visibility including, without limitation, emissions such as steam, dust and smoke.

b. No lights shall be constructed, maintained, directed or allowed to shine from the said leased lands, which could interfere with or impair pilot vision. All light emissions must be shielded to prevent them from being used as geographic reference pints by aircraft personnel.

c. No electrical emissions shall be emitted from sources situated on said leased lands which could interfere in any way with aircraft communications systems, ordnance or navigational equipment now in existence or hereinafter invented.

d. No garbage shall be dumped or placed and no feeding stations or other facilities attractive to birds shall be constructed or maintained on said leased lands. All trash, debris and empty pesticide containers shall be removed from Government property and properly disposed of each day at Lessee's expense.

e. Relic hunting, or antique hunting or recovery is prohibited.

f. Aerial crop dusting, unless specifically authorized by permit, is prohibited

g. Hunting on the leased land is permitted. The Station is responsible for coordinating the hunting program with the Lessee. Excessive damage by these activities must be reported immediately to the Naval Air Station, Oceana, Natural Resources Specialist at (757) 433-3461.

h. A cultivation regimen of cutting, no-till seed drilling and discing to a depth no greater than 16 cm (6.4 inches) below the surface shall be followed.

B. REIMBURSABLE WORK

If at any time during the lease it is determined that work not identified in the Soil and Water Conservation Plan, as Non-Reimbursable work is necessary, the procedures below will be followed:

The NAVFAC Mid-Atlantic Natural Resource Specialist will prepare a Scope of Work and Government Cost Estimate. Scope of Work will include what work is to be done and identify how or what method should be used to complete the work. It will also include a time schedule in which the work must be completed.

The NAVFAC Mid-Atlantic Natural Resource Specialist will forward the Scope of Work and Government Cost Estimate to the Real Estate Contracting Officer.

The Real Estate Contracting Officer will forward the Scope of Work to the Lessee and request a cost proposal.

The Lessee will send a cost proposal to the Real Estate Contracting Officer. This proposal may be based on Lessee having a third party perform the work. The Lessee may at this time inform the Government that he is incapable of performing the work.

If the Lessee submits a proposal and is acceptable, the Real Estate Contracting Officer will either; (1) issue a letter of authorization to proceed, advising a modification to the lease will be forthcoming or (2) forward a modification to the Lessee reflecting changes. Work should not begin until a letter or authorization or a modification has been received.

If the proposal is unacceptable, the Government will negotiate with the Lessee or determine alternative means of completing the required work.

When work is completed, Lessee and Navy Representatives will perform a joint inspection. If work is acceptable and within the time frame allotted, terms of the modification will be activated; i.e., rent reduction granted.

If it is determined during a joint inspection that the work was not completed properly or done within the required time frame, the Navy may, at its option, allow the Lessee additional time, not to exceed 25% of original time allotted, to complete the work or the Navy will have the work completed and charge the Lessee.

C. ENVIRONMENTAL/INDEMNIFICATION

In accordance with 10 U.S.C. 2692, the Lessee may not allow the treatment, storage or disposal of any Toxic or Hazardous materials on the leased premises. For the purposes of this provision, the terms "storage" and "Toxic or Hazardous Materials" are defined as provided in 48 CFR 252.223-7006.

The Lessee will reimburse the Lessor for all expenditures incurred if the Lessor is required by any regulatory authority or voluntarily chooses to undertake any Remedial Action to address Contamination on the leased premises resulting from the acts or omissions of the Lessee or its contractors. The Lessor shall contact the Lessee before taking any Remedial Action and give the Lessee a reasonable opportunity to undertake such Remedial Action if the Lessor believes that the Lessee has the capability to do so. Notwithstanding the above, the Lessee may immediately take any Remedial Action required of the Lessee by law.

During the term of this Lease, if the Lessee becomes aware that a Release of Toxic or Hazardous Materials has occurred that has resulted in Contamination of the leased premises, the Lessee will provide oral notice to the Lessor within 24 hours of becoming aware of such Contamination, providing all relevant facts and circumstances. The Lessor may request from the Lessee a more detailed written description of these facts and circumstances within a time period specified by the Lessor. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws relating to such Release, including reporting the occurrence to the appropriate Federal, State, or local regulatory authority or taking required Remedial Action, related to addressing the Contamination and to minimize the impacts of such Release. The Lessee will provide all information requested by the Lessor regarding such actions.

The Lessee, at its sole expense, will promptly take all action necessary to comply with Applicable Environmental Laws pertaining to a Release described in the preceding paragraph, including but not limited to: one, report the occurrence to appropriate Federal, State, or local regulatory authorities, if so directed by the Government; tow, take timely and effective steps to minimize the Release and its impact on human health and the environment; and three, take Remedial Action. The Government may direct the Lessee to provide all information requested by the Government regarding such actions within a time certain.

During the term of this Lease, the Lessee will ensure that all activities conducted by the Lessee or its contractors on the leased premises are carried out in compliance with Applicable Environmental Laws. The Lessee will provide oral notice to the Lessor within 24 hours of receiving any complaint, order, directive, claim, citation, or notice by any Governmental authority or any other person or entity with respect to a violation of Applicable Environmental Laws resulting from the activities of the Lessee or its contractors on the leased premises. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws as directed by any Federal, State, or local regulatory authority. The Lessor may request a more detailed written description of the events or circumstances leading to this event within a time specified by the Lessor. Without limitation of the foregoing, the Lessor may, but will not be obligated to, enter onto the leased premises and take any Remedial Action as it deems necessary or advisable to address any Contamination of the leased premises by Toxic or Hazardous Materials or to ensure compliance with Applicable Environmental Laws.

At any time, the Lessor or its representatives may conduct inspections on the leased premises to ensure compliance with Applicable Environmental Laws. To assist in this evaluation, the Lessee will provide to the Lessor or the Lessor's representative, any and all books, records, or documents in their possession, or in the possession of their agents or contractors, related to the activities or operations on the leased premises, which the Lessor or its representatives may examine, copy, or make extracts from.

As the Lessor deems appropriate, the Lessor may require that the Lessee, from time to time, promptly conduct such tests and procedures for the purpose of ensuring that the leased premises are in compliance with Applicable Environmental Laws and of having the leased premises certified to the Lessor as such. Such tests and procedures shall be conducted by recognized professionals to be approved by the Lessor and in a manner that is satisfactory to the Lessor. When requesting such tests and procedures, the Lessor will work with the Lessee to establish accepted timeframes, appropriate parties to perform the required activities, and schedules for performance. If an agreement cannot be reached regarding any of the foregoing, the Lessor or its representatives may undertake such tests and procedures, with the Lessee being obligated to reimburse the Lessor for all costs incurred.

For the purposes of this provision, the terms used above are defined as follows:

"Toxic or Hazardous Materials" means any hazardous, harmful, odorous, radioactive, toxic or dangerous waste, substance or material, including, without limitation, asbestos, polychlorinated biphenyls ("PCBs") and petroleum products, and any hazardous or toxic substance, material or waste, or any pollutant or contaminant defined as such in, or for the purposes of, any environmental laws as are now or in the future may be in effect. The Lessee's obligation under this provision shall extend to any and all such Toxic or Hazardous Materials whether or not such substance was defined, recognized, known, or suspected of being hazardous, toxic, dangerous, or wasteful at the time of any act or omission giving rise to the Lessee's obligation.

"Contamination" means a level of Toxic or Hazardous Materials in the air, in or on soil, in the surfacewater, or in the groundwater that exceeds levels allowed by Applicable Environmental Laws.

"Applicable Environmental Laws" means:

one, any Federal, State, or local statute, law, ordinance, rule, regulation, or order (whether voluntary or not) that govern the activities or operations of the leased premises, or the persons carrying out those activities or operations, relating to the environment, natural resources, or human health and safety.

two, Executive Orders of the President of the United States;

three, decisions of courts and administrative tribunals of competent jurisdiction;

four, administrative orders of regulatory agencies of competent jurisdiction (involuntary or on consent); and

five, regulations and directives of the Department of Defense, the Department of the Navy, and the U.S. Marine Corps (for Marine Corps installations only),

which pertain to the human environment (as defined in the National Environmental Policy act of 1969); transportation of hazardous material; and human health and safety (including occupational safety).

Applicable Environmental Laws include, without limitation the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. § 9601 *et seq*.), the Hazardous Material Transportation Act (49 U.S.C. § 1801 *et seq*.), the Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq*.), the Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq*.), the Clean Air Act (42 U.S.C. § 7401 *et seq*.), the Toxic Substances Control Act (15 U.S.C. § 2601 *et seq*.), and the Occupational Safety and Health Act (29 U.S.C. § 651 *et seq*.), Superfund Amendments and Reauthorization Act Title III (SARA) Emergency Planning and Community Right-to-Know Act (EPCRA) reporting requirements (40 CFR 355, 40 CFR 370, 40 CFR 372 and 29 CFR 1910.1200), as such laws have been amended or supplemented now or in the future.

"Release" means any release, spill, emission, leaking, pumping, injection, deposit, disposal, leaching, or migration into the environment, whether accidental or otherwise, resulting from the act or omissions of the Lessee, its contractors, or by natural conditions.

"Remedial Action" means any investigation or monitoring of the condition of the leased premises or any cleanup, remedial, removal, or restoration work required or performed on the leased premises because of the presence, suspected presence, release, or suspected release of Toxic or Hazardous Materials.

The Lessor shall not be responsible for damages to property or injuries to persons which may arise from or be incident to the use and occupation of the leased premises by the Lessee, nor for damages to the property or injuries to the person of the Lessor's officers, agents, servants, or employees, or others who may be on the leased premises at their invitation or the invitation of any one of them arising from or incident to governmental activities except as permitted under the Federal Torts Claim Act, 28 U.S.C. 2671 et seq.

F. APPLICABLE STATE AND CITY LAWS, CODES, AND ORDINANCES

The Lessee agrees to comply with all applicable State and City laws, codes and ordinances applicable to use of the leased premises at Lessee's expense. Lessee further agrees to obtain all necessary permits and related items at Lessee's expense.

G. INSURANCE REQUIREMENTS

Prior to award of the Lease, the LESSEE shall submit a certificate of insurance meeting the following requirements. Public Liability and Property Damage shall meet the following requirements at a minimum:

$50,000	Third Party Property Damage
$500,000	Third Party Personal Injury Per Person
$1,000,000	Third Party Personal Injury Per Accident

The policy/certificate of insurance shall contain an endorsement reading as follows:

a. Loss, if any under this policy shall be adjusted with (name of LESSEE) and the proceeds, at the election of the GOVERNMENT, shall be payable to (name of LESSEE); any proceeds not paid to (name of LESSEE) shall be payable to the Treasurer of the United States of America.

b. The insurer waives any right of subrogation against the United States of America which might arise by reason of any payment made under this policy.

c. The GOVERNMENT shall be given thirty (30) days written notice prior to making any material change in or the cancellation of the policy. Please strike out (and initial) any clauses that state "…failure to make such notice imposes no obligation or liability of any kind upon the company, etc …"

d. The United States of America (Department of the Navy) is added as an additional insured in operations of the policyholder at or from the premises leased at Naval Auxiliary Landing Field, Fentress, Virginia, identified as Unit F1.

e. This insurance certificate is for use of premises known as **339 acres more or less, at Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F1, Contract number N40085-15-RP-00016 or LO10500**.

If, at any time, the GOVERNMENT determines that the insurance maintained by the LESSEE does not in fact adequately protect the GOVERNMENT, LESSEE may be required to carry such other insurance in such form, for such amounts and for such periods of time, and with such insurers as the GOVERNMENT may from time to time require or approve.

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10501
CONTRACT NUMBER:
N40085-15-RP-00017

LEASE BETWEEN Heath Cutrell

(HEREINAFTER CALLED "LESSEE") AND THE UNITED STATES OF AMERICA HEREINAFTER CALLED THE "GOVERNMENT".

THE GOVERNMENT HEREBY LEASES TO LESSEE THE PROPERTY DESCRIBED BELOW UNDER THE TERMS, CONDITIONS, GENERAL PROVISIONS AND SPECIAL PROVISIONS SET FORTH ON THIS PAGE AND SUBSEQUENT PAGES OF THIS LEASE FORM.

1. **LEASED PROPERTY:** ALL THAT PORTION OF THE NAVAL ACTIVITY IDENTIFIED IN ARTICLE 9, WHICH PORTION IS HEREINAFTER CALLED THE "PREMISES" AND DESCRIBED AS FOLLOWS: Approximately 255.5 acres, more or less, at the Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F2 in the Soil and Water Conservation Plan attached hereto and made a part hereof as Exhibit "A."

2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.

LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM; *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF FIVE (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $25,098.66, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,750.88 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $7,596.91, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $8,750.88 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $35,003.50, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,750.88 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ N/A

6. **EXECUTION BY LESSEE**

NAME OF LESSEE: Heath Cutrell

BY: Heath Cutrell
(SIGNATURE)

Nicholas Ruffin
(WITNESS)

Owner
(TITLE)

4-7-15
(DATE)

7. **CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE**
I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) (SIGNATURE) (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY: [signature]
(CONTRACTING OFFICER)

4/13/15
(DATE)

Scott Hart
(WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS
Naval Air Station, Oceana Virginia Beach, Virginia	Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE: 3030 Cedarville Road Chesapeake, VA 23322 Phone: 757-567-9044	

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10501
CONTRACT NUMBER:
N40085-15-RP-00017

LEASE BETWEEN Heath Cutrell

(HEREINAFTER CALLED "**LESSEE**") AND THE **UNITED STATES OF AMERICA** HEREINAFTER CALLED THE "**GOVERNMENT**",

THE GOVERNMENT HEREBY LEASES TO LESSEE THE PROPERTY DESCRIBED BELOW UNDER THE TERMS, CONDITIONS, GENERAL PROVISIONS AND SPECIAL PROVISIONS SET FORTH ON THIS PAGE AND SUBSEQUENT PAGES OF THIS LEASE FORM.

1. **LEASED PROPERTY**: ALL THAT PORTION OF THE NAVAL ACTIVITY IDENTIFIED IN ARTICLE 9, WHICH PORTION IS HEREINAFTER CALLED THE "PREMISES" AND DESCRIBED AS FOLLOWS: Approximately 255.5 acres, more or less, at the Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F2 in the Soil and Water Conservation Plan attached hereto and made a part hereof as Exhibit "A."

2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.

LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM; *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF FIVE (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $25,098.66, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,750.88 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $7,596.91, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $8,750.88 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $35,003.50, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,750.88 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ ____N/A_____

6. **EXECUTION BY LESSEE**

NAME OF LESSEE_____Heath Cutrell_____

BY_____

_____ _____
(SIGNATURE) (WITNESS)

_____ _____
(TITLE) (DATE)

7. CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE
I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) _____ (SIGNATURE) _____ (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY_____ _____ _____
(CONTRACTING OFFICER) (DATE) (WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS
Naval Air Station, Oceana Virginia Beach, Virginia	Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE 3030 Cedarville Road Chesapeake, VA 23322 Phone: 757-567-9044	

10. GENERAL PROVISIONS

A. REPRESENTATIONS

The property under this lease is provided as is, where is. The term "as-is, where is" means that the Government is leasing the subject property in whatever condition it presently exists, and that the lessee is accepting the subject property with all faults, whether or not they could be ascertained by an inspection of the property or review of any due diligence material available. LESSEE has examined, knows and accepts the condition and state of repair of the Premises and all appurtenances thereto and acknowledges that the Government has made no representation concerning such condition and state of repair, nor any agreement or promise to alter, improve, adapt, repair or keep in repair such Premises and appurtenances, or any item thereof, which has not been fully set forth on this lease which contains all the agreements made and entered into between Lessee and the Government.

B. PROHIBITION OF FEDERAL SUBSIDY PARTICIPATION

Notwithstanding the uses permitted to it in Article 4 of this lease, Lessee shall at no time during the term of this lease, or any extension thereof, use the Premises or its interest therein in any manner which shall constitute direct participation in any subsidy program of the Federal Government relative to either the use or abstention from use of the Premises.

C. SUBJECTION TO GOVERNMENT SOIL & WATER CONSERVATION PLAN

During the term of this lease the Lessee shall apply the conservation measures and use the Premises in accordance with the conservation plan attached hereto and made a part hereof. Lessee shall in no manner substantially change the contour or condition of the land constituting any part of the Premises except for such changes as shall be reasonably required to effect soil and water conservation measures. (Soil and Water Conservation Plan is attached as Exhibit "A")

D. INSTALLATIONS AND REMOVALS

Subject to the prior written approval of the Government, Lessee shall have the right to erect, at its own expense, such temporary structures on the Premises as may be necessary or incidental to its use under this lease. All such structures shall remain the property of Lessee and Lessee shall remove any erected structures from the Premises prior to the expiration of the term of this lease. In the event the Government terminates this lease, Lessee shall be given thirty (30) days to accomplish such removal. All property not so removed shall be deemed abandoned by Lessee and may be used or disposed of by the Government in any manner whatsoever without any liability to account to the Government. Any such abandonment shall not reduce Lessee's obligation to restore the Premises.

E. SUBJECTION TO EXISTING AND FUTURE EASEMENTS AND RIGHTS-OF-WAY

This lease is subject to all outstanding easements and rights of way for location of any type of facility over, across, in and upon the Premises. In addition, the Government reserves the right to grant such additional easements as it shall determine to be in the public interest. The Government also reserves all mineral rights in the Premises, together with such rights of access and use of the surface as may be necessary for the mining and saving of any mineral deposits located thereon or thereunder. The Government reserves the right to allow ingress and egress to workers officially engaged in the construction, installation, maintenance, operation, repair or replacement of facilities located thereon, and to any Federal, State or local officials.

F. RESTORATION OF PREMISES

Before the expiration of this lease or the prior termination thereof, Lessee shall, if required to do so by the Government, restore the Premises to the condition existing at the time of its entrance thereon under this lease, or to such improved condition as they may have been placed in by the Government or the Lessee during the term of this lease, reasonable wear and tear and damage by the elements or from other causes over which Lessee had no control excepted; *Provided,* in the event the Government shall terminate this lease upon less than thirty (30) days notice Lessee shall have thirty (30) days from receipt of notice of termination to accomplish such restoration.

G. LIENS

Lessee shall promptly discharge or cause to be discharged any valid lien, *right in rem*, claim or demand of any kind, except one in favor of the

Government, which at any time may arise or exist with respect to the Premises or materials or equipment furnished therefor, or any part thereof, and if the same shall not be promptly discharged by Lessee, the Government may discharge, or cause to be discharged, the same at the expense of the Lessee.

H. TERMINATION BY GOVERNMENT

The Government shall have the right to terminate this lease, in whole or in part, at any time, without prior notice, and regardless of any lack of breach by Lessee of any of the terms and conditions of this lease. In the event of termination for any reason not involving a breach by Lessee of the terms and conditions of the lease the Government shall make an equitable adjustment of any advance rentals paid by Lessee hereunder and, if the Government's use of the Premises does not require immediate possession thereof, Lessee shall be permitted, within such time as the Local Government Representative shall prescribe, to harvest, gather and remove from the Premises such crops as can be so harvested and removed, but if the Government's requirements necessitate immediate repossession of the Premises, so as to require immediate removal of Lessee's livestock, and/or, to preclude Lessee from such harvesting and removal of any growing or matured crops, Lessee hereby specifically releases, remises, and forever discharges the Government from any and all liability or claims for loss or damage of any nature arising out of such termination and repossession, including, but not limited to, destruction of diminution in value of, or inability to harvest any growing crops, and/or death or diminution of value of any livestock of Lessee.

In the event that the Government shall elect to terminate this lease on account of the breach by the Lessee of any of the terms and conditions hereof no adjustment in advance rentals paid by Lessee shall be made, and the Government shall be entitled to recover and Lessee shall pay to the Government:

(1) The costs incurred in resuming possession of the Premises.

(2) The costs incurred in performing any obligation on the part of Lessee to be performed hereunder.

(3) An amount equal to the aggregate of all rents and charges assumed hereunder and not theretofore paid, less the net rentals, if any, collected by the Government on the re-letting of the Premises, which amounts shall be due and payable at the time when the rent reserved under this lease would become due and payable.

The Government may, at its option, attach any livestock or crops of Lessee on the Premises in full or partial satisfaction of Lessee's obligations under this Article.

I. SURRENDER

Upon the expiration of this lease or its prior termination, in whole or in part, Lessee shall quietly, and peacefully remove itself and its property from the Premises, or part thereof as to which this lease shall be terminated, and surrender the possession thereof to the Government. Upon failure or neglect of Lessee to so remove, the Government and its officers or agents may enter the Premises and cause the removal of all persons and property therefrom without recourse to any action or proceeding at law or in equity. Lessee hereby expressly waives any provision of law requiring notice to quit possession of the Premises. Such removal shall be at the sole cost and expense of Lessee and Lessee shall indemnify and save and hold harmless the Government, its officer, agents and employees for and from any and all liability or claims for damages of any nature whatsoever which may arise out of or be attributable to such removal.

J. DAMAGE TO GOVERNMENT PROPERTY

In the event of the destruction of or damage to any Government property located on or adjacent to the Premises by Lessee, or any of its officers, agents, servants, employees, subtenants, licensee or invitees, Lessee shall promptly repair or replace such property to the satisfaction of the Government, or pay to the Government an amount of money sufficient to compensate it for the loss or damage sustained, as the Government shall elect.

K. NON-LIABILITY OF GOVERNMENT

Lessee covenants that it will indemnify and save and hold harmless the Government, its officers, agents and employees for and from any and all liability or claims for loss of or damage to any property owned by or in the custody of Lessee, its officers, agents, servants, employees, subtenants, licensees or invitees, or for the death of or injury to any of the same which may arise out of or be attributable to the condition, state of repair or Lessee's use and occupancy of the Premises, or the furnishings of any utilities or services (including supply of water from wells or other sources), or any interruption therein or failure thereof, whether or not the same shall be occasioned by the negligence or

lack of diligence of Lessee, its officers, agents, servants or employees.

L. UTILITIES AND SERVICES

In the event that the Government shall furnish Lessee with any utilities and services maintained by the Government which Lessee may require in connection with its use of the Premises, Lessee shall pay the Government the charges therefor in addition to the cash rent required under this lease. Such charges and the method of payment thereof shall be determined by the Local Government Representative in accordance with applicable laws and regulations, on such basis as the Local Government Representative may establish which may include a requirement for the installation of adequate connecting and metering equipment at the sole cost and expense of Lessee. It is expressly agreed and understood that the Government in no way warrants the continued maintenance or adequacy of any utilities or services furnished by it to Lessee.

M. ACCESS

The Government shall have access to the Premises at all reasonable times for any purposes not inconsistent with the quiet use and enjoyment thereof by Lessee, including, but not limited to, the purpose of inspection.

N. COVENANT AGAINST CONTINGENT FEES

Lessee warrants that no person or agency has been employed or retained to solicit or secure this lease upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, excepting bona fide employees or bona fide established commercial agencies maintained by Lessee for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this lease without liability or in its discretion to require Lessee to pay, in addition to the rental or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

O. STATE AND LOCAL TAXES

In the event that as a result of any future Act of Congress, subjecting Government-owned property to taxation, any taxes, assessments or similar charges are imposed by State or local authorities upon the Premises (other than upon Lessee's possessory interest therein), Lessee shall pay the same when due and payable and this lease shall be renegotiated so as to accomplish an equitable reduction in the rental provided for herein, which reduction shall in no event exceed the amount of such taxes, assessments, or similar charges; *Provided,* in event the parties hereto are unable to agree within ninety (90) days from the date of the imposition of such taxes, assessments, or similar charges, upon a rental which in the opinion of the Local Government Representative constitutes a reasonable return to the Government on the Premises, then in such event the Local Government Representative shall have the right to determine the amount of the rental, which determination shall be binding on Lessee, subject to appeal as a dispute in accordance with the provisions of paragraph P of this Article 10.

P. DISPUTES

1.1 This lease is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613) (the Act).

1.2 Except as provided in the Act, all disputes arising under or relating to this lease shall be resolved under this clause.

1.3 "Claim," as used in this clause, means a written demand or written assertion by the Lessee or the Government seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of lease terms, or other relief arising under or relating to this lease. A claim arising under this lease, unlike a claim relating to this lease, is a claim that can be resolved under a lease clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Lessee seeking the payment of money exceeding $100,000 is not a claim under the Act until certified as required by subparagraph 1.4(2) below. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

1.4(1) A claim by the Lessee shall be made in writing and submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, for a written decision. A claim by the Government against the Lessee shall be subject to a written decision by the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

1.4(2)(a)The Lessee shall provide the certification specified in subparagraph 1.4(2)(c) of this clause when submitting any claim ---

(A) Exceeding $100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

1.4(2)(b) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

1.4(2)(c)The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Lessee believes the Government liable; and that I am duly authorized to certify the claim on behalf of the Lessee."

1.4(3) The certification may be executed by any person duly authorized to bind the Lessee with respect to the claim.

1.5 For Lessee claim of $100,000 or less, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, if requested in writing by the Lessee, render a decision within sixty (60) days of the request. For Lessee-certified claims over $100,000, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, within sixty (60) days, decide the claim or notify the Lessee of the date by which the decision will be made.

1.6 The Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, decision shall be final unless the Lessee appeals or files a suit as provided in the Act.

1.7 At the time a claim by the Lessee is submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, or a claim by the Government is presented to the Lessee, the parties, by mutual consent, may agree to use ADR. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in paragraph 1.4(2)(c) of this clause, and executed in accordance with paragraph 1.4(3) of this clause.

1.8 The Government shall pay interest on the amount found due and unpaid by the Government from (1) the date the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim (properly certified if required), or (2) the date of payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in FAR 33.201, interest shall be paid from the date that the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury, as provided in the Act, which is applicable to the period during which the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

1.9 The Lessee shall proceed diligently with the performance of the lease, pending, final resolution of any request for relief, claim, appeal, or action arising under the lease, and comply with any decision of the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

Q. OFFICIALS NOT TO BENEFIT

No Member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share of part of this lease, or to any benefit to arise therefrom but this provision shall not be construed to extend to this lease if made with a corporation for its general benefit.

R. LABOR PROVISION

(1) Equal Opportunity

During the term of this lease the Lessee agrees as follows:

(a) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their

race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Government setting forth the provisions of this nondiscrimination clause.

(b) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding a notice to be provided by the Government, advising the labor union or worker's representative of the Lessee's commitments under this Equal Opportunity clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Lessee will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Lessee will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor or pursuant thereto, and will permit access to his books, records, and accounts by the Government and the Secretary of Labor for purposes of investigating to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Lessee will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each sublessee or vendor. The Lessee will take such action with respect to any sublessee or purchase order as the Government may direct as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with sublessee or vendor as a result of such direction by the Government, the Lessee may request the United States to enter into such litigation to protect the interests of the United States.

(2) Convict Labor

In connection with the performance of work required by this lease, Lessee agrees not to employ any person undergoing a sentence of imprisonment at hard labor.

(3) Contract Work Hours Standards Act (40 U.S. Code 327-330)

This lease, to the extent that it is a contract of a character specified in the Contract Work Hours Standards Act (40 U.S.C. 327-330) and is not covered by the Walsh-Healy Public Contracts Act (41 U.S.C. 35-45), is subject to the following provisions and exceptions of said Contract Work Hours Standards Act and to all other provisions and exceptions of said law:

(a) The Lessee shall not require or permit any laborer or mechanic in any workweek in which he is employed on any work under this contract to work in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek on work subject to the provisions of the Contract Work Hours Standards Act unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek, whichever is the greater number of overtime hours. The "basic rate of pay," as used in this clause, shall be the amount paid per hour, exclusive of the Lessee's contribution or cost for fringe benefits and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained in the wage determination, whichever is greater.

(b) In the event of any violation of the provisions of paragraph (a), the Lessee shall be liable to any affected employee for any amounts due and to the United States for liquidated damages. Such

liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions of paragraph (a) in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of 8 hours or in excess of the standard workweek of 40 hours without payment of the overtime wages required by paragraph (a).

S. NOTICES

No notice, order, direction, determination, requirement, consent, or approval under this lease shall be of any effect unless in writing. All notices required under this lease shall be addressed to Lessee, or to the Local Government Representative, as may be appropriate, at the address thereof specified in Article 9 of this lease or at such other address as may from time to time be agreed upon by the parties hereto.

T. FAILURE OF GOVERNMENT TO INSIST ON COMPLIANCE

The failure of the Government to insist, in any one or more instances, upon performances of any of the terms, covenants or conditions of this lease shall not be construed as a waiver or relinquishment of the Government's right to the future performance of any such terms, covenants or conditions and Lessee's obligations in respect to such future performance shall continue in full force and effect.

U. ASSIGNMENT OR SUBLETTING

Lessee shall not transfer or assign this lease or any interest therein nor sublet or otherwise make available to any third party or parties any portion of the Premises or rights therein without prior written consent of the Government. Under any assignment made, with or without consent, the assignee shall be deemed to have assumed all the obligations of Lessee hereunder, but no assignment shall relieve the assignor of any of Lessee's obligations hereunder except for an extension of the lease term beginning after such assignment, and then only if the Government shall have consented thereto.

V. GOVERNMENT RULES AND REGULATIONS

Lessee shall comply with such rules and regulations regarding station security, ingress, egress, safety and sanitation as may be prescribed, from time to time, by the Local Government Representative, or by the Commanding Officer of the Naval activity of which the Premises forms a part.

W. PAYMENTS

All payments to the Government required under this lease shall be made by check or postal money order made payable to the U.S. Treasurer and mailed to Commander Naval Facilities Engineering Command, Atlantic, Attn: FM, 6506 Hampton Blvd., Norfolk, VA 23508.

X. INTEREST

Notwithstanding any other provision of this lease, unless paid within thirty (30) days, all amounts that become payable by the Lessee to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code) shall bear interest from the date due until paid and shall be subject to adjustments as provided by Part 6 of Appendix E of the Armed Services Procurement Regulation, as in effect on the date of this lease. The interest rate per annum shall be the interest rate in effect which has been established by the Secretary of the Treasury pursuant to Public Law 92-41; 85 STAT 97 for the Renegotiation Board, as of the date the amount becomes due as herein provided. Amounts shall be due upon the earliest one of (i) the date fixed pursuant to this contract; (ii) the date of the first written demand for payment, consistent with this lease, including demand consequent upon default termination; or (iii) the date of transmittal by the Government to the Lessee of a proposed supplemental agreement to confirm completed negotiations fixing the amount.

Y. ADMINISTRATION

The local Government Representative specified in Article 9 of this lease shall, under the direction of the Commander, Naval Facilities Engineering Command, Mid-Atlantic, have complete charge of the administration of this lease, and shall exercise full supervision and general direction thereof insofar as the interest of the Department are affected.

Z. INDEMNIFICATION

The Lessee accepts responsibility for all liability related to, or arising under, Lessee's use of the property. Further, Lessee shall release and hold harmless the Government, its officers, agents, and employees from all liability, suits, claims, actions, or demands in any way related to, or arising under, Lessee's use of the property. This includes, but is not limited to, all environmental suits, claims, and enforcement actions, arising during Lessee's construction on, or use of, the property, or after such construction, or use, has ended. Further, Lessee shall reimburse the Government for all expenditures incurred if the Government voluntarily chooses to undertake any remedial action to address contamination on the premises or facilities resulting from the acts or omissions of the Lessee.

11. SPECIAL PROVISIONS

The following specified additional provisions, which shall control in the event of any conflict with the General Provisions of Article 10, are hereby incorporated into this lease by attachment hereto.

A. RESTRICTIONS:

a. No substance shall be released into the air from the leased lands that could impair visibility including, without limitation, emissions such as steam, dust and smoke.

b. No lights shall be constructed, maintained, directed or allowed to shine from the said leased lands, which could interfere with or impair pilot vision. All light emissions must be shielded to prevent them from being used as geographic reference pints by aircraft personnel.

c. No electrical emissions shall be emitted from sources situated on said leased lands which could interfere in any way with aircraft communications systems, ordnance or navigational equipment now in existence or hereinafter invented.

d. No garbage shall be dumped or placed and no feeding stations or other facilities attractive to birds shall be constructed or maintained on said leased lands. All trash, debris and empty pesticide containers shall be removed from Government property and properly disposed of each day at Lessee's expense.

e. Relic hunting, or antique hunting or recovery is prohibited.

f. Aerial crop dusting, unless specifically authorized by permit, is prohibited

g. Hunting on the leased land is permitted. The Station is responsible for coordinating the hunting program with the Lessee. Excessive damage by these activities must be reported immediately to the Naval Air Station, Oceana, Natural Resources Specialist at (757) 433-3461.

h. A cultivation regimen of cutting, no-till seed drilling and discing to a depth no greater than 16 cm (6.4 inches) below the surface shall be followed.

B. REIMBURSABLE WORK

If at any time during the lease it is determined that work not identified in the Soil and Water Conservation Plan, as Non-Reimbursable work is necessary, the procedures below will be followed:

The NAVFAC Mid-Atlantic Natural Resource Specialist will prepare a Scope of Work and Government Cost Estimate. Scope of Work will include what work is to be done and identify how or what method should be used to complete the work. It will also include a time schedule in which the work must be completed.

The NAVFAC Mid-Atlantic Natural Resource Specialist will forward the Scope of Work and Government Cost Estimate to the Real Estate Contracting Officer.

The Real Estate Contracting Officer will forward the Scope of Work to the Lessee and request a cost proposal.

The Lessee will send a cost proposal to the Real Estate Contracting Officer. This proposal may be based on Lessee having a third party perform the work. The Lessee may at this time inform the Government that he is incapable of performing the work.

If the Lessee submits a proposal and is acceptable, the Real Estate Contracting Officer will either; (1) issue a letter of authorization to proceed, advising a modification to the lease will be forthcoming or (2) forward a modification to the Lessee reflecting changes. Work should not begin until a letter or authorization or a modification has been received.

If the proposal is unacceptable, the Government will negotiate with the Lessee or determine alternative means of completing the required work.

When work is completed, Lessee and Navy Representatives will perform a joint inspection. If work is acceptable and within the time frame allotted, terms of the modification will be activated; i.e., rent reduction granted.

If it is determined during a joint inspection that the work was not completed properly or done within the required time frame, the Navy may, at its option, allow the Lessee additional time, not to exceed 25% of original time allotted, to complete the work or the Navy will have the work completed and charge the Lessee.

C. ENVIRONMENTAL/INDEMNIFICATION

In accordance with 10 U.S.C. 2692, the Lessee may not allow the treatment, storage or disposal of any Toxic or Hazardous materials on the leased premises. For the purposes of this provision, the terms "storage" and "Toxic or Hazardous Materials" are defined as provided in 48 CFR 252.223-7006.

The Lessee will reimburse the Lessor for all expenditures incurred if the Lessor is required by any regulatory authority or voluntarily chooses to undertake any Remedial Action to address Contamination on the leased premises resulting from the acts or omissions of the Lessee or its contractors. The Lessor shall contact the Lessee before taking any Remedial Action and give the Lessee a reasonable opportunity to undertake such Remedial Action if the Lessor believes that the Lessee has the capability to do so. Notwithstanding the above, the Lessee may immediately take any Remedial Action required of the Lessee by law.

During the term of this Lease, if the Lessee becomes aware that a Release of Toxic or Hazardous Materials has occurred that has resulted in Contamination of the leased premises, the Lessee will provide oral notice to the Lessor within 24 hours of becoming aware of such Contamination, providing all relevant facts and circumstances. The Lessor may request from the Lessee a more detailed written description of these facts and circumstances within a time period specified by the Lessor. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws relating to such Release, including reporting the occurrence to the appropriate Federal, State, or local regulatory authority or taking required Remedial Action, related to addressing the Contamination and to minimize the impacts of such Release. The Lessee will provide all information requested by the Lessor regarding such actions.

The Lessee, at its sole expense, will promptly take all action necessary to comply with Applicable Environmental Laws pertaining to a Release described in the preceding paragraph, including but not limited to: one, report the occurrence to appropriate Federal, State, or local regulatory authorities, if so directed by the Government; tow, take timely and effective steps to minimize the Release and its impact on human health and the environment; and three, take Remedial Action. The Government may direct the Lessee to provide all information requested by the Government regarding such actions within a time certain.

During the term of this Lease, the Lessee will ensure that all activities conducted by the Lessee or its contractors on the leased premises are carried out in compliance with Applicable Environmental Laws. The Lessee will provide oral notice to the Lessor within 24 hours of receiving any complaint, order, directive, claim, citation, or notice by any Governmental authority or any other person or entity with respect to a violation of Applicable Environmental Laws resulting from the activities of the Lessee or its contractors on the leased premises. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws as directed by any Federal, State, or local regulatory authority. The Lessor may request a more detailed written description of the events or circumstances leading to this event within a time specified by the Lessor. Without limitation of the foregoing, the Lessor may, but will not be obligated to, enter onto the leased premises and take any Remedial Action as it deems necessary or advisable to address any Contamination of the leased premises by Toxic or Hazardous Materials or to ensure compliance with Applicable Environmental Laws.

At any time, the Lessor or its representatives may conduct inspections on the leased premises to ensure compliance with Applicable Environmental Laws. To assist in this evaluation, the Lessee will provide to the Lessor or the Lessor's representative, any and all books, records, or documents in their possession, or in the possession of their agents or contractors, related to the activities or operations on the leased premises, which the Lessor or its representatives may examine, copy, or make extracts from.

As the Lessor deems appropriate, the Lessor may require that the Lessee, from time to time, promptly conduct such tests and procedures for the purpose of ensuring that the leased premises are in compliance with Applicable Environmental Laws and of having the leased premises certified to the Lessor as such. Such tests and procedures shall be conducted by recognized professionals to be approved by the Lessor and in a manner that is satisfactory to the Lessor. When requesting such tests and procedures, the Lessor will work with the Lessee to establish accepted timeframes, appropriate parties to perform the required activities, and schedules for performance. If an agreement cannot be reached regarding any of the foregoing, the Lessor or its representatives may undertake such tests and procedures, with the Lessee being obligated to reimburse the Lessor for all costs incurred.

For the purposes of this provision, the terms used above are defined as follows:

"Toxic or Hazardous Materials" means any hazardous, harmful, odorous, radioactive, toxic or dangerous waste, substance or material, including, without limitation, asbestos, polychlorinated biphenyls ("PCBs") and petroleum products, and any hazardous or toxic substance, material or waste, or any pollutant or contaminant defined as such in, or for the purposes of, any environmental laws as are now or in the future may be in effect. The Lessee's obligation under this provision shall extend to any and all such Toxic or Hazardous Materials whether or not such substance was defined, recognized, known, or suspected of being hazardous, toxic, dangerous, or wasteful at the time of any act or omission giving rise to the Lessee's obligation.

"Contamination" means a level of Toxic or Hazardous Materials in the air, in or on soil, in the surfacewater, or in the groundwater that exceeds levels allowed by Applicable Environmental Laws.

"Applicable Environmental Laws" means:

one, any Federal, State, or local statute, law, ordinance, rule, regulation, or order (whether voluntary or not) that govern the activities or operations of the leased premises, or the persons carrying out those activities or operations, relating to the environment, natural resources, or human health and safety.

two, Executive Orders of the President of the United States;

three, decisions of courts and administrative tribunals of competent jurisdiction;

four, administrative orders of regulatory agencies of competent jurisdiction (involuntary or on consent); and

five, regulations and directives of the Department of Defense, the Department of the Navy, and the U.S. Marine Corps (for Marine Corps installations only),

which pertain to the human environment (as defined in the National Environmental Policy act of 1969); transportation of hazardous material; and human health and safety (including occupational safety).

Applicable Environmental Laws include, without limitation the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. § 9601 *et seq*.), the Hazardous Material Transportation Act (49 U.S.C. § 1801 *et seq*.), the Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq*.), the Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq*.), the Clean Air Act (42 U.S.C. § 7401 *et seq*.), the Toxic Substances Control Act (15 U.S.C. § 2601 *et seq*.), and the Occupational Safety and Health Act (29 U.S.C. § 651 *et seq*.), Superfund Amendments and Reauthorization Act Title III (SARA) Emergency Planning and Community Right-to-Know Act (EPCRA) reporting requirements (40 CFR 355, 40 CFR 370, 40 CFR 372 and 29 CFR 1910.1200), as such laws have been amended or supplemented now or in the future.

"Release" means any release, spill, emission, leaking, pumping, injection, deposit, disposal, leaching, or migration into the environment, whether accidental or otherwise, resulting from the act or omissions of the Lessee, its contractors, or by natural conditions.

"Remedial Action" means any investigation or monitoring of the condition of the leased premises or any cleanup, remedial, removal, or restoration work required or performed on the leased premises because of the presence, suspected presence, release, or suspected release of Toxic or Hazardous Materials.

The Lessor shall not be responsible for damages to property or injuries to persons which may arise from or be incident to the use and occupation of the leased premises by the Lessee, nor for damages to the property or injuries to the person of the Lessor's officers, agents, servants, or employees, or others who may be on the leased premises at their invitation or the invitation of any one of them arising from or incident to governmental activities except as permitted under the Federal Torts Claim Act, 28 U.S.C. 2671 et seq.

F. APPLICABLE STATE AND CITY LAWS, CODES, AND ORDINANCES

The Lessee agrees to comply with all applicable State and City laws, codes and ordinances applicable to use of the leased premises at Lessee's expense. Lessee further agrees to obtain all necessary permits and related items at Lessee's expense.

G. INSURANCE REQUIREMENTS

Prior to award of the Lease, the LESSEE shall submit a certificate of insurance meeting the following requirements. Public Liability and Property Damage shall meet the following requirements at a minimum:

$50,000	Third Party Property Damage
$500,000	Third Party Personal Injury Per Person
$1,000,000	Third Party Personal Injury Per Accident

The policy/certificate of insurance shall contain an endorsement reading as follows:

a. Loss, if any under this policy shall be adjusted with (name of LESSEE) and the proceeds, at the election of the GOVERNMENT, shall be payable to (name of LESSEE); any proceeds not paid to (name of LESSEE) shall be payable to the Treasurer of the United States of America.

b. The insurer waives any right of subrogation against the United States of America which might arise by reason of any payment made under this policy.

c. The GOVERNMENT shall be given thirty (30) days written notice prior to making any material change in or the cancellation of the policy. Please strike out (and initial) any clauses that state "…failure to make such notice imposes no obligation or liability of any kind upon the company, etc …"

d. The United States of America (Department of the Navy) is added as an additional insured in operations of the policyholder at or from the premises leased at Naval Auxiliary Landing Field, Fentress, Virginia, identified as Unit F2.

e. This insurance certificate is for use of premises known as **255.5 acres more or less, at Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F2, Contract number N40085-15-RP-00017 or LO10501**.

If, at any time, the GOVERNMENT determines that the insurance maintained by the LESSEE does not in fact adequately protect the GOVERNMENT, LESSEE may be required to carry such other insurance in such form, for such amounts and for such periods of time, and with such insurers as the GOVERNMENT may from time to time require or approve.

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10502
CONTRACT NUMBER:
N40085-15-RP-00018

LEASE BETWEEN Heath Cutrell

(HEREINAFTER CALLED "LESSEE") AND THE UNITED STATES OF AMERICA HEREINAFTER CALLED THE "GOVERNMENT".

THE GOVERNMENT HEREBY LEASES TO LESSEE THE PROPERTY DESCRIBED BELOW UNDER THE TERMS, CONDITIONS, GENERAL PROVISIONS AND SPECIAL PROVISIONS SET FORTH ON THIS PAGE AND SUBSEQUENT PAGES OF THIS LEASE FORM.

1. **LEASED PROPERTY:** ALL THAT PORTION OF THE NAVAL ACTIVITY IDENTIFIED IN ARTICLE 9, WHICH PORTION IS HEREINAFTER CALLED THE "PREMISES" AND DESCRIBED AS FOLLOWS: Approximately 263.2 acres, more or less, at the Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F3 in the Soil and Water Conservation Plan attached hereto and made a part hereof as Exhibit "A."

2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.

LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM: *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF FIVE (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $24,449.07, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,524.39 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $7,400.29, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $8,524.39 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $34,097.56, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,524.39 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ N/A

6. **EXECUTION BY LESSEE**

NAME OF LESSEE Heath Cutrell

BY Heath Cutrell
(SIGNATURE)

Nichole Raffin
(WITNESS)

Owner
(TITLE)

4-7-15
(DATE)

7. **CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE**
I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) (SIGNATURE) (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY
(CONTRACTING OFFICER)

4/13/15
(DATE)

Scott
(WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS
Naval Air Station, Oceana Virginia Beach, Virginia	Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE 3030 Cedarville Road Chesapeake, VA 23322 Phone: 757 342-3336	

NAVFAC 11011/22 (Rev. 7-75)
Supersedes NAVDOCKS 2595 and 2596

DEPARTMENT OF THE NAVY LEASE FOR AGRICULTURAL OR GRAZING PURPOSES

FILE NO: LO-10502
CONTRACT NUMBER:
N40085-15-RP-00018

LEASE BETWEEN Heath Cutrell

(HEREINAFTER CALLED "**LESSEE**") AND THE **UNITED STATES OF AMERICA** HEREINAFTER CALLED THE "**GOVERNMENT**",

THE GOVERNMENT HEREBY LEASES TO LESSEE THE PROPERTY DESCRIBED BELOW UNDER THE TERMS, CONDITIONS, GENERAL PROVISIONS AND SPECIAL PROVISIONS SET FORTH ON THIS PAGE AND SUBSEQUENT PAGES OF THIS LEASE FORM.

1. **LEASED PROPERTY**: ALL THAT PORTION OF THE NAVAL ACTIVITY IDENTIFIED IN ARTICLE 9, WHICH PORTION IS HEREINAFTER CALLED THE "PREMISES" AND DESCRIBED AS FOLLOWS: Approximately 263.2 acres, more or less, at the Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F3 in the Soil and Water Conservation Plan attached hereto and made a part hereof as Exhibit "A."

2. **TERM:** THE TERM OF THIS LEASE SHALL BEGIN ON 13 April 2015 AND END ON 31 December 2015 UNLESS SOONER TERMINATED IN ACCORDANCE WITH THE PROVISIONS OF ARTICLE 10H HEREOF.

LESSEE MAY REQUEST TO EXTEND THE TERM OF THIS LEASE FOR four (4) ADDITIONAL PERIODS OF ONE (1) YEAR EACH BY DELIVERY TO THE LOCAL GOVERNMENT REPRESENTATIVE OF WRITTEN NOTICE OF ITS INTENTION TO EXTEND NO LATER THAN NINETY (90) DAYS PRIOR TO THE EXPIRATION OF THE THEN CURRENT TERM; *PROVIDED*, NO EXTENSION SHALL BE GRANTED WHICH CREATES A TOTAL TERM IN EXCESS OF FIVE (5) YEARS.

3. **RENT:** DURING THE INITIAL TERM OF THIS LEASE, WHICH IS FOR A PERIOD OF EIGHT (8) MONTHS AND EIGHTEEN (18) DAYS, THE LESSEE SHALL PAY THE GOVERNMENT A RENTAL OF $24,449.07, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,524.39 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF. THE FIRST PAYMENT WILL BE $7,400.29, WHICH IS THE PRORATED QUARTERLY PAYMENT RATE FOR THE LEASE DURING THE PERIOD OF 13 APRIL 2015 TO 30 JUNE 2015. FOR THE INITIAL TERM AND ANY RENEWAL TERMS, ALL FUTURE PAYMENTS WILL BE $8,524.39 AND DUE ON THE FIRST DAY OF JULY, OCTOBER, JANUARY, AND APRIL.

AFTER THE INITIAL EIGHT (8) MONTH AND EIGHTEEN (18) DAY TERM, AND PROVIDED LESSEE RENEWS THE LEASE, LESSEE SHALL PAY THE GOVERNMENT ANNUAL RENTAL OF $34,097.56, PAYABLE QUARTERLY IN ADVANCE AT THE RATE OF $8,524.39 PER QUARTER, IN CONFORMITY WITH THE PROVISIONS OF ARTICLE 10W HEREOF.

4. **USE:** THE PREMISES SHALL BE USED SOLELY FOR production of row crops (e.g., corn, soybeans, small grains, cotton) truck crops or hay/silage crops.

5. **PERFORMANCE BOND OR SECURITY:** TO SECURE THE FAITHFUL PERFORMANCE OF ITS OBLIGATIONS HEREUNDER LESSEE SHALL PROVIDE THE GOVERNMENT WITH EITHER: (a) COLLATERAL SECURITY IN THE FORM OF CASH OR NEGOTIABLE GOVERNMENT BONDS, OR (b) A PERFORMANCE BOND ISSUED BY A CORPORATE SURETY AND SATISFACTORY TO THE GOVERNMENT IN ALL RESPECTS, IN THE AMOUNT OF $ N/A

6. **EXECUTION BY LESSEE**

NAME OF LESSEE Heath Cutrell

BY _____

_____ _____
(SIGNATURE) (WITNESS)

_____ _____
(TITLE) (DATE)

7. CERTIFICATION BY SECRETARY OR ASSISTANT SECRETARY OF CORPORATE LESSEE

I CERTIFY THAT THE PERSON WHO SIGNED THIS LEASE ON BEHALF OF LESSEE WAS THEN THE OFFICER INDICATED AND THIS AGREEMENT WAS DULY SIGNED FOR AND ON BEHALF OF SAID CORPORATION BY AUTHORITY OF ITS GOVERNING BODY AND IS WITHIN THE SCOPE OF ITS CORPORATE POWERS.

(CORPORATE SEAL) _____ (SIGNATURE) _____ (TITLE)

8. **EXECUTION FOR AND ON BEHALF OF THE GOVERNMENT**
THE UNITED STATES OF AMERICA

BY _____ _____ _____
(CONTRACTING OFFICER) (DATE) (WITNESS)

9. **NAVY IDENTIFICATION DATA**

NAME AND ADDRESS OF NAVAL ACTIVITY	LOCAL GOVERNMENT REPRESENTATIVE/ TITLE AND ADDRESS
Naval Air Station, Oceana Virginia Beach, Virginia	Commanding Officer, NAVFAC MIDLANT, Code OPHRRES 9324 Virginia Avenue Norfolk, Virginia 23511-3095
ADDRESS OF LESSEE 3030 Cedarville Road Chesapeake, VA 23322 Phone: 757-342-3336	

10. GENERAL PROVISIONS

A. REPRESENTATIONS

The property under this lease is provided as is, where is. The term "as-is, where is" means that the Government is leasing the subject property in whatever condition it presently exists, and that the lessee is accepting the subject property with all faults, whether or not they could be ascertained by an inspection of the property or review of any due diligence material available. LESSEE has examined, knows and accepts the condition and state of repair of the Premises and all appurtenances thereto and acknowledges that the Government has made no representation concerning such condition and state of repair, nor any agreement or promise to alter, improve, adapt, repair or keep in repair such Premises and appurtenances, or any item thereof, which has not been fully set forth on this lease which contains all the agreements made and entered into between Lessee and the Government.

B. PROHIBITION OF FEDERAL SUBSIDY PARTICIPATION

Notwithstanding the uses permitted to it in Article 4 of this lease, Lessee shall at no time during the term of this lease, or any extension thereof, use the Premises or its interest therein in any manner which shall constitute direct participation in any subsidy program of the Federal Government relative to either the use or abstention from use of the Premises.

C. SUBJECTION TO GOVERNMENT SOIL & WATER CONSERVATION PLAN

During the term of this lease the Lessee shall apply the conservation measures and use the Premises in accordance with the conservation plan attached hereto and made a part hereof. Lessee shall in no manner substantially change the contour or condition of the land constituting any part of the Premises except for such changes as shall be reasonably required to effect soil and water conservation measures. (Soil and Water Conservation Plan is attached as Exhibit "A")

D. INSTALLATIONS AND REMOVALS

Subject to the prior written approval of the Government, Lessee shall have the right to erect, at its own expense, such temporary structures on the Premises as may be necessary or incidental to its use under this lease. All such structures shall remain the property of Lessee and Lessee shall remove any erected structures from the Premises prior to the expiration of the term of this lease. In the event the Government terminates this lease, Lessee shall be given thirty (30) days to accomplish such removal. All property not so removed shall be deemed abandoned by Lessee and may be used or disposed of by the Government in any manner whatsoever without any liability to account to the Government. Any such abandonment shall not reduce Lessee's obligation to restore the Premises.

E. SUBJECTION TO EXISTING AND FUTURE EASEMENTS AND RIGHTS-OF-WAY

This lease is subject to all outstanding easements and rights of way for location of any type of facility over, across, in and upon the Premises. In addition, the Government reserves the right to grant such additional easements as it shall determine to be in the public interest. The Government also reserves all mineral rights in the Premises, together with such rights of access and use of the surface as may be necessary for the mining and saving of any mineral deposits located thereon or thereunder. The Government reserves the right to allow ingress and egress to workers officially engaged in the construction, installation, maintenance, operation, repair or replacement of facilities located thereon, and to any Federal, State or local officials.

F. RESTORATION OF PREMISES

Before the expiration of this lease or the prior termination thereof, Lessee shall, if required to do so by the Government, restore the Premises to the condition existing at the time of its entrance thereon under this lease, or to such improved condition as they may have been placed in by the Government or the Lessee during the term of this lease, reasonable wear and tear and damage by the elements or from other causes over which Lessee had no control excepted; *Provided,* in the event the Government shall terminate this lease upon less than thirty (30) days notice Lessee shall have thirty (30) days from receipt of notice of termination to accomplish such restoration.

G. LIENS

Lessee shall promptly discharge or cause to be discharged any valid lien, *right in rem*, claim or demand of any kind, except one in favor of the

Government, which at any time may arise or exist with respect to the Premises or materials or equipment furnished therefor, or any part thereof, and if the same shall not be promptly discharged by Lessee, the Government may discharge, or cause to be discharged, the same at the expense of the Lessee.

H. TERMINATION BY GOVERNMENT

The Government shall have the right to terminate this lease, in whole or in part, at any time, without prior notice, and regardless of any lack of breach by Lessee of any of the terms and conditions of this lease. In the event of termination for any reason not involving a breach by Lessee of the terms and conditions of the lease the Government shall make an equitable adjustment of any advance rentals paid by Lessee hereunder and, if the Government's use of the Premises does not require immediate possession thereof, Lessee shall be permitted, within such time as the Local Government Representative shall prescribe, to harvest, gather and remove from the Premises such crops as can be so harvested and removed, but if the Government's requirements necessitate immediate repossession of the Premises, so as to require immediate removal of Lessee's livestock, and/or, to preclude Lessee from such harvesting and removal of any growing or matured crops, Lessee hereby specifically releases, remises, and forever discharges the Government from any and all liability or claims for loss or damage of any nature arising out of such termination and repossession, including, but not limited to, destruction of diminution in value of, or inability to harvest any growing crops, and/or death or diminution of value of any livestock of Lessee.

In the event that the Government shall elect to terminate this lease on account of the breach by the Lessee of any of the terms and conditions hereof no adjustment in advance rentals paid by Lessee shall be made, and the Government shall be entitled to recover and Lessee shall pay to the Government:

(1) The costs incurred in resuming possession of the Premises.

(2) The costs incurred in performing any obligation on the part of Lessee to be performed hereunder.

(3) An amount equal to the aggregate of all rents and charges assumed hereunder and not theretofore paid, less the net rentals, if any, collected by the Government on the re-letting of the Premises, which amounts shall be due and payable at the time when the rent reserved under this lease would become due and payable.

The Government may, at its option, attach any livestock or crops of Lessee on the Premises in full or partial satisfaction of Lessee's obligations under this Article.

I. SURRENDER

Upon the expiration of this lease or its prior termination, in whole or in part, Lessee shall quietly, and peacefully remove itself and its property from the Premises, or part thereof as to which this lease shall be terminated, and surrender the possession thereof to the Government. Upon failure or neglect of Lessee to so remove, the Government and its officers or agents may enter the Premises and cause the removal of all persons and property therefrom without recourse to any action or proceeding at law or in equity. Lessee hereby expressly waives any provision of law requiring notice to quit possession of the Premises. Such removal shall be at the sole cost and expense of Lessee and Lessee shall indemnify and save and hold harmless the Government, its officer, agents and employees for and from any and all liability or claims for damages of any nature whatsoever which may arise out of or be attributable to such removal.

J. DAMAGE TO GOVERNMENT PROPERTY

In the event of the destruction of or damage to any Government property located on or adjacent to the Premises by Lessee, or any of its officers, agents, servants, employees, subtenants, licensee or invitees, Lessee shall promptly repair or replace such property to the satisfaction of the Government, or pay to the Government an amount of money sufficient to compensate it for the loss or damage sustained, as the Government shall elect.

K. NON-LIABILITY OF GOVERNMENT

Lessee covenants that it will indemnify and save and hold harmless the Government, its officers, agents and employees for and from any and all liability or claims for loss of or damage to any property owned by or in the custody of Lessee, its officers, agents, servants, employees, subtenants, licensees or invitees, or for the death of or injury to any of the same which may arise out of or be attributable to the condition, state of repair or Lessee's use and occupancy of the Premises, or the furnishings of any utilities or services (including supply of water from wells or other sources), or any interruption therein or failure thereof, whether or not the same shall be occasioned by the negligence or

lack of diligence of Lessee, its officers, agents, servants or employees.

L. UTILITIES AND SERVICES

In the event that the Government shall furnish Lessee with any utilities and services maintained by the Government which Lessee may require in connection with its use of the Premises, Lessee shall pay the Government the charges therefor in addition to the cash rent required under this lease. Such charges and the method of payment thereof shall be determined by the Local Government Representative in accordance with applicable laws and regulations, on such basis as the Local Government Representative may establish which may include a requirement for the installation of adequate connecting and metering equipment at the sole cost and expense of Lessee. It is expressly agreed and understood that the Government in no way warrants the continued maintenance or adequacy of any utilities or services furnished by it to Lessee.

M. ACCESS

The Government shall have access to the Premises at all reasonable times for any purposes not inconsistent with the quiet use and enjoyment thereof by Lessee, including, but not limited to, the purpose of inspection.

N. COVENANT AGAINST CONTINGENT FEES

Lessee warrants that no person or agency has been employed or retained to solicit or secure this lease upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, excepting bona fide employees or bona fide established commercial agencies maintained by Lessee for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this lease without liability or in its discretion to require Lessee to pay, in addition to the rental or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

O. STATE AND LOCAL TAXES

In the event that as a result of any future Act of Congress, subjecting Government-owned property to taxation, any taxes, assessments or similar charges are imposed by State or local authorities upon the Premises (other than upon Lessee's possessory interest therein), Lessee shall pay the same when due and payable and this lease shall be renegotiated so as to accomplish an equitable reduction in the rental provided for herein, which reduction shall in no event exceed the amount of such taxes, assessments, or similar charges; *Provided,* in event the parties hereto are unable to agree within ninety (90) days from the date of the imposition of such taxes, assessments, or similar charges, upon a rental which in the opinion of the Local Government Representative constitutes a reasonable return to the Government on the Premises, then in such event the Local Government Representative shall have the right to determine the amount of the rental, which determination shall be binding on Lessee, subject to appeal as a dispute in accordance with the provisions of paragraph P of this Article 10.

P. DISPUTES

1.1 This lease is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613) (the Act).

1.2 Except as provided in the Act, all disputes arising under or relating to this lease shall be resolved under this clause.

1.3 "Claim," as used in this clause, means a written demand or written assertion by the Lessee or the Government seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of lease terms, or other relief arising under or relating to this lease. A claim arising under this lease, unlike a claim relating to this lease, is a claim that can be resolved under a lease clause that provides for the relief sought by the claimant. However, a written demand or written assertion by the Lessee seeking the payment of money exceeding $100,000 is not a claim under the Act until certified as required by subparagraph 1.4(2) below. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

1.4(1) A claim by the Lessee shall be made in writing and submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, for a written decision. A claim by the Government against the Lessee shall be subject to a written decision by the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

1.4(2)(a)The Lessee shall provide the certification specified in subparagraph 1.4(2)(c) of this clause when submitting any claim ---

(A) Exceeding $100,000; or

(B) Regardless of the amount claimed, when using--

(1) Arbitration conducted pursuant to 5 U.S.C. 575-580; or

(2) Any other alternative means of dispute resolution (ADR) technique that the agency elects to handle in accordance with the Administrative Dispute Resolution Act (ADRA).

1.4(2)(b) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.

1.4(2)(c)The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Lessee believes the Government liable; and that I am duly authorized to certify the claim on behalf of the Lessee."

1.4(3) The certification may be executed by any person duly authorized to bind the Lessee with respect to the claim.

1.5 For Lessee claim of $100,000 or less, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, if requested in writing by the Lessee, render a decision within sixty (60) days of the request. For Lessee-certified claims over $100,000, the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, must, within sixty (60) days, decide the claim or notify the Lessee of the date by which the decision will be made.

1.6 The Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, decision shall be final unless the Lessee appeals or files a suit as provided in the Act.

1.7 At the time a claim by the Lessee is submitted to the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, or a claim by the Government is presented to the Lessee, the parties, by mutual consent, may agree to use ADR. When using arbitration conducted pursuant to 5 U.S.C. 575-580, or when using any other ADR technique that the agency elects to handle in accordance with the ADRA, any claim, regardless of amount, shall be accompanied by the certification described in paragraph 1.4(2)(c) of this clause, and executed in accordance with paragraph 1.4(3) of this clause.

1.8 The Government shall pay interest on the amount found due and unpaid by the Government from (1) the date the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim (properly certified if required), or (2) the date of payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in FAR 33.201, interest shall be paid from the date that the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury, as provided in the Act, which is applicable to the period during which the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic, receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.

1.9 The Lessee shall proceed diligently with the performance of the lease, pending, final resolution of any request for relief, claim, appeal, or action arising under the lease, and comply with any decision of the Commanding Officer, Naval Facilities Engineering Command, Mid-Atlantic.

Q. OFFICIALS NOT TO BENEFIT

No Member of or Delegate to Congress, or Resident Commissioner, shall be admitted to any share of part of this lease, or to any benefit to arise therefrom but this provision shall not be construed to extend to this lease if made with a corporation for its general benefit.

R. LABOR PROVISION

(1) Equal Opportunity

During the term of this lease the Lessee agrees as follows:

(a) The Lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Lessee will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their

race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer, recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; selection for training, including apprenticeship. The Lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Government setting forth the provisions of this nondiscrimination clause.

(b) The Lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(c) The Lessee will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding a notice to be provided by the Government, advising the labor union or worker's representative of the Lessee's commitments under this Equal Opportunity clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Lessee will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Lessee will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor or pursuant thereto, and will permit access to his books, records, and accounts by the Government and the Secretary of Labor for purposes of investigating to ascertain compliance with such rules, regulations and orders.

(f) In the event of the Lessee's noncompliance with the Equal Opportunity clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the Lessee may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Lessee will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each sublessee or vendor. The Lessee will take such action with respect to any sublessee or purchase order as the Government may direct as a means of enforcing such provisions including sanctions for noncompliance: *Provided, however,* that in the event the Lessee becomes involved in, or is threatened with, litigation with sublessee or vendor as a result of such direction by the Government, the Lessee may request the United States to enter into such litigation to protect the interests of the United States.

(2) Convict Labor

In connection with the performance of work required by this lease, Lessee agrees not to employ any person undergoing a sentence of imprisonment at hard labor.

(3) Contract Work Hours Standards Act (40 U.S. Code 327-330)

This lease, to the extent that it is a contract of a character specified in the Contract Work Hours Standards Act (40 U.S.C. 327-330) and is not covered by the Walsh-Healy Public Contracts Act (41 U.S.C. 35-45), is subject to the following provisions and exceptions of said Contract Work Hours Standards Act and to all other provisions and exceptions of said law:

(a) The Lessee shall not require or permit any laborer or mechanic in any workweek in which he is employed on any work under this contract to work in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek on work subject to the provisions of the Contract Work Hours Standards Act unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all such hours worked in excess of 8 hours in any calendar day or in excess of 40 hours in such workweek, whichever is the greater number of overtime hours. The "basic rate of pay," as used in this clause, shall be the amount paid per hour, exclusive of the Lessee's contribution or cost for fringe benefits and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained in the wage determination, whichever is greater.

(b) In the event of any violation of the provisions of paragraph (a), the Lessee shall be liable to any affected employee for any amounts due and to the United States for liquidated damages. Such

liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions of paragraph (a) in the sum of $10 for each calendar day on which such employee was required or permitted to be employed on such work in excess of 8 hours or in excess of the standard workweek of 40 hours without payment of the overtime wages required by paragraph (a).

S. NOTICES

No notice, order, direction, determination, requirement, consent, or approval under this lease shall be of any effect unless in writing. All notices required under this lease shall be addressed to Lessee, or to the Local Government Representative, as may be appropriate, at the address thereof specified in Article 9 of this lease or at such other address as may from time to time be agreed upon by the parties hereto.

T. FAILURE OF GOVERNMENT TO INSIST ON COMPLIANCE

The failure of the Government to insist, in any one or more instances, upon performances of any of the terms, covenants or conditions of this lease shall not be construed as a waiver or relinquishment of the Government's right to the future performance of any such terms, covenants or conditions and Lessee's obligations in respect to such future performance shall continue in full force and effect.

U. ASSIGNMENT OR SUBLETTING

Lessee shall not transfer or assign this lease or any interest therein nor sublet or otherwise make available to any third party or parties any portion of the Premises or rights therein without prior written consent of the Government. Under any assignment made, with or without consent, the assignee shall be deemed to have assumed all the obligations of Lessee hereunder, but no assignment shall relieve the assignor of any of Lessee's obligations hereunder except for an extension of the lease term beginning after such assignment, and then only if the Government shall have consented thereto.

V. GOVERNMENT RULES AND REGULATIONS

Lessee shall comply with such rules and regulations regarding station security, ingress, egress, safety and sanitation as may be prescribed, from time to time, by the Local Government Representative, or by the Commanding Officer of the Naval activity of which the Premises forms a part.

W. PAYMENTS

All payments to the Government required under this lease shall be made by check or postal money order made payable to the U.S. Treasurer and mailed to Commander Naval Facilities Engineering Command, Atlantic, Attn: FM, 6506 Hampton Blvd., Norfolk, VA 23508.

X. INTEREST

Notwithstanding any other provision of this lease, unless paid within thirty (30) days, all amounts that become payable by the Lessee to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code) shall bear interest from the date due until paid and shall be subject to adjustments as provided by Part 6 of Appendix E of the Armed Services Procurement Regulation, as in effect on the date of this lease. The interest rate per annum shall be the interest rate in effect which has been established by the Secretary of the Treasury pursuant to Public Law 92-41; 85 STAT 97 for the Renegotiation Board, as of the date the amount becomes due as herein provided. Amounts shall be due upon the earliest one of (i) the date fixed pursuant to this contract; (ii) the date of the first written demand for payment, consistent with this lease, including demand consequent upon default termination; or (iii) the date of transmittal by the Government to the Lessee of a proposed supplemental agreement to confirm completed negotiations fixing the amount.

Y. ADMINISTRATION

The local Government Representative specified in Article 9 of this lease shall, under the direction of the Commander, Naval Facilities Engineering Command, Mid-Atlantic, have complete charge of the administration of this lease, and shall exercise full supervision and general direction thereof insofar as the interest of the Department are affected.

Z. INDEMNIFICATION

The Lessee accepts responsibility for all liability related to, or arising under, Lessee's use of the property. Further, Lessee shall release and hold harmless the Government, its officers, agents, and employees from all liability, suits, claims, actions, or demands in any way related to, or arising under, Lessee's use of the property. This includes, but is not limited to, all environmental suits, claims, and enforcement actions, arising during Lessee's construction on, or use of, the property, or after such construction, or use, has ended. Further, Lessee shall reimburse the Government for all expenditures incurred if the Government voluntarily chooses to undertake any remedial action to address contamination on the premises or facilities resulting from the acts or omissions of the Lessee.

11. SPECIAL PROVISIONS

The following specified additional provisions, which shall control in the event of any conflict with the General Provisions of Article 10, are hereby incorporated into this lease by attachment hereto.

A. RESTRICTIONS:

a. No substance shall be released into the air from the leased lands that could impair visibility including, without limitation, emissions such as steam, dust and smoke.

b. No lights shall be constructed, maintained, directed or allowed to shine from the said leased lands, which could interfere with or impair pilot vision. All light emissions must be shielded to prevent them from being used as geographic reference pints by aircraft personnel.

c. No electrical emissions shall be emitted from sources situated on said leased lands which could interfere in any way with aircraft communications systems, ordnance or navigational equipment now in existence or hereinafter invented.

d. No garbage shall be dumped or placed and no feeding stations or other facilities attractive to birds shall be constructed or maintained on said leased lands. All trash, debris and empty pesticide containers shall be removed from Government property and properly disposed of each day at Lessee's expense.

e. Relic hunting, or antique hunting or recovery is prohibited.

f. Aerial crop dusting, unless specifically authorized by permit, is prohibited

g. Hunting on the leased land is permitted. The Station is responsible for coordinating the hunting program with the Lessee. Excessive damage by these activities must be reported immediately to the Naval Air Station, Oceana, Natural Resources Specialist at (757) 433-3461.

h. A cultivation regimen of cutting, no-till seed drilling and discing to a depth no greater than 16 cm (6.4 inches) below the surface shall be followed.

B. REIMBURSABLE WORK

If at any time during the lease it is determined that work not identified in the Soil and Water Conservation Plan, as Non-Reimbursable work is necessary, the procedures below will be followed:

The NAVFAC Mid-Atlantic Natural Resource Specialist will prepare a Scope of Work and Government Cost Estimate. Scope of Work will include what work is to be done and identify how or what method should be used to complete the work. It will also include a time schedule in which the work must be completed.

The NAVFAC Mid-Atlantic Natural Resource Specialist will forward the Scope of Work and Government Cost Estimate to the Real Estate Contracting Officer.

The Real Estate Contracting Officer will forward the Scope of Work to the Lessee and request a cost proposal.

The Lessee will send a cost proposal to the Real Estate Contracting Officer. This proposal may be based on Lessee having a third party perform the work. The Lessee may at this time inform the Government that he is incapable of performing the work.

If the Lessee submits a proposal and is acceptable, the Real Estate Contracting Officer will either; (1) issue a letter of authorization to proceed, advising a modification to the lease will be forthcoming or (2) forward a modification to the Lessee reflecting changes. Work should not begin until a letter or authorization or a modification has been received.

If the proposal is unacceptable, the Government will negotiate with the Lessee or determine alternative means of completing the required work.

When work is completed, Lessee and Navy Representatives will perform a joint inspection. If work is acceptable and within the time frame allotted, terms of the modification will be activated; i.e., rent reduction granted.

If it is determined during a joint inspection that the work was not completed properly or done within the required time frame, the Navy may, at its option, allow the Lessee additional time, not to exceed 25% of original time allotted, to complete the work or the Navy will have the work completed and charge the Lessee.

C. ENVIRONMENTAL/INDEMNIFICATION

In accordance with 10 U.S.C. 2692, the Lessee may not allow the treatment, storage or disposal of any Toxic or Hazardous materials on the leased premises. For the purposes of this provision, the terms "storage" and "Toxic or Hazardous Materials" are defined as provided in 48 CFR 252.223-7006.

The Lessee will reimburse the Lessor for all expenditures incurred if the Lessor is required by any regulatory authority or voluntarily chooses to undertake any Remedial Action to address Contamination on the leased premises resulting from the acts or omissions of the Lessee or its contractors. The Lessor shall contact the Lessee before taking any Remedial Action and give the Lessee a reasonable opportunity to undertake such Remedial Action if the Lessor believes that the Lessee has the capability to do so. Notwithstanding the above, the Lessee may immediately take any Remedial Action required of the Lessee by law.

During the term of this Lease, if the Lessee becomes aware that a Release of Toxic or Hazardous Materials has occurred that has resulted in Contamination of the leased premises, the Lessee will provide oral notice to the Lessor within 24 hours of becoming aware of such Contamination, providing all relevant facts and circumstances. The Lessor may request from the Lessee a more detailed written description of these facts and circumstances within a time period specified by the Lessor. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws relating to such Release, including reporting the occurrence to the appropriate Federal, State, or local regulatory authority or taking required Remedial Action, related to addressing the Contamination and to minimize the impacts of such Release. The Lessee will provide all information requested by the Lessor regarding such actions.

The Lessee, at its sole expense, will promptly take all action necessary to comply with Applicable Environmental Laws pertaining to a Release described in the preceding paragraph, including but not limited to: one, report the occurrence to appropriate Federal, State, or local regulatory authorities, if so directed by the Government; tow, take timely and effective steps to minimize the Release and its impact on human health and the environment; and three, take Remedial Action. The Government may direct the Lessee to provide all information requested by the Government regarding such actions within a time certain.

During the term of this Lease, the Lessee will ensure that all activities conducted by the Lessee or its contractors on the leased premises are carried out in compliance with Applicable Environmental Laws. The Lessee will provide oral notice to the Lessor within 24 hours of receiving any complaint, order, directive, claim, citation, or notice by any Governmental authority or any other person or entity with respect to a violation of Applicable Environmental Laws resulting from the activities of the Lessee or its contractors on the leased premises. The Lessee will promptly take all actions, at its sole expense, as are necessary to comply with all Applicable Environmental Laws as directed by any Federal, State, or local regulatory authority. The Lessor may request a more detailed written description of the events or circumstances leading to this event within a time specified by the Lessor. Without limitation of the foregoing, the Lessor may, but will not be obligated to, enter onto the leased premises and take any Remedial Action as it deems necessary or advisable to address any Contamination of the leased premises by Toxic or Hazardous Materials or to ensure compliance with Applicable Environmental Laws.

At any time, the Lessor or its representatives may conduct inspections on the leased premises to ensure compliance with Applicable Environmental Laws. To assist in this evaluation, the Lessee will provide to the Lessor or the Lessor's representative, any and all books, records, or documents in their possession, or in the possession of their agents or contractors, related to the activities or operations on the leased premises, which the Lessor or its representatives may examine, copy, or make extracts from.

As the Lessor deems appropriate, the Lessor may require that the Lessee, from time to time, promptly conduct such tests and procedures for the purpose of ensuring that the leased premises are in compliance with Applicable Environmental Laws and of having the leased premises certified to the Lessor as such. Such tests and procedures shall be conducted by recognized professionals to be approved by the Lessor and in a manner that is satisfactory to the Lessor. When requesting such tests and procedures, the Lessor will work with the Lessee to establish accepted timeframes, appropriate parties to perform the required activities, and schedules for performance. If an agreement cannot be reached regarding any of the foregoing, the Lessor or its representatives may undertake such tests and procedures, with the Lessee being obligated to reimburse the Lessor for all costs incurred.

For the purposes of this provision, the terms used above are defined as follows:

"Toxic or Hazardous Materials" means any hazardous, harmful, odorous, radioactive, toxic or dangerous waste, substance or material, including, without limitation, asbestos, polychlorinated biphenyls ("PCBs") and petroleum products, and any hazardous or toxic substance, material or waste, or any pollutant or contaminant defined as such in, or for the purposes of, any environmental laws as are now or in the future may be in effect. The Lessee's obligation under this provision shall extend to any and all such Toxic or Hazardous Materials whether or not such substance was defined, recognized, known, or suspected of being hazardous, toxic, dangerous, or wasteful at the time of any act or omission giving rise to the Lessee's obligation.

"Contamination" means a level of Toxic or Hazardous Materials in the air, in or on soil, in the surfacewater, or in the groundwater that exceeds levels allowed by Applicable Environmental Laws.

"Applicable Environmental Laws" means:

one, any Federal, State, or local statute, law, ordinance, rule, regulation, or order (whether voluntary or not) that govern the activities or operations of the leased premises, or the persons carrying out those activities or operations, relating to the environment, natural resources, or human health and safety.

two, Executive Orders of the President of the United States;

three, decisions of courts and administrative tribunals of competent jurisdiction;

four, administrative orders of regulatory agencies of competent jurisdiction (involuntary or on consent); and

five, regulations and directives of the Department of Defense, the Department of the Navy, and the U.S. Marine Corps (for Marine Corps installations only),

which pertain to the human environment (as defined in the National Environmental Policy act of 1969); transportation of hazardous material; and human health and safety (including occupational safety).

Applicable Environmental Laws include, without limitation the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. § 9601 *et seq*.), the Hazardous Material Transportation Act (49 U.S.C. § 1801 *et seq*.), the Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq*.), the Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq*.), the Clean Air Act (42 U.S.C. § 7401 *et seq*.), the Toxic Substances Control Act (15 U.S.C. § 2601 *et seq*.), and the Occupational Safety and Health Act (29 U.S.C. § 651 *et seq*.), Superfund Amendments and Reauthorization Act Title III (SARA) Emergency Planning and Community Right-to-Know Act (EPCRA) reporting requirements (40 CFR 355, 40 CFR 370, 40 CFR 372 and 29 CFR 1910.1200), as such laws have been amended or supplemented now or in the future.

"Release" means any release, spill, emission, leaking, pumping, injection, deposit, disposal, leaching, or migration into the environment, whether accidental or otherwise, resulting from the act or omissions of the Lessee, its contractors, or by natural conditions.

"Remedial Action" means any investigation or monitoring of the condition of the leased premises or any cleanup, remedial, removal, or restoration work required or performed on the leased premises because of the presence, suspected presence, release, or suspected release of Toxic or Hazardous Materials.

The Lessor shall not be responsible for damages to property or injuries to persons which may arise from or be incident to the use and occupation of the leased premises by the Lessee, nor for damages to the property or injuries to the person of the Lessor's officers, agents, servants, or employees, or others who may be on the leased premises at their invitation or the invitation of any one of them arising from or incident to governmental activities except as permitted under the Federal Torts Claim Act, 28 U.S.C. 2671 et seq.

F. APPLICABLE STATE AND CITY LAWS, CODES, AND ORDINANCES

The Lessee agrees to comply with all applicable State and City laws, codes and ordinances applicable to use of the leased premises at Lessee's expense. Lessee further agrees to obtain all necessary permits and related items at Lessee's expense.

G. INSURANCE REQUIREMENTS

Prior to award of the Lease, the LESSEE shall submit a certificate of insurance meeting the following requirements. Public Liability and Property Damage shall meet the following requirements at a minimum:

$50,000	Third Party Property Damage
$500,000	Third Party Personal Injury Per Person
$1,000,000	Third Party Personal Injury Per Accident

The policy/certificate of insurance shall contain an endorsement reading as follows:

a. Loss, if any under this policy shall be adjusted with (name of LESSEE) and the proceeds, at the election of the GOVERNMENT, shall be payable to (name of LESSEE); any proceeds not paid to (name of LESSEE) shall be payable to the Treasurer of the United States of America.

b. The insurer waives any right of subrogation against the United States of America which might arise by reason of any payment made under this policy.

c. The GOVERNMENT shall be given thirty (30) days written notice prior to making any material change in or the cancellation of the policy. Please strike out (and initial) any clauses that state "…failure to make such notice imposes no obligation or liability of any kind upon the company, etc …"

d. The United States of America (Department of the Navy) is added as an additional insured in operations of the policyholder at or from the premises leased at Naval Auxiliary Landing Field, Fentress, Virginia, identified as Unit F2.

e. This insurance certificate is for use of premises known as **263.2 acres more or less, at Naval Auxiliary Landing Field, Fentress, Chesapeake, Virginia, identified as Unit F3, Contract number N40085-15-RP-00018 or LO10502**.

If, at any time, the GOVERNMENT determines that the insurance maintained by the LESSEE does not in fact adequately protect the GOVERNMENT, LESSEE may be required to carry such other insurance in such form, for such amounts and for such periods of time, and with such insurers as the GOVERNMENT may from time to time require or approve.

Enclosure 2 Soil and Water Conservation Plans

SOIL AND WATER CONSERVATION PLAN

Naval Air Station, Oceana
Virginia Beach, Virginia

Unit-O1
Farmable Area: 314.8 Acres
November 12, 2014

GENERAL INFORMATION

This Plan was prepared by **Mr. Emmett Carawan the Natural Resources Specialist at the Environmental Planning and Conservation Division, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC), Building Z-144, Room 214 Virginia Avenue, Norfolk, VA 23511 phone 757-341-0495.** Mr. Carawan will be the Government Representative of the Navy in administering the Soil and Water Conservation Plan.

The Real Estate Contracting Officer, Mr. Paul Moomaw, Hampton Roads IPT, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC) Norfolk, Virginia Telephone 757-341-1509 will be the Government Representative for the Navy in administering the lease.

Daily operational conflicts or problems can be resolved by calling the **NASO Natural Resources Specialist at 757-433-3461 or the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.**

The unit of land available for agriculture leasing is located on the eastern side of Naval Air Station Oceana, Virginia Beach, VA. The gross area of 314.8 acres includes access roads and drainage ditches. Net farmable area will be less than this. The farmable area is made up of five (5) non-contiguous parcels of land (Attachment "2").

Special Provisions

Current military use of the land is to provide buffer and peripheral areas to perform military air operations within an effective compatible use zone. **There is a strict prohibition of electronic interference with communications.**

The station requires that the lessee coordinate at least 72 hours prior to bringing equipment and/or chemicals onto the installation, with the NAS Oceana's Natural Resources Specialist at 757-433-3461.

In the event that the lessee experiences a delay or problem caused by the Navy, they must immediately notify the NAS Oceana Natural Resources Specialist to resolve the problem at 757-433-3461.

Hunting and horseback riding on leased lands is permitted. The Station is responsible for coordinating the programs with the lessee. Excessive damage caused by these activities must be reported immediately to the NAS Oceana Natural Resources Specialist 757-433-3461.

Farming operations are to be restricted to the production of corn, soybeans, small grains, cotton, or hay/silage crops. When agreeing to the terms and conditions of the agricultural lease, special attention shall be paid to crop selection and its underlying impacts to the Bird/Animal Strike Hazard (BASH) program.

The Commanding Officer of NAS Oceana requests that crop location and planting schedules be provided to the NAS Oceana Natural Resources Specialist 757-433-3461 and the AODO at Oceana_aodo_kntu@navy.mil **or 757-433-2161/3 to help mitigate hazards at least a few days in advance. These schedules should be provided within 72 hours of field preparation and planting each season.** Tilling of soil prior to planting should be conducted at night whenever possible to reduce the affinity of exposed ground and food sources for birds. When harvesting crops, spillage should be minimized and cleaned up promptly.

No deviation in land use or drainage improvements, as outlined in this plan, shall be permitted without prior written consent of the Real Estate Contracting Officer.

Under Article 10B of the Lease General Provisions, cultivation of federally subsidized crops on the leased land is prohibited.

The Lessee is required to park and load all farm equipment and vehicles within leased property boundaries.

All equipment should be clean (no visible soil, plant or animal material) prior to arrival on the installation to minimize and avoid the spread of non-native invasive species. It is recommended that all equipment after utilization on the installation also be cleaned prior to utilization on other properties. If equipment is being utilized on one Navy installation and is transported to another Navy installation it must be cleaned prior to use on the other Navy property.

Cultural Resources

A "Phase I" archaeological survey has been partially completed at NAS Oceana. This survey has identified prehistoric and historic sites on the Station; many of these sites are found within the agricultural units. To alleviate any potential destruction of these sites the State Historic Preservation Officer (SHPO) recommends that the only ground-disturbing activity permitted will be the ongoing agricultural cultivation practices and be limited to the current plow zone. If the lessee anticipates a problem which would cause him to deviate from his current cultivation practices he shall notify Mr. Emmett Carawan, Government Representative at NAVFAC MID-ATLANTIC 757-341-0495.

Conservation Inventory

Approximately 200 acres of the lease area are designated resource management areas under the Chesapeake Bay Preservation Act. The "Act" which became effective on January 1, 1995, requires a Nutrient Management Plan be approved by the local Soil and Water Conservation District. The State Soil Conservation Service will develop this Plan for the Lessee. The Nutrient Management Plan will become part of this Soil and Water Conservation Plan when it is furnished to the NAVFAC MID-ATLANTIC Natural Resource Specialist, Mr. Emmett Carawan at 757-341-0495. The remaining acreage is within the southern or owl's creek watersheds.

The 314.8 acres are considered a single farming unit. The land is wet and requires drainage. The land capability is Class IIIW for soil type 71 Acredale silt loam. The land capability is Class III when properly drained. Open ditch drainage is required to assure production.

Conservation Practices

All conservation practices shall be performed in accordance with standard specifications of the USDA **Natural Resources Conservation Service (NRCS)**. The Lessee shall utilize the technical services of the local Field Office located at the Municipal Center, Chesapeake, Virginia, in the design, layout, construction, and supervision of the conservation practices performed. All improvements shall become the property of the government at the expiration of the lease.

Soil fertility shall be maintained at the optimum level for the crops that are to be grown. USDA NRCS should be notified if nutrient deficiencies arise and resolved in accordance with their recommendations. USDA NRCS or the Virginia Tech Extension Service can assist in making fertilizer and lime recommendations that will be sufficient to maintain adequate pH levels and soil fertility.

Permission is granted to the lessee to take advantage of Hampton Roads Sanitation Division's Bio Solid disposal program. Coordination of this program shall be made **30 days prior** to application with the NAVFAC MID-ATLANTIC and NAS Oceana Natural Resource Specialists.

Herbicides/Pesticides

Pesticides to be used by the Lessee must be coordinated and approved by Mr. Jack Markham 757-322-4882 at NAVFAC Atlantic's Applied Biology Section, within 30 days of award of the lease. Pesticide requirements are found in Attachments 3, 4 and 5 of this Plan. The pesticide approval submission form must include product labels and Material Safety Data Sheets (MSDSs) when submitted to NAVFAC Atlantic's Applied Biology Section, (Address and phone number is located in the Government Offices section of this Soil & Water Conservation Plan). Actual application of herbicides / pesticides shall be reported quarterly on the Pesticide Application Record keeping form. The quarterly report shall be submitted to Mr. Markham, no later than 15 April, 15 July, 15 October, and 15 December, of each crop year.

Application of pesticides will conform to the Environmental Protection Agencies "Worker protection standards" as stated on the Pesticide label.

Mixing of pesticides is allowed on site if the lessee uses spill containment equipment. Storing of pesticides on site is not allowed.

The Lessee shall report all farm chemical spills, leaks or releases to NAS Oceana via the emergency coordination number at 757-433-9111 and to the NAS Oceana's Natural Resources Specialist at 757-433-3461.

If the Lessee finds it necessary to apply pesticides by aerial application of pesticides, the Lessee must have approval of NAVFAC Atlantics Applied Biologist at 757-322-4882 and the NAS Oceana's Natural Resources Specialist at 757-433-3461, 72 hours in advance of the anticipated spray application. This approval / notification must be direct contact and not voice mail message. Notification shall include POC for the Crop Dusting pilot, date, time and location of the spray application.

The pilot of the crop dusting aircraft shall contact the NAS Oceana Air Operations Duty Officer (757-433-2163) prior to takeoff to update ETA and location, and coordinate with Air Traffic Control (757-433-3471).

The Pilot shall contact the NTU Tower prior to entering the Class Delta airspace and receive clearance to begin the spray operations.

The Air Operations Officer will determine whether or not to cancel or reschedule the operation.

The control and/or eradication of Federal and State listed noxious weeds, particularly **Johnsongrass,** *Sorghum haleplense*, is required. Any pesticides and herbicides used for insect, disease, or weed control shall be approved and registered by the Environmental Protection Agency for the crops being grown.

The lessee is responsible for removal of all debris, refuse, garbage, pesticide containers, and unused residue of farm operations from the leased area and the Installation. The Lessee is encouraged to use the City of Chesapeake's pesticide container recycling program (see back of pesticide form for information).

Additional requirements for pesticide use on the property are provided in Attachment 3, Pesticide Mixing, Storage and Use on Navy-Owned Property Leased for Agricultural Purposes.

Conservation Requirements

Non-Reimbursable work

Soil and water conservation goals on this property include control of surface run-off and concurrent reduction in soil erosion, sedimentation and nutrient loading. The following measures will achieve these goals and are the responsibility of the lessee:

1. A conservation cropping system shall be established to include minimum tillage.

2. Maintenance of ditches and culverts is the responsibility of the lessee (subject to inspection at any time during the term of the lease) and shall include the following:

a. Mowing of ditch banks is required every other year of the lease. Mowing must be completed by 31 December. If this poses a problem for the lessee, he should notify the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.

b. **No-tilled strips/Vegetation buffer strips, a minimum of three (3) feet wide, shall be maintained along edges of ditch banks to prevent soil sloughing into ditches, and to serve as erosion control filter strips. Width of no-tilled strips will be strictly enforced. Width of no-tilled strips are measured from the top of the ditch bank and away from the ditch, towards the crop. Lessee shall avoid " scalping" ditch banks to avoid eroding ditch banks.**

c. Boundary ditches are considered lease area to the ditch center-line.

3. Any acreage not cropped shall be seeded to a cover crop of hay or silage for protection and erosion control. If land is left fallow crop residue shall be left on the soil surface as a winter cover to provide mulch and soil improvement until seedbed preparation the following spring. Minimum tillage practices are encouraged.

Yearly inspections by the Government Representatives of the Navy in administering the Soil and Water Conservation Plan will ensure compliance with these conditions and other environmental requirements.

Reimbursable Work

During the term of this lease, it is anticipated that reimbursable work will be requested. The reimbursable work will be based on a scope of work furnished by the Government. The Lessee will be requested to provide an estimate for the work based on the scope of work. If the Lessee decides not to do the work himself, he may contract with a third party to do so (to be approved by the Real Estate Contracting Officer), or inform the Government that he is not capable of performing the work.

If the proposal is acceptable the Real Estate Contracting Officer will either; (1) issue a letter of authorization to begin work or (2) will forward a lease modification to the lease authorizing the work. Work should not begin until the letter of authorization or lease modification has been received.

When work is completed, a joint inspection will be performed by the Lessee and Navy representatives. If the work is complete and acceptable, terms of the letter or modification will be activated (i.e., rent reduction granted).

GOVERNMENT OFFICES CONCERNED WITH THIS LEASE

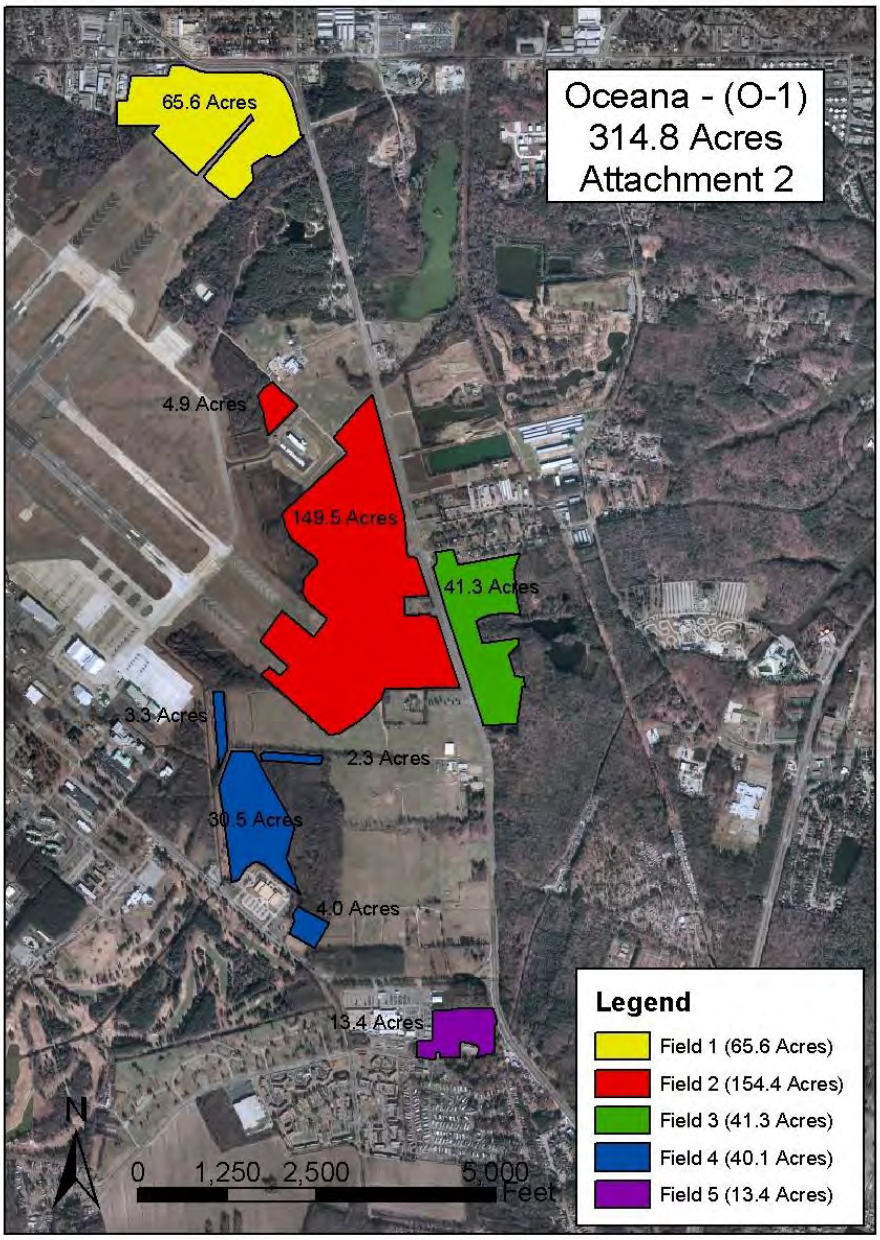
Mr. Jack Markham
Code EV51
NAVFAC Atlantic
6506 Hampton, Blvd.
Norfolk, VA 23508-1278
(757) 322-4882

Ms. Michael Wright
NASO Oceana
953 Hornet Drive
Building 820
Virginia Beach, VA 23460-2273
(757) 433-3461

Mr Paul Moomaw
Real Estate Contracting Officer
Naval Facilities Engineering Command
Mid-Atlantic
Virginia and Taussig Ave
Norfolk, VA 23511-2699
(757) 341-1509

Mr. Emmett Carawan
Natural Resources Specialist
NAVFAC Mid-Atlantic
Virginia and Taussig Ave.
Norfolk, VA 23511
757-341-0495

ATTACHMENT 2



ATTACHMENT 3

Pesticide Mixing, Storage, and Use
on
Navy-Owned Property
Leased for Agricultural Purposes

1. a. Certified Applicators Requirement

All pesticide applications shall be performed by a State-certified pesticide applicator. Private applicator's licenses are acceptable if the Lessee performs the work. Commercial grade license(s) are required if the Lessee hires (for fee) an application company to apply the pesticide(s). "Registered Technician" status is not considered "Commercial Grade" or "Private" pesticide applicator license grade. The pesticide applicator shall be certified in the category in which the work will be performed.

b. Integrated Pest Management

Integrated Pest Management (IPM) is a pest population management system that uses all suitable control techniques (chemical, biological, cultural, mechanical, or physical) to maintain pest populations at or below tolerable levels. Integrated Pest Management (IPM) techniques shall be used to the maximum extent practicable.

2. SUBMITTAL REQUIREMENTS

a. Business License

If a commercial applicator will apply pesticides (i.e. the Lessee does NOT have a private applicators license), the commercial applicator shall provide proof of a business license (as a pesticide application business) as required by the State of Virginia. A copy of this business license shall be forwarded to the Navy representative designated as responsible for oversight of the outlease before the pesticide application(s) are performed.

b. Certificate of Insurance

If a commercial applicator will apply pesticide(s), proof of Insurance as a pesticide applicator business shall be forwarded to the Navy representative designated as responsible for oversight of the outlease before the pesticide application(s) are performed.

c. Pesticide Approval

All pesticides must be approved within 30 days after award of lease. A list of the pesticide(s) proposed for use (by either a private and/or commercial applicator) shall be submitted to the designated Navy representative for approval before the pesticide application(s) are performed. The "Pesticides Approval Submission" form (attachment 2) shall be used. Any changes in pesticides to be used shall have prior approval before their use (Submittal for changes shall be on the pesticide approval form provided).

d. Pesticide Labels and Material Safety Data Sheets

Attached to the Pesticide Approval Form, submit legible copies of the pesticide label and material safety data sheets for each pesticide proposed for use.

e. Commercial Grade Pesticide Applicators Certificate(s) In the Appropriate Categories

Attached to the Pesticide Approval form, submit legible copies of State pesticide applicators certificate(s) in the appropriate applicator categories (the category in which the work will be performed).

f. Pesticide Label/MSDS Reference Book

The Lessee shall maintain a reference book of approved pesticide labels and Material Safety Data Sheets (MSDS), and have it readily available **ON-SITE** (in the truck or other vehicle that was used to arrive on site) whenever any pesticides are on site. The reference book shall be readily available for inspection.

g. Reporting Pesticide and Fertilizer Use

The Lessee shall report all pesticide and/or fertilizer use on the Pesticide Application Record Keeping Form (attached to the contract) and forward the form to the Navy representative designated as responsible for oversight of the outlease.

3. PESTICIDE APPLICATION AND CONTROL OPERATIONS

All pesticides must be used in accordance with Federal, state, local, and installation publications, and any requirements identified in attachments. All pesticides shall be procured, processed, handled, and applied in strict accordance with the manufacturer's label. All pesticides shall be registered with the U.S. Environmental Protection Agency and the cognizant State pesticide regulatory agency.

a. Pesticide Preparation and Use.

During preparation, and/or application of pesticides, the Contractor shall:

(1) Always store pesticides in original containers having EPA-registered labels or in containers meeting EPA label requirements; and
(2) Use application equipment appropriate for the nature and size of work, that is clean, calibrated, and in proper operational condition; and
(3) Never leave equipment unattended during filling and application/usage; and
(4) Use back flow preventers on hoses when connected to water outlets in filling operations, and
(5) Inspect equipment (per manufacturer's label) and the area during application to insure proper and safe treatment; and
(6) Keep safety equipment and spill kit available on site when pesticides are present.

b. Pesticide Mixing.

The Lessee shall mix pesticides on a portable containment device. The device shall be capable of containing the maximum amount of pesticide and diluent being mixed at one time.

c. Storage of Other Pesticides.

No other pesticides shall be stored overnight at the site. Any pesticide container and/or application tank shall be secured against theft and vandalism when the site is unattended during the day. Only those pesticides expected to be used that day should be imported to the site.

d. Pesticide Disposal.

The Lessee shall not dispose of any pesticides, pesticide containers, pesticide residue, pesticide rinse water, or any pesticide contaminated articles on government property.

e. Spill Management.

A pesticide spill containment kit shall be available on site if pesticides are being applied. The kit shall contain (at least) absorbent material capable of absorbing at least 25 gallons of liquid, rubber boots, rubber gloves, safety goggles, and a shovel.

f. **Safety Equipment.**

When pesticides are being mixed or applied, a portable eyewash station and at least 2 gallons of fresh water (in plastic jugs marked “emergency wash water”) shall be within 25 feet of the operation.

g. Pesticide Spills and Decontamination.

The Lessee is responsible for properly cleaning, decontaminating, and reporting pesticide spills to the Navy representative.

h. Pesticide Dispersal Equipment Markings.

All pesticide dispersal equipment shall be clearly and plainly marked with "DANGER"..."PESTICIDES".

4. SPECIFIC PESTICIDE USE PROVISIONS

a. The Lessee shall coordinate, 72 hours in advance, with the Navy representative designated as responsible for oversight of the outlease that pesticide(s) and/or application equipment will be brought onto the site.

b. All application of pesticides shall conform to the Worker Protection Standards CFR 170 as amended.
c. All pesticide applications shall conform to all label and supplemental labeling of the pesticide product.
d. All applicable laws and regulations regarding notification and posting shall be strictly adhered to.

5. HERBICIDE REQUIREMENTS

Only glyphosate herbicides may be used for bare ground vegetation management. Paraquat use is not permitted. Simizine or any simizine family herbicide use is not permitted. Selective herbicides may be approved for use. If lessee is growing cotton, specialty defoliant herbicides will be authorized through the normal approval process.

ATTACHMENT "4"

REPORTING REQUIREMENTS

Item # Description	Submit To	Date Required
1. Submit Pesticide Approval Form, Labels and MSDS Sheets 30 days after award of lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
2. Submit copies of current State Certification for all employees that will be applying pesticides, including those of contract Commercial Applicators 30 days after award of lease. Include copies of proof of insurance by Commercial Applicator.	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
3. Submit Soil Test and Nutrient Mgt. Plan 90 days after award of lease	Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist	90 days
4. Submit Pesticide Application Reporting Form (attachment 6) beginning April 1 of lease year continuing quarterly for the life of the lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	Quarterly
5. Pesticide Spill Report	Michael Wright, NAS Oceana Natural Resources Specialist Emergency Communication Center	Immediately
6. Approval of Aerial Pesticide application	Jack Markham, NAVFAC ATLANTIC Applied Biology Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist Michael Wright, NASO Natural Resources Specialist	72 Hrs prior

Send pesticide approval forms and reports to:
Commander
NAVFAC Atlantic
Attn: Mr. Jack Markham EV51
LRA Bldg A
6506 Hampton Blvd.
Norfolk, Virginia 23508-1278

ATTACHMENT 5

PESTICIDE APPROVAL SUBMISSION
(This list MUST be submitted and approval obtained
prior to initiation of work)

NOTES:
1. *LEGIBLE COPIES OF THE PESTICIDE LABEL AND MATERIAL SAFETY DATA SHEET FOR EACH PESTICIDE LISTED MUST BE ATTACHED.*
2. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA LICENSE AS AN APPLICATOR OF PESTICIDES MUST BE ATTACHED.*
3. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA COMMERCIAL GRADE CERTIFIED PESTICIDE APPLICATOR'S CERTIFICATE IN THE APPROPRIATE CATEGORY(S) MUST BE ATTACHED.*

PROPOSED PESTICIDE	**EPA REG.#**	**INTENDED USE** (EX: selective weed control, bare ground weed control etc.)	**INTENDED LOCATION** (EX: Area A, between rows, on crop etc.)

Note: Copy this form if you need more pages.

SOIL AND WATER CONSERVATION PLAN

Naval Air Station, Oceana
Virginia Beach, Virginia

Unit-O2
Farmable Area: 329.7 Acres
November 12, 2014

GENERAL INFORMATION

This Plan was prepared by **Mr. Emmett Carawan the Natural Resources Specialist at the Environmental Planning and Conservation Division, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC), Building Z-144, Room 214 Virginia Avenue, Norfolk, VA 23511 phone 757-341-0495.** Mr. Carawan will be the Government Representative of the Navy in administering the Soil and Water Conservation Plan.

The Real Estate Contracting Officer, Mr. Paul Moomaw, Hampton Roads IPT, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC) Norfolk, Virginia Telephone 757-341-1509 will be the Government Representative for the Navy in administering the lease.

Daily operational conflicts or problems can be resolved by calling the **NASO Natural Resources Specialist at 757-433-3461 or the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.**

The unit of land available for agriculture leasing is located on the southern and Western side of Naval Air Station Oceana, Virginia Beach, VA. The gross area of 329.7 acres includes access roads and drainage ditches. Net farmable area will be less than this. The farmable area is made up of five (5) non-contiguous parcels of land (Attachment "2").

Special Provisions

Current military use of the land is to provide buffer and peripheral areas to perform military air operations within an effective compatible use zone. **There is a strict prohibition of electronic interference with communications.**

The station requires that the lessee coordinate at least 72 hours prior to bringing equipment and/or chemicals onto the installation, with the NAS Oceana's Natural Resources Specialist at 757-433-3461.

In the event that the lessee experiences a delay or problem caused by the Navy, they must immediately notify the NAS Oceana Natural Resources Specialist to resolve the problem at 757-433-3461.

Hunting and horseback riding on the leased lands is permitted. The Station is responsible for coordinating the programs with the lessee. Excessive damage caused by these activities must be reported immediately to the NAS Oceana Natural Resources Specialist 757-433-3461.

Farming operations are to be restricted to the production of corn, soybeans, small grains, cotton, or hay/silage crops. When agreeing to the terms and conditions of the agricultural lease, special attention shall be paid to crop selection and its underlying impacts to the Bird/Animal Strike Hazard (BASH) program.

The Commanding Officer of NAS Oceana requests that crop location and planting schedules be provided to the NAS Oceana Natural Resources Specialist 757-433-3461 and the AODO at Oceana_aodo_kntu@navy.mil **or 757-433-2161/3 to help mitigate hazards at least a few days in advance. These schedules should be provided within 72 hours of field preparation and planting each season.** Tilling of soil prior to planting should be conducted at night whenever possible to reduce the affinity of exposed ground and food sources for birds. When harvesting crops, spillage should be minimized and cleaned up promptly.

No deviation in land use or drainage improvements, as outlined in this plan, shall be permitted without prior written consent of the **Real Estate Contracting Officer.**

The Lessee is required to park and load all farm equipment and vehicles within leased property boundaries.

All equipment should be clean (no visible soil, plant or animal material) prior to arrival on the installation to minimize and avoid the spread of non-native invasive species. It is recommended that all equipment after utilization on the installation also be cleaned prior to utilization on other properties. If equipment is being utilized on one Navy installation and is transported to another Navy installation it must be cleaned prior to use on the other Navy property.

Cultural Resources

A "Phase I" archaeological survey has been partially completed at NAS Oceana. This survey has identified prehistoric and historic sites on the Station; many of these sites are found within the agricultural units. To alleviate any potential destruction of these sites the State Historic Preservation Officer (SHPO) recommends that the only ground-disturbing activity permitted will be the ongoing agricultural cultivation practices and be limited to the current plow zone. If the lessee anticipates a problem which would cause him to deviate from his current cultivation practices he shall notify Mr. Emmett Carawan, Government Representative at NAVFAC MID-ATLANTIC 757-341-0495.

Conservation Inventory

Approximately 219.3 acres of the lease area are designated resource management areas under the Chesapeake Bay Preservation Act. The "Act" which became effective on January 1, 1995, requires a Nutrient Management Plan be approved by the local Soil and Water Conservation District for this acreage. The State Soil Conservation Service will develop this Plan for the Lessee. The Nutrient Management Plan will become part of this Soil and Water Conservation Plan when it is furnished to the NAVFAC MIDLANT Natural Resource Specialist, Mr. Emmett Carawan at 757-341-0495. The remaining acreage is within the southern watershed.

The 329.7 acres are considered a single farming unit. The land is wet and requires drainage. The land capability is Class IIIW for soil type 71 Acredale silt loam. The land capability is Class III when properly drained. Open ditch drainage is required to assure production.

Conservation Practices

All conservation practices shall be performed in accordance with standard specifications of the USDA **Natural Resources Conservation Service (NRCS)**. The Lessee shall utilize the technical services of the local Field Office located at the Municipal Center, Chesapeake, Virginia, in the design, layout, construction, and supervision of the conservation practices performed. All improvements shall become the property of the government at the expiration of the lease.

Soil fertility shall be maintained at the optimum level for the crops that are to be grown. USDA NRCS should be notified if nutrient deficiencies arise and resolved in accordance with their recommendations. USDA NRCS or the Virginia Tech Extension Service can assist in making fertilizer and lime recommendations that will be sufficient to maintain adequate pH levels and soil fertility.

Permission is granted to the lessee to take advantage of Hampton Roads Sanitation Division's Bio Solid disposal program. Coordination of this program shall be made **30 days prior** to application with the NAVFAC MID-ATLANTIC and NAS Oceana Natural Resource Specialists.

Herbicides/Pesticides

Pesticides to be used by the Lessee must be coordinated and approved by Mr. Jack Markham 322-4882 at NAVFAC Atlantic's Applied Biology Section, within 30 days of award of the lease. Pesticide requirements are found in Attachments 3, 4 and 5of this Plan. The pesticide approval submission form must include product labels and Material Safety Data Sheets (MSDSs) when submitted to NAVFAC Atlantic's Applied Biology Section, (Address and phone number is located in the Government Offices section of this Soil & Water Conservation Plan). Actual application of herbicides / pesticides shall be reported quarterly on the Pesticide Application Record keeping form. The quarterly report shall be submitted to Mr. Markham, no later than 15 April, 15 July, 15 October, and 15 December, of each crop year.

Application of pesticides will conform to the Environmental Protection Agencies "Worker protection standards" as stated on the Pesticide label.

Mixing of pesticides is allowed on site if the lessee uses spill containment equipment. Storing of pesticides on site is not allowed.

The Lessee shall report all farm chemical spills, leaks or releases to NAS Oceana via the emergency coordination number at 757-433-9111 and to the NAS Oceana's Natural Resources Specialist at 757-433-3461.

If the Lessee finds it necessary to apply pesticides by aerial application of pesticides, the Lessee must have approval of NAVFAC Atlantics Applied Biologist at 757-322-4882 and the NAS Oceana's Natural Resources Specialist at 757-433-3461, 72 hours in advance of the anticipated spray application. This approval / notification must be direct contact and not voice mail message. Notification shall include POC for the Crop Dusting pilot, date, time and location of the spray application.

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Additional requirements for pesticide use on the property are provided in Attachment 3, Pesticide Mixing, Storage and Use on Navy-Owned Property Leased for Agricultural Purposes.

Conservation Requirements

Non-Reimbursable work

Soil and water conservation goals on this property include control of surface run-off and concurrent reduction in soil erosion, sedimentation and nutrient loading. The following measures will achieve these goals and are the responsibility of the lessee:

1. A conservation cropping system shall be established to include minimum tillage.

2. Maintenance of ditches and culverts is the responsibility of the lessee (subject to inspection at any time during the term of the lease) and shall include the following:

a. Mowing of ditch banks is required every other year of the lease. Mowing must be completed by 31 December. If this poses a problem for the lessee, he should notify the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.

b. **No-tilled strips/Vegetation buffer strips, a minimum of three (3) feet wide, shall be maintained along edges of ditch banks to prevent soil sloughing into ditches, and to serve as erosion control filter strips. Width of no-tilled strips will be strictly enforced. Width of no-tilled strips are measured from the top of the ditch bank and away from the ditch, towards the crop. Lessee shall avoid " scalping" ditch banks to avoid eroding ditch banks.**

c. Boundary ditches are considered lease area to the ditch center-line.

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During the term of this lease, it is anticipated that reimbursable work will be requested. The reimbursable work will be based on a scope of work furnished by the Government. The Lessee will be requested to provide an estimate for the work based on the scope of work. If the Lessee decides not to do the work himself, he may contract with a third party to do so (to be approved by the Real Estate Contracting Officer), or inform the Government that he is not capable of performing the work.

If the proposal is acceptable the Real Estate Contracting Officer will either; (1) issue a letter of authorization to begin work or (2) will forward a lease modification to the lease authorizing the work. Work should not begin until the letter of authorization or lease modification has been received.

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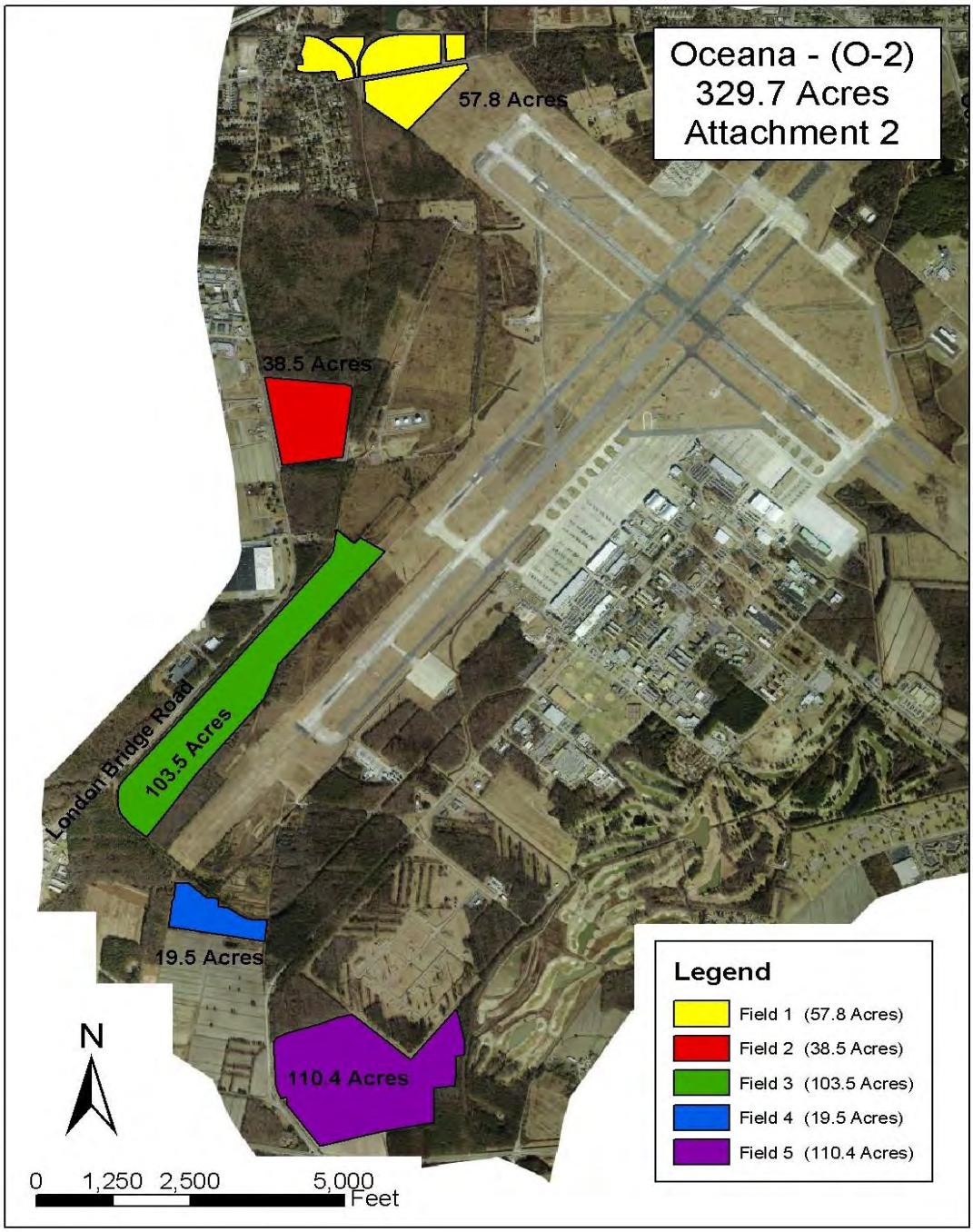
ATTACHMENT 2



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All pesticide dispersal equipment shall be clearly and plainly marked with "DANGER"..."PESTICIDES".

4. SPECIFIC PESTICIDE USE PROVISIONS

a. The Lessee shall coordinate, 72 hours in advance, with the Navy representative designated as responsible for oversight of the outlease that pesticide(s) and/or application equipment will be brought onto the site.

b. All application of pesticides shall conform to the Worker Protection Standards CFR 170 as amended.

c. All pesticide applications shall conform to all label and supplemental labeling of the pesticide product.

d. All applicable laws and regulations regarding notification and posting shall be strictly adhered to.

5. HERBICIDE REQUIREMENTS

Only glyphosate herbicides may be used for bare ground vegetation management. Paraquat use is not permitted. Simizine or any simizine family herbicide use is not permitted. Selective herbicides may be approved for use. If lessee is growing cotton specialty defoliant herbicides will be authorized through the normal approval process.

ATTACHMENT "4"

REPORTING REQUIREMENTS

Item # Description	Submit To	Date Required
1. Submit Pesticide Approval Form, Labels and MSDS Sheets 30 days after award of lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
2. Submit copies of current State Certification for all employees that will be applying pesticides, including those of contract Commercial Applicators 30 days after award of lease. Include copies of proof of insurance by Commercial Applicator.	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
3. Submit Soil Test and Nutrient Mgt. Plan 90 days after award of lease	Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist	90 days
4. Submit Pesticide Application Reporting Form (attachment 6) beginning April 1 of lease year continuing quarterly for the life of the lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	Quarterly
5. Pesticide Spill Report	Michael Wright, NAS Oceana Natural Resources Specialist Emergency Communication Center	Immediately
6. Approval of Aerial Pesticide application	Jack Markham, NAVFAC ATLANTIC Applied Biology Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist Michael Wright, NASO Natural Resources Specialist	72 Hrs prior

Send pesticide approval forms and reports to:
Commander
NAVFAC Atlantic
Attn: Mr. Jack Markham EV51
LRA Bldg A
6506 Hampton Blvd.
Norfolk, Virginia 23508-1278

ATTACHMENT 5

PESTICIDE APPROVAL SUBMISSION
(This list MUST be submitted and approval obtained
prior to initiation of work)

NOTES:

1. *LEGIBLE COPIES OF THE PESTICIDE LABEL AND MATERIAL SAFETY DATA SHEET FOR EACH PESTICIDE LISTED MUST BE ATTACHED.*
2. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA LICENSE AS AN APPLICATOR OF PESTICIDES MUST BE ATTACHED.*
3. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA COMMERCIAL GRADE CERTIFIED PESTICIDE APPLICATOR'S CERTIFICATE IN THE APPROPRIATE CATEGORY(S) MUST BE ATTACHED.*

PROPOSED PESTICIDE	**EPA REG.#**	**INTENDED USE** (EX: selective weed control, bare ground weed control etc.)	**INTENDED LOCATION** (EX: Area A, between rows, on crop etc.)

Note: Copy this form if you need more pages.

SOIL AND WATER CONSERVATION PLAN

Naval Auxiliary Landing Field
Fentress
Chesapeake, Virginia

Unit-F-1
Farmable Area: 339.0 Acres
SIF: 12.1 Acres
November 12, 2014

GENERAL INFORMATION

This Plan was prepared by **Mr. Emmett Carawan the Natural Resources Specialist at the Environmental Planning and Conservation Division, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC), Building Z-144, Room 214 Virginia Avenue, Norfolk, VA 23511 phone 757-341-0495.** Mr. Carawan will be the Government Representative of the Navy in administering the Soil and Water Conservation Plan.

The Real Estate Contracting Officer, Mr. Paul Moomaw, Hampton Roads IPT, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC) Norfolk, Virginia Telephone 757-341-1509 will be the Government Representative for the Navy in administering the lease.

Daily operational conflicts or problems can be resolved by calling the **NASO Natural Resources Specialist at 757-433-3461 or the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.**

The unit of land available for agriculture leasing is located at Naval Auxiliary Landing Field Fentress, Chesapeake, Virginia. The general location is shown on Attachment "1".

The gross area of 339.0 acres includes access roads and drainage ditches. Net farmable area will be less than the 339.0 acres. Also included in this lease is a 12.1acre spray irrigation field (SIF). The unit is located on the Northeastern side of the Station, and is accessed off of Fentress Airfield Road and Lockheed Road (Attachment 2).

Spray Irrigation Field Provisions

The Spray Irrigation Field (SIF) consists of 12.1 acres and is identified as SIF. The 12.1 acres is a wastewater irrigation area regulated under Virginia Department of Environmental Quality (DEQ) permit VPA01003. The Lessee may crop this area for the production hay / silage in conformance to the permit requirements.

If the Lessee chooses not to place the SIF in hay / silage production, the Lessee must mow, rake and remove cuttings in accordance with the permit (approximately six times per year). **Bids should reflect the cost of this mowing, raking and cutting removal.**

All conservation practices including liming, fertilization, and development of an annual crop plan shall be performed in accordance with permit no VPA01003 and the Nutrient Management Plan. The Station's representative will notify the Lessee of irrigation cycles or mowing requirements.

The Lessee must submit an annual report to the NASO Natural Resources Specialist and NAVFAC MID-ATLANTIC Natural Resources Specialist by January 15 of each year. This report will include a summary of agronomic practices which have occurred during the preceding growing season, including (but not limited to):

1. The timing and number of cuttings.
2. An estimate of total crop yield (tons / acre).
3. Lime and fertilizer additions.
4. Pesticide / herbicide usage.
5. Reseeding.

No hunting is permitted in the SIF area.
The DEQ's, Inspector may inspect the SIF at any time.

Special Provisions

Current military use of the land is to provide buffer and peripheral areas to perform military air operations within an effective compatible use zone. **There is a strict prohibition of electronic interference with communications.**

The station requires that the lessee coordinate at least 72 hours prior to bringing equipment and/or chemicals onto the installation, with the NAS Oceana's Natural Resources Specialist at 757-433-3461.

In the event that the lessee experiences a delay or problem caused by the Navy, they must immediately notify the NAS Oceana Natural Resources Specialist to resolve the problem at 757-433-3461.

Hunting on the leased lands is permitted. The Station is responsible for coordinating the programs with the lessee. Excessive damage caused by these activities must be reported immediately to the NAS Oceana Natural Resources Specialist at 757-433-3461.

Farming operations are to be restricted to the production of corn, soybeans, small grains, cotton, or hay/silage crops. When agreeing to the terms and conditions of the agricultural lease, special attention shall be paid to crop selection and its underlying impacts to the Bird/Animal Strike Hazard (BASH) program.

The Commanding Officer of NAS Oceana requests that crop location and planting schedules be provided to the NAS Oceana Natural Resources Specialist 757-433-3461 and the AODO at Oceana_aodo_kntu@navy.mil **or 757 433-2161/3 to help mitigate hazards at least a few days in advance. These schedules should be provided within 72 hours of field preparation and planting each season.** Tilling of soil prior to planting should be conducted at night whenever possible to reduce the affinity of exposed ground and food sources for birds. When harvesting crops, spillage should be minimized and cleaned up promptly.

No deviation in land use or drainage improvements, as outlined in this plan, shall be permitted without prior written consent of the Real Estate Contracting Officer.

Under Article 10B of the Lease General Provisions, cultivation of federally subsidized crops on the leased land is prohibited.

The Lessee is required to park and load all farm equipment and vehicles within leased property boundaries.

All equipment should be clean (no visible soil, plant or animal material) prior to arrival on the installation to minimize and avoid the spread of non-native invasive species. It is recommended that all equipment after utilization on the installation also be cleaned prior to utilization on other properties. If equipment is being utilized on one Navy installation and is transported to another Navy installation it must be cleaned prior to use on the other Navy property.

Cultural Resources

A "Phase I" archaeological survey has been partially completed at NALF Fentress. This survey has identified prehistoric and historic sites on the Station; many of these sites are found within the agricultural units. To alleviate any potential destruction of these sites the State Historic Preservation Officer (SHPO) recommends that the only ground-disturbing activity permitted will be the ongoing agricultural cultivation practices and be limited to the current plow zone. If the lessee anticipates a problem which would cause him to deviate from his current cultivation practices he shall notify Mr. Emmett Carawan, Government Representative at NAVFAC MID-ATLANTIC 757-341-0495.

Conservation Inventory

The 339.0 acres are considered a single farming unit. The land is wet and requires drainage. The land capability is Class IIIW for soil type 71 Acredale silt loam. The land capability is Class III when properly drained. Open ditch drainage is required to assure production.

Conservation Practices

All conservation practices shall be performed in accordance with standard specifications of the USDA **Natural Resources Conservation Service (NRCS)**. The Lessee shall utilize the technical services of the local Field Office located at the Municipal Center, Chesapeake, Virginia, in the design, layout, construction, and supervision of the conservation practices performed. All improvements shall become the property of the government at the expiration of the lease.

Soil fertility shall be maintained at the optimum level for the crops that are to be grown. USDA NRCS should be notified if nutrient deficiencies arise and resolved in accordance with their recommendations. USDA NRCS or the Virginia Tech Extension Service can assist in making fertilizer and lime recommendations that will be sufficient to maintain adequate pH levels and soil fertility.

Permission is granted to the lessee to take advantage of Hampton Roads Sanitation Division's Bio Solid disposal program. Coordination of this program shall be made, **30 days prior** to application with the NAVFAC MID-ATLANTIC and NAS Oceana Natural Resource Specialists.

Herbicides/Pesticides

Pesticides to be used by the Lessee must be coordinated and approved by Mr. Jack Markham (757-322-4882) at NAVFAC Atlantic's Applied Biology Section, within 30 days of award of the lease. Pesticide requirements are found in Attachments 3,4 and 5 of this Plan. The pesticide approval submission form must include product labels and Material Safety Data Sheets (MSDSs) when submitted to NAVFAC Atlantic's Applied Biology Section, (Address and phone number is located in the Government Offices section of this Soil & Water Conservation Plan). Actual application of herbicides / pesticides shall be reported quarterly on the Pesticide Application Record keeping form. The quarterly report shall be submitted to Mr. Markham, no later than 15 April, 15 July, 15 October, and 15 December, of each crop year.

Application of pesticides will conform to the Environmental Protection Agencies "Worker protection standards" as stated on the Pesticide label.

Mixing of pesticides is allowed on site if the lessee uses spill containment equipment. Storing of pesticides on site is not allowed.

The Lessee shall report all farm chemical spills, leaks or releases to NAS Oceana via the emergency coordination number at 757-433-9111 and to the NAS Oceana's Natural Resources Specialist at 757-433-3461.

If the Lessee finds it necessary to apply pesticides by aerial application of pesticides, the Lessee must have approval of NAVFAC Atlantics Applied Biologist at 757-322-4882 and the NAS Oceana's Natural Resources Specialist at 757-433-3461, 72 hours in advance of the anticipated spray application. This approval / notification must be direct contact and not voice mail message. Notification shall include POC for the Crop Dusting pilot, date, time and location of the spray application.

The pilot of the crop dusting aircraft shall contact the NAS Oceana Air Operations Duty Officer (757-433-2163) prior to takeoff to update ETA and location, and coordinate with Air Traffic Control (757-433-3471).

The Pilot shall contact the NTU Tower prior to entering the Class Delta airspace and receive clearance to begin the spray operations.

The Air Operations Officer will determine whether or not to cancel or reschedule the operation.

The control and/or eradication of Federal and State listed noxious weeds, particularly **Johnsongrass,** *Sorghum haleplense,* is required. Any pesticides and herbicides used for insect, disease, or weed control shall be approved and registered by the Environmental Protection Agency for the crops being grown.

The lessee is responsible for removal of all debris, refuse, garbage, pesticide containers, and unused residue of farm operations from the leased area and the Installation. The Lessee is encouraged to use the City of Chesapeake's pesticide container recycling program (see back of pesticide form for information).

Additional requirements for pesticide use on the property are provided in Attachment 3, Pesticide Mixing, Storage and Use on Navy-Owned Property Leased for Agricultural Purposes.

Conservation Requirements (SIF)

Non-Reimbursable Work
Soil and water conservation goals on this property include control of surface run-off and concurrent reduction in soil erosion, sedimentation and nutrient loading. The following measures will achieve these goals and are the responsibility of the lessee:

1. Since soil and wastewater test results vary over time, Soil tests must be conducted at least twice during the term of the lease to insure maximum economic benefits of the nutrient/wastewater applications.

2. Control and/or eradication of state regulated noxious weeds will be required, especially Johnsongrass.

3. The lessee will be responsible for removal of all debris, refuse, garbage, pesticide containers, and unused residue of farm operations from the leased area and the station.

4. The lessee is responsible for repairing damage incurred by him or his employees to the sprinkler system. If lessee finds that the sprinkler system has malfunctioned or is damaged, He is to report damage immediately to the crash control desk at NALF Fentress 757-433-2259.

This plan addresses the spray irrigation of treated, primarily, domestic wastewater generated at NALF Fentress. Approximately 6000 gallons of treated wastewater is produced per day or 2,190,000 gallons per year. Treatment consists of a raw sewage lagoon with a capacity for 462,000 gallons, a 282,000 gallon polishing pond and a storage lagoon with a capacity of 550,000 gallons providing storage for approximately 2.8 months. The effluent is chlorinated and then pumped to the irrigation field. This field is composed of irrigation zones, a total of 6 acres with buffer zones established. The fields are approved by the DEQ to be planted in the following crops:

1. Small grains, corn, soybeans

2. Orchard or fescue grass for hay or green chop.

To achieve long term economic yields and reduce environmental risks, three major considerations are required:

1. Control the nutrient application rates carefully to match expected uptake of nutrients by the planted crops. .

2. Be aware of environmentally sensitive areas when making nutrient applications.

3. Control the timing of nutrient applications to maximize crop uptake.

Conservation Requirements

Non-Reimbursable work

Soil and water conservation goals on this property include control of surface run-off and concurrent reduction in soil erosion, sedimentation and nutrient loading. The following measures will achieve these goals and are the responsibility of the lessee:

1. A conservation cropping system shall be established to include minimum tillage.

2. Maintenance of ditches and culverts is the responsibility of the lessee (subject to inspection at any time during the term of the lease) and shall include the following:

a. Mowing of ditch banks is required every other year of the lease. Mowing must be completed by 31 December. If this poses a problem for the lessee, he should notify the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.

b. **No-tilled strips/Vegetation buffer strips, a minimum of three (3) feet wide, shall be maintained along edges of ditch banks to prevent soil sloughing into ditches, and to serve as erosion control filter strips. Width of no-tilled strips will be strictly enforced. Width of no-tilled strips are measured from the top of the ditch bank and away from the ditch, towards the crop. Lessee shall avoid " scalping" ditch banks to avoid eroding ditch banks.**

c. Boundary ditches are considered lease area to the ditch center-line.

3. Any acreage not cropped shall be seeded to a cover crop of hay or silage for protection and erosion control. If land is left fallow crop residue shall be left on the soil surface as a winter cover to provide mulch and soil improvement until seedbed preparation the following spring. Minimum tillage practices are encouraged.

Yearly inspections by the Government Representatives of the Navy in administering the Soil and Water Conservation Plan will ensure compliance with these conditions and other environmental requirements.

Reimbursable Work

During the term of this lease, it is anticipated that reimbursable work will be requested. The reimbursable work will be based on a scope of work furnished by the Government. The Lessee will be requested to provide an estimate for the work based on the scope of work. If the Lessee decides not to do the work himself, he may contract with a third party to do so (to be approved by the Real Estate Contracting Officer), or inform the Government that he is not capable of performing the work.

If the proposal is acceptable the Real Estate Contracting Officer will either; (1) issue a letter of authorization to begin work or (2) will forward a lease modification to the lease authorizing the work. Work should not begin until the letter of authorization or lease modification has been received.

When work is completed, a joint inspection will be performed by the Lessee and Navy representatives. If the work is complete and acceptable, terms of the letter or modification will be activated (i.e., rent reduction granted).

GOVERNMENT OFFICES CONCERNED WITH THIS LEASE

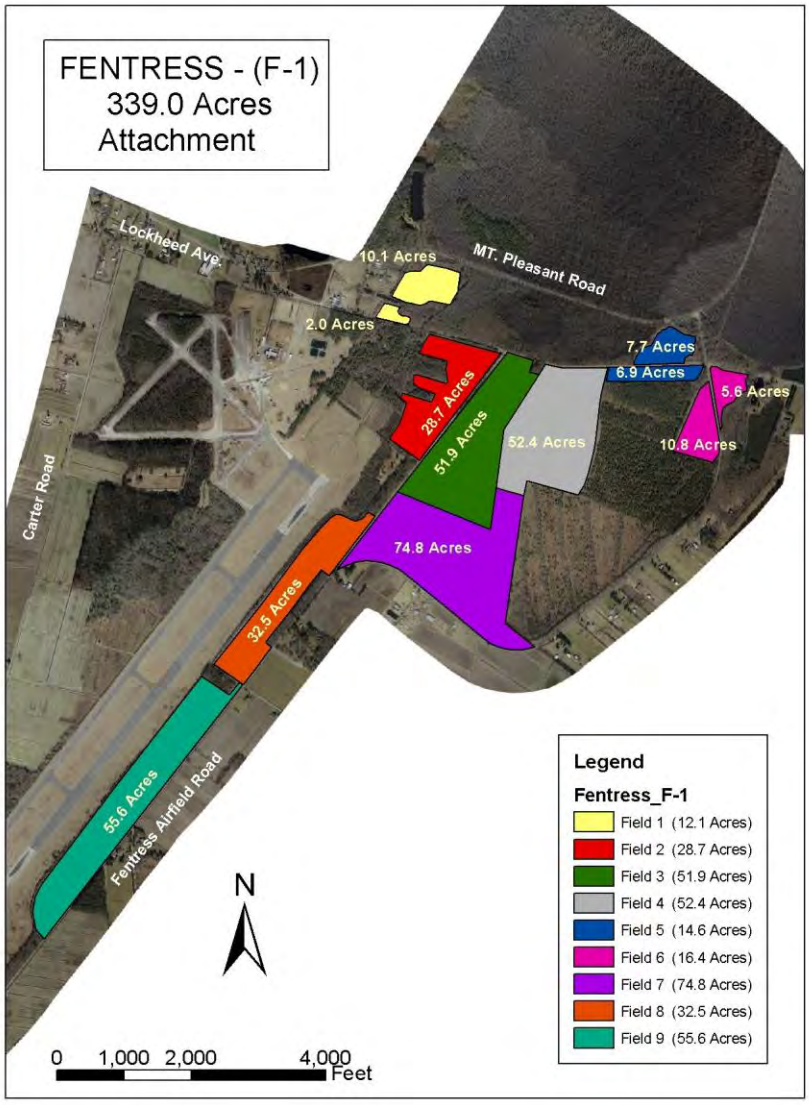
Mr. Jack Markham
Code EV51
NAVFAC Atlantic
6506 Hampton, Blvd.
Norfolk, VA 23508-1278
(757) 322-4882

Ms. Michael Wright
NASO Oceana
953 Hornet Drive
Building 820
Virginia Beach, VA 23460-2273
(757) 433-3461

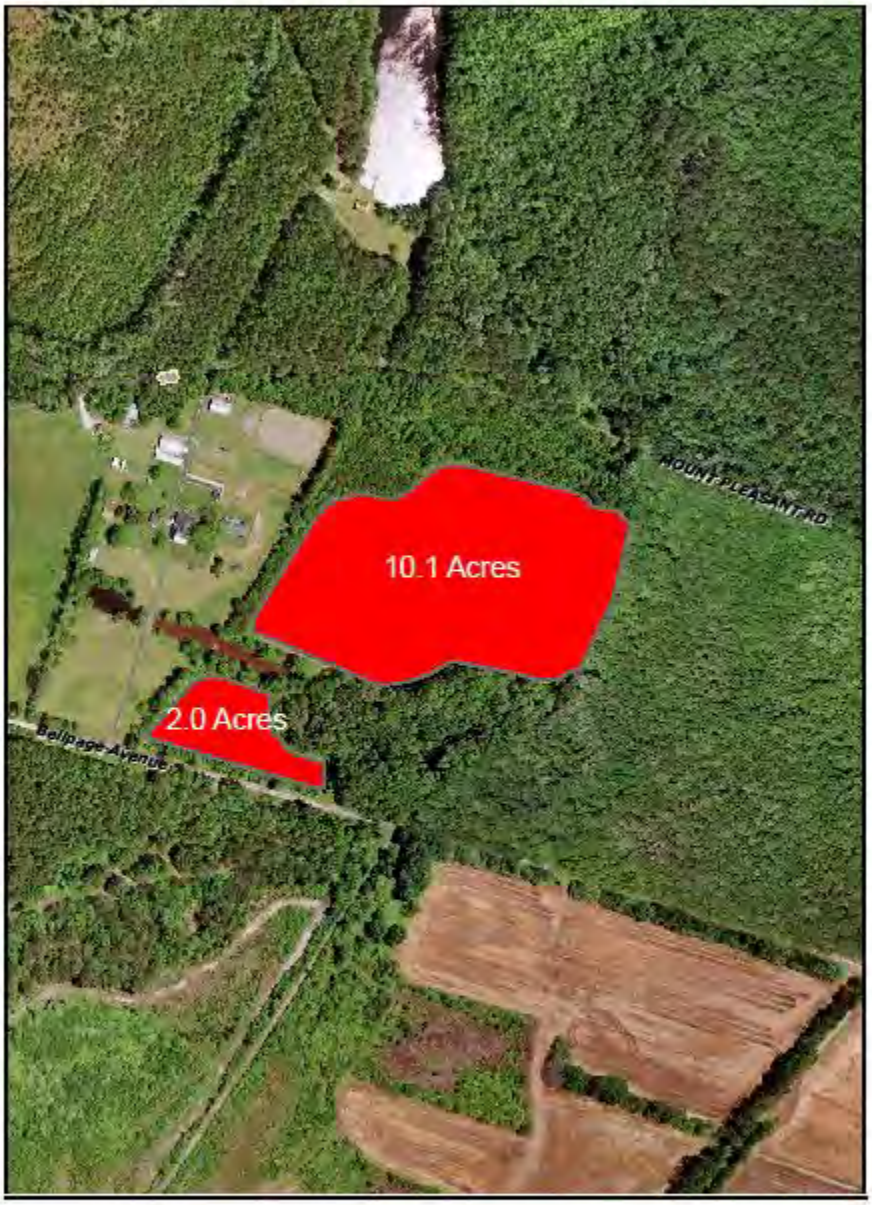
Mr. Paul Moomaw
Real Estate Contracting Officer
Naval Facilities Engineering Command
Mid-Atlantic
Virginia and Taussig Ave
Norfolk, VA 23511-2699
757 341-1509

Mr. Emmett Carawan
Natural Resources Specialist
NAVFAC Mid-Atlantic
Virginia and Taussig Ave.
Norfolk, VA 23511
757-341-0495

Attachment 1



Attachment 2



ATTACHMENT 3

Pesticide Mixing, Storage, and Use
on
Navy-Owned Property
Leased for Agricultural Purposes

1. a. Certified Applicators Requirement

All pesticide applications shall be performed by a State-certified pesticide applicator. Private applicator's licenses are acceptable if the Lessee performs the work. Commercial grade license(s) are required if the Lessee hires (for fee) an application company to apply the pesticide(s). "Registered Technician" status is not considered "Commercial Grade" or "Private" pesticide applicator license grade. The pesticide applicator shall be certified in the category in which the work will be performed.

b. Integrated Pest Management

Integrated Pest Management (IPM) is a pest population management system that uses all suitable control techniques (chemical, biological, cultural, mechanical, or physical) to maintain pest populations at or below tolerable levels. Integrated Pest Management (IPM) techniques shall be used to the maximum extent practicable.

2. SUBMITTAL REQUIREMENTS

a. Business License

If a commercial applicator will apply pesticides (i.e. the Lessee does NOT have a private applicators license), the commercial applicator shall provide proof of a business license (as a pesticide application business) as required by the State of Virginia. A copy of this business license shall be forwarded to the Navy representative designated as responsible for oversight of the outlease before the pesticide application(s) are performed.

b. Certificate of Insurance

If a commercial applicator will apply pesticide(s), proof of Insurance as a pesticide applicator business shall be forwarded to the Navy representative designated as responsible for oversight of the outlease before the pesticide application(s) are performed.

c. Pesticide Approval

All pesticides must be approved within 30 days after award of lease. A list of the pesticide(s) proposed for use (by either a private and/or commercial applicator) shall be submitted to the designated Navy representative for approval before the pesticide application(s) are performed. The "Pesticides Approval Submission" form (attachment 2) shall be used. Any changes in pesticides to be used shall have prior approval before their use (Submittal for changes shall be on the pesticide approval form provided).

d. Pesticide Labels and Material Safety Data Sheets

Attached to the Pesticide Approval Form, submit legible copies of the pesticide label and material safety data sheets for each pesticide proposed for use.

e. Commercial Grade Pesticide Applicators Certificate(s) In the Appropriate Categories

Attached to the Pesticide Approval form, submit legible copies of State pesticide applicators certificate(s) in the appropriate applicator categories (the category in which the work will be performed).

f. Pesticide Label/MSDS Reference Book

The Lessee shall maintain a reference book of approved pesticide labels and Material Safety Data Sheets (MSDS), and have it readily available **ON-SITE** (in the truck or other vehicle that was used to arrive on site) whenever any pesticides are on site. The reference book shall be readily available for inspection.

g. Reporting Pesticide and Fertilizer Use

The Lessee shall report all pesticide and/or fertilizer use on the Pesticide Application Record Keeping Form (attached to the contract) and forward the form to the Navy representative designated as responsible for oversight of the outlease.

3. PESTICIDE APPLICATION AND CONTROL OPERATIONS

All pesticides must be used in accordance with Federal, state, local, and installation publications, and any requirements identified in attachments. All pesticides shall be procured, processed, handled, and applied in strict accordance with the manufacturer's label. All pesticides shall be registered with the U.S. Environmental Protection Agency and the cognizant State pesticide regulatory agency.

a. Pesticide Preparation and Use.

During preparation, and/or application of pesticides, the Contractor shall:

(1) Always store pesticides in original containers having EPA-registered labels or in containers meeting EPA label requirements; and
(2) Use application equipment appropriate for the nature and size of work, that is clean, calibrated, and in proper operational condition; and
(3) Never leave equipment unattended during filling and application/usage; and
(4) Use back flow preventers on hoses when connected to water outlets in filling operations, and
(5) Inspect equipment (per manufacturer's label) and the area during application to insure proper and safe treatment; and
(6) Keep safety equipment and spill kit available on site when pesticides are present.

b. Pesticide Mixing.

The Lessee shall mix pesticides on a portable containment device. The device shall be capable of containing the maximum amount of pesticide and diluents being mixed at one time.

c. Storage of Other Pesticides.

No other pesticides shall be stored overnight at the site. Any pesticide container and/or application tank shall be secured against theft and vandalism when the site is unattended during the day. Only those pesticides expected to be used that day should be imported to the site.

d. Pesticide Disposal.

The Lessee shall not dispose of any pesticides, pesticide containers, pesticide residue, pesticide rinse water, or any pesticide contaminated articles on government property.

e. Spill Management.

A pesticide spill containment kit shall be available on site if pesticides are being applied. The kit shall contain (at least) absorbent material capable of absorbing at least 25 gallons of liquid, rubber boots, rubber gloves, safety goggles, and a shovel.

f. **Safety Equipment.**

When pesticides are being mixed or applied, a portable eyewash station and at least 2 gallons of fresh water (in plastic jugs marked “emergency wash water”) shall be within 25 feet of the operation.

g. Pesticide Spills and Decontamination.

The Lessee is responsible for properly cleaning, decontaminating, and reporting pesticide spills to the Navy representative.

h. Pesticide Dispersal Equipment Markings.

All pesticide dispersal equipment shall be clearly and plainly marked with "DANGER"..."PESTICIDES".

4. SPECIFIC PESTICIDE USE PROVISIONS

a. The Lessee shall coordinate, 72 hours in advance, with the Navy representative designated as responsible for oversight of the outlease that pesticide(s) and/or application equipment will be brought onto the site.

b. All application of pesticides shall conform to the Worker Protection Standards CFR 170 as amended.

c. All pesticide applications shall conform to all label and supplemental labeling of the pesticide product.

d. All applicable laws and regulations regarding notification and posting shall be strictly adhered to.

5. HERBICIDE REQUIREMENTS

Only glyphosate herbicides may be used for bare ground vegetation management. Paraquat use is not permitted. Simizine or any simizine family herbicide use is not permitted. Selective herbicides may be approved for use. If lessee is growing cotton specialty defoliant herbicides will be authorized through the normal approval process.

ATTACHMENT "4"

REPORTING REQUIREMENTS

Item # Description	Submit To	Date Required
1. Submit Pesticide Approval Form, Labels and MSDS Sheets 30 days after award of lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
2. Submit copies of current State Certification for all employees that will be applying pesticides, including those of contract Commercial Applicators 30 days after award of lease. Include copies of proof of insurance by Commercial Applicator.	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
3. Submit Soil Test and Nutrient Mgt. Plan 90 days after award of lease	Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist	90 days
4. Submit Pesticide Application Reporting Form (attachment 6) beginning April 1 of lease year continuing quarterly for the life of the lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	Quarterly
5. Pesticide Spill Report	Michael Wright, NAS Oceana Natural Resource Specialist Emergency Communication Center	Immediately
6. Approval of Aerial Pesticide application	Jack Markham, NAVFAC ATLANTIC Applied Biology, Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist Michael Wright, NASO Natural Resources Specialist	72 Hrs prior
7. Annual SIF Activity report	Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist Michael Wright, NASO Natural Resources Specialist	JAN/15

Send pesticide approval forms and reports to:
Commander
NAVFAC Atlantic
Attn: Mr. Jack Markham EV51
LRA Bldg A
6506 Hampton Blvd.
Norfolk, Virginia 23508-1278

ATTACHMENT 5

PESTICIDE APPROVAL SUBMISSION
(This list MUST be submitted and approval obtained
prior to initiation of work)

NOTES:

1. *LEGIBLE COPIES OF THE PESTICIDE LABEL AND MATERIAL SAFETY DATA SHEET FOR EACH PESTICIDE LISTED MUST BE ATTACHED.*
2. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA LICENSE AS AN APPLICATOR OF PESTICIDES MUST BE ATTACHED.*
3. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA COMMERCIAL GRADE CERTIFIED PESTICIDE APPLICATOR'S CERTIFICATE IN THE APPROPRIATE CATEGORY(S) MUST BE ATTACHED.*

PROPOSED PESTICIDE	**EPA REG.#**	**INTENDED USE** (EX: selective weed control, bare ground weed control etc.)	**INTENDED LOCATION** (EX: Area A, between rows, on crop etc.)

Note: Copy this form if you need more pages.

SOIL AND WATER CONSERVATION PLAN

Naval Auxiliary Landing Field
Fentress
Chesapeake, Virginia

Unit-F-2
Farmable Area: 255.5 Acres
November 19, 2014

GENERAL INFORMATION

This Plan was prepared by **Mr. Emmett Carawan the Natural Resources Specialist at the Environmental Planning and Conservation Division, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC), Building Z-144, Room 214 Virginia Avenue, Norfolk, VA 23511 phone 757-341-0495.** Mr. Carawan will be the Government Representative of the Navy in administering the Soil and Water Conservation Plan.

The Real Estate Contracting Officer, Mr Paul Moomaw, Hampton Roads IPT, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC) Norfolk, Virginia Telephone -757-341-1509 will be the Government Representative for the Navy in administering the lease.

Daily operational conflicts or problems can be resolved by calling the **NASO Natural Resources Specialist at 757-433-3461 or the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.**

The unit of land available for agriculture leasing is located at Naval Auxiliary Landing Field Fentress, Chesapeake, Virginia. The gross area of approximately 255.5 acres includes access roads and drainage ditches and is made up of two non-contiguous parcels of land. The unit is located on the Southern side of side of the Station, and is accessed off of Fentress Airfield Road and Government Road. A location map is found in Attachment 2.

Special Provisions

Current military use of the land is to provide buffer and peripheral areas to perform military air operations within an effective compatible use zone. **There is a strict prohibition of electronic interference with communications.**

The station requires that the lessee coordinate at least 72 hours prior to bringing equipment and/or chemicals onto the installation, with the NAS Oceana's Natural Resources Specialist at 757-433-3461.

In the event that the lessee experiences a delay or problem caused by the Navy, they must immediately notify the NAS Oceana Natural Resources Specialist to resolve the problem at 757-433-3461.

Hunting on the leased lands is permitted. The Station is responsible for coordinating the programs with the lessee. Excessive damage caused by these activities must be reported immediately to the NAS Oceana Natural Resources Specialist 757-433-3461.

Farming operations are to be restricted to the production of corn, soybeans, small grains, cotton, or hay/silage crops. When agreeing to the terms and conditions of the agricultural lease, special attention shall be paid to crop selection and its underlying impacts to the Bird/Animal Strike Hazard (BASH) program.

The Commanding Officer of NAS Oceana requests that crop location and planting schedules be provided to the NAS Oceana Natural Resources Specialist 757-433-3461 and the AODO at Oceana_aodo_kntu@navy.mil **or 757 433-2161/3 to help mitigate hazards at least a few days in advance. These schedules should be provided within 72 hours of field preparation and planting each season.** Tilling of soil prior to planting should be conducted at night whenever possible to reduce the affinity of exposed ground and food sources for birds. When harvesting crops, spillage should be minimized and cleaned up promptly.

No deviation in land use or drainage improvements, as outlined in this plan, shall be permitted without prior written consent of the **Real Estate Contracting Officer.**

Under Article 10B of the Lease General Provisions, cultivation of federally subsidized crops on the leased land is prohibited.

The Lessee is required to park and load all farm equipment and vehicles within leased property boundaries.

All equipment should be clean (no visible soil, plant or animal material) prior to arrival on the installation to minimize and avoid the spread of non-native invasive species. It is recommended that all equipment after utilization on the installation also be cleaned prior to utilization on other properties. If equipment is being utilized on one Navy installation and is transported to another Navy installation it must be cleaned prior to use on the other Navy property.

Cultural Resources

A "Phase I" archaeological survey has been partially completed at NALF Fentress. This survey has identified prehistoric and historic sites on the Station; many of these sites are found within the agricultural units. To alleviate any potential destruction of these sites the State Historic Preservation Officer (SHPO) recommends that the only ground-disturbing activity permitted will be the ongoing agricultural cultivation practices and be limited to the current plow zone. If the lessee anticipates a problem which would cause him to deviate from his current cultivation practices he shall notify Mr. Emmett Carawan, Government Representative at NAVFAC MID-ATLANTIC 757-341-0495.

Conservation Inventory

The 255.5 acres is considered a single farming unit. The land is wet and requires drainage. The land capability is Class IIIW for soil type 71, Acredale silt loam. The land capability is Class III when properly drained. Open ditch drainage is required to assure production.

Conservation Practices

All conservation practices shall be performed in accordance with standard specifications of the USDA **Natural Resources Conservation Service (NRCS)**. The Lessee shall utilize the technical services of the local Field Office located at the Municipal Center, Chesapeake, Virginia, in the design, layout, construction, and supervision of the conservation practices performed. All improvements shall become the property of the government at the expiration of the lease.

Soil fertility shall be maintained at the optimum level for the crops that are to be grown. USDA NRCS should be notified if nutrient deficiencies arise and resolved in accordance with their recommendations. USDA NRCS or the Virginia Tech Extension Service can assist in making fertilizer and lime recommendations that will be sufficient to maintain adequate pH levels and soil fertility.

Permission is granted to the lessee to take advantage of Hampton Roads Sanitation Division's pasteurized sludge disposal program. Co-ordination of this program shall be made, **30 days prior** to application with the NAVFAC MID-ATLANTIC and NAS Oceana Natural Resource Specialists.

Herbicides/Pesticides

Pesticides to be used by the Lessee must be coordinated and approved by Mr. Jack Markham 757-322-4882 at NAVFAC Atlantic's Applied Biology Section, within 30 days of award of the lease. Pesticide requirements are found in Attachments 3, 4 and 5 of this Plan. The pesticide approval submission form must include product labels and Material Safety Data Sheets (MSDSs) when submitted to NAVFAC

Atlantic's Applied Biology Section, (Address and phone number is located in the Government Offices section of this Soil & Water Conservation Plan). Actual application of herbicides / pesticides shall be reported quarterly on the Pesticide Application Record keeping form. The quarterly report shall be submitted to Mr. Markham, no later than 15 April, 15 July, 15 October, and 15 December, of each crop year.

Application of pesticides will conform to the Environmental Protection Agencies "Worker protection standards" as stated on the Pesticide label.

Mixing of pesticides is allowed on site if the lessee uses spill containment equipment. Storing of pesticides on site is not allowed.

The Lessee shall report all farm chemical spills, leaks or releases to NAS Oceana via the emergency coordination number at 757-433-3911 and to the NAS Oceana's Natural Resources Specialist at 757-433-3461.

If the Lessee finds it necessary to apply pesticides by aerial application of pesticides, the Lessee must have approval of NAVFAC Atlantics Applied Biologist at 757-322-4882 and the NAS Oceana's Natural Resources Specialist at 757-433-3461, 72 hours in advance of the anticipated spray application. This approval / notification must be direct contact and not voice mail message. Notification shall include POC for the Crop Dusting pilot, date, time and location of the spray application.

The pilot of the crop dusting aircraft shall contact the NAS Oceana Air Operations Duty Officer (757-433-2163) prior to takeoff to update ETA and location, and coordinate with Air Traffic Control (757-433-3471).

The Pilot shall contact the NTU Tower prior to entering the Class Delta airspace and receive clearance to begin the spray operations.

The Air Operations Officer will determine whether or not to cancel or reschedule the operation.

The control and/or eradication of Federal and State listed noxious weeds, particularly **Johnsongrass,** *Sorghum haleplense,* is required. Any pesticides and herbicides used for insect, disease, or weed control shall be approved and registered by the Environmental Protection Agency for the crops being grown.

The lessee is responsible for removal of all debris, refuse, garbage, pesticide containers, and unused residue of farm operations from the leased area and the Installation. The Lessee is encouraged to use the City of Chesapeake's pesticide container recycling program (see back of pesticide form for information).

Additional requirements for pesticide use on the property are provided in Attachment 3, Pesticide Mixing, Storage and Use on Navy-Owned Property Leased for Agricultural Purposes.

Conservation Requirements

Non-Reimbursable work

Soil and water conservation goals on this property include control of surface run-off and concurrent reduction in soil erosion, sedimentation and nutrient loading. The following measures will achieve these goals and are the responsibility of the lessee:

1. A conservation cropping system shall be established to include minimum tillage.

2. Maintenance of ditches and culverts is the responsibility of the lessee (subject to inspection at any time during the term of the lease) and shall include the following:

a. Mowing of ditch banks is required every other year of the lease. Mowing must be completed by 31 December. If this poses a problem for the lessee, he should notify the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.

b. **No-tilled strips/Vegetation buffer strips, a minimum of three (3) feet wide, shall be maintained along edges of ditch banks to prevent soil sloughing into ditches, and to serve as erosion control filter strips. Width of no-tilled strips will be strictly enforced. Width of no-tilled strips are measured from the top of the ditch bank and away from the ditch, towards the crop. Lessee shall avoid " scalping" ditch banks to avoid eroding ditch banks.**

c. Boundary ditches are considered lease area to the ditch center-line.

3. Any acreage not cropped shall be seeded to a cover crop of hay or silage for protection and erosion control. If land is left fallow crop residue shall be left on the soil surface as a winter cover to provide mulch and soil improvement until seedbed preparation the following spring. Minimum tillage practices are encouraged.

Yearly inspections by the Government Representatives of the Navy in administering the Soil and Water Conservation Plan will ensure compliance with these conditions and other environmental requirements.

Reimbursable Work

During the term of this lease, it is anticipated that reimbursable work will be requested. The reimbursable work will be based on a scope of work furnished by the Government. The Lessee will be requested to provide an estimate for the work based on the scope of work. If the Lessee decides not to do the work himself, he may contract with a third party to do so (to be approved by the Real Estate Contracting Officer), or inform the Government that he is not capable of performing the work.

If the proposal is acceptable the Real Estate Contracting Officer will either; (1) issue a letter of authorization to begin work or (2) will forward a lease modification to the lease authorizing the work. Work should not begin until the letter of authorization or lease modification has been received.

When the work has been completed, a joint inspection will be performed by the Lessee and Navy representatives. If the work is complete and acceptable, terms of the letter or modification will be activated (i.e., rent reduction granted).

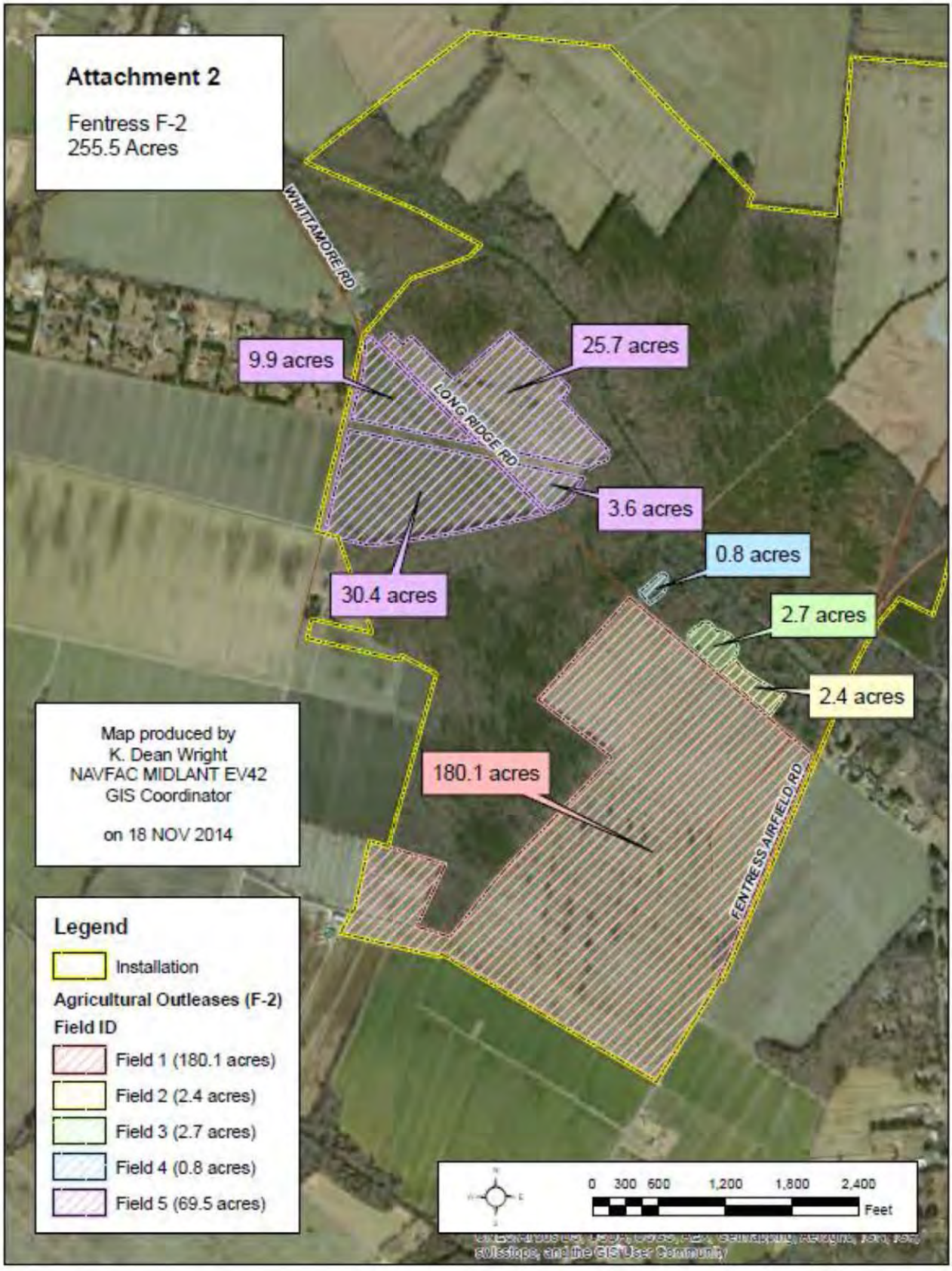
GOVERNMENT OFFICES CONCERNED WITH THIS LEASE

Mr. Jack Markham
Code EV51
NAVFAC Atlantic
6506 Hampton, Blvd.
Norfolk, VA 23508-1278
(757) 322-4882

Ms. Michael Wright
NASO Oceana
953 Hornet Drive
Building 820
Virginia Beach, VA 23460-2273
(757) 433-3461

Mr. Paul Moomaw
Real Estate Contracting Officer
Naval Facilities Engineering Command
Mid-Atlantic
Virginia and Taussig Ave
Norfolk, VA 23511-2699
(757) 341-1509

Mr. Emmett Carawan
Natural Resources Specialist
NAVFAC Mid-Atlantic
Virginia and Taussig Ave.
Norfolk, VA 23511
757-341-0495


Attachment 2
Fentress F-2
255.5 Acres
WHITTAMORE RD
9.9 acres
25.7 acres
LONG RIDGE RD
3.6 acres
0.8 acres
30.4 acres
2.7 acres
2.4 acres
180.1 acres
FENTRESS AIRFIELD RD
Map produced by
K. Dean Wright
NAVFAC MIDLANT EV42
GIS Coordinator
on 18 NOV 2014
Legend
Installation
Agricultural Outleases (F-2)
Field ID
Field 1 (180.1 acres)
Field 2 (2.4 acres)
Field 3 (2.7 acres)
Field 4 (0.8 acres)
Field 5 (69.5 acres)
0 300 600 1,200 1,800 2,400
Feet

ATTACHMENT 3

Pesticide Mixing, Storage, and Use
on
Navy-Owned Property
Leased for Agricultural Purposes

1. a. Certified Applicators Requirement

All pesticide applications shall be performed by a State-certified pesticide applicator. Private applicator's licenses are acceptable if the Lessee performs the work. Commercial grade license(s) are required if the Lessee hires (for fee) an application company to apply the pesticide(s). "Registered Technician" status is not considered "Commercial Grade" or "Private" pesticide applicator license grade. The pesticide applicator shall be certified in the category in which the work will be performed.

b. Integrated Pest Management

Integrated Pest Management (IPM) is a pest population management system that uses all suitable control techniques (chemical, biological, cultural, mechanical, or physical) to maintain pest populations at or below tolerable levels. Integrated Pest Management (IPM) techniques shall be used to the maximum extent practicable.

2. SUBMITTAL REQUIREMENTS

a. Business License

If a commercial applicator will apply pesticides (i.e. the Lessee does NOT have a private applicators license), the commercial applicator shall provide proof of a business license (as a pesticide application business) as required by the State of Virginia. A copy of this business license shall be forwarded to the Navy representative designated as responsible for oversight of the outlease before the pesticide application(s) are performed.

b. Certificate of Insurance

If a commercial applicator will apply pesticide(s), proof of Insurance as a pesticide applicator business shall be forwarded to the Navy representative designated as responsible for oversight of the outlease before the pesticide application(s) are performed.

c. Pesticide Approval

All pesticides must be approved within 30 days after award of lease. A list of the pesticide(s) proposed for use (by either a private and/or commercial applicator) shall be submitted to the designated Navy representative for approval before the pesticide application(s) are performed. The "Pesticides Approval Submission" form (attachment 2) shall be used. Any changes in pesticides to be used shall have prior approval before their use (Submittal for changes shall be on the pesticide approval form provided).

d. Pesticide Labels and Material Safety Data Sheets

Attached to the Pesticide Approval Form, submit legible copies of the pesticide label and material safety data sheets for each pesticide proposed for use.

e. Commercial Grade Pesticide Applicators Certificate(s) In the Appropriate Categories

Attached to the Pesticide Approval form, submit legible copies of State pesticide applicators certificate(s) in the appropriate applicator categories (the category in which the work will be performed).

f. Pesticide Label/MSDS Reference Book

The Lessee shall maintain a reference book of approved pesticide labels and Material Safety Data Sheets (MSDS), and have it readily available **ON-SITE** (in the truck or other vehicle that was used to arrive on site) whenever any pesticides are on site. The reference book shall be readily available for inspection.

g. Reporting Pesticide and Fertilizer Use

The Lessee shall report all pesticide and/or fertilizer use on the Pesticide Application Record Keeping Form (attached to the contract) and forward the form to the Navy representative designated as responsible for oversight of the outlease.

3. PESTICIDE APPLICATION AND CONTROL OPERATIONS

All pesticides must be used in accordance with Federal, state, local, and installation publications, and any requirements identified in attachments. All pesticides shall be procured, processed, handled, and applied in strict accordance with the manufacturer's label. All pesticides shall be registered with the U.S. Environmental Protection Agency and the cognizant State pesticide regulatory agency.

a. Pesticide Preparation and Use.

During preparation, and/or application of pesticides, the Contractor shall:

(1) Always store pesticides in original containers having EPA-registered labels or in containers meeting EPA label requirements; and
(2) Use application equipment appropriate for the nature and size of work, that is clean, calibrated, and in proper operational condition; and
(3) Never leave equipment unattended during filling and application/usage; and
(4) Use back flow preventers on hoses when connected to water outlets in filling operations, and
(5) Inspect equipment (per manufacturer's label) and the area during application to insure proper and safe treatment; and
(6) Keep safety equipment and spill kit available on site when pesticides are present.

b. Pesticide Mixing.

The Lessee shall mix pesticides on a portable containment device. The device shall be capable of containing the maximum amount of pesticide and diluent being mixed at one time.

c. Storage of Other Pesticides.

No other pesticides shall be stored overnight at the site. Any pesticide container and/or application tank shall be secured against theft and vandalism when the site is unattended during the day. Only those pesticides expected to be used that day should be imported to the site.

d. Pesticide Disposal.

The Lessee shall not dispose of any pesticides, pesticide containers, pesticide residue, pesticide rinse water, or any pesticide contaminated articles on government property.

e. Spill Management.

A pesticide spill containment kit shall be available on site if pesticides are being applied. The kit shall contain (at least) absorbent material capable of absorbing at least 25 gallons of liquid, rubber boots, rubber gloves, safety goggles, and a shovel.

f. **Safety Equipment.**

When pesticides are being mixed or applied, a portable eyewash station and at least 2 gallons of fresh water (in plastic jugs marked “emergency wash water”) shall be within 25 feet of the operation.

g. Pesticide Spills and Decontamination.

The Lessee is responsible for properly cleaning, decontaminating, and reporting pesticide spills to the Navy representative.

h. Pesticide Dispersal Equipment Markings.

All pesticide dispersal equipment shall be clearly and plainly marked with "DANGER"..."PESTICIDES".

4. SPECIFIC PESTICIDE USE PROVISIONS

a. The Lessee shall coordinate, 72 hours in advance, with the Navy representative designated as responsible for oversight of the outlease that pesticide(s) and/or application equipment will be brought onto the site.
b. All application of pesticides shall conform to the Worker Protection Standards CFR 170 as amended.
c. All pesticide applications shall conform to all label and supplemental labeling of the pesticide product.
d. All applicable laws and regulations regarding notification and posting shall be strictly adhered to.

5. HERBICIDE REQUIREMENTS

Only glyphosate herbicides may be used for bare ground vegetation management. Paraquat use is not permitted. Simizine or any simizine family herbicide use is not permitted. Selective herbicides may be approved for use. If lessee is growing cotton specialty defoliant herbicides will be authorized through the normal approval process.

ATTACHMENT "4"

REPORTING REQUIREMENTS

Item # Description	Submit To	Date Required
1. Submit Pesticide Approval Form, Labels and MSDS Sheets 30 days after award of lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
2. Submit copies of current State Certification for all employees that will be applying pesticides, including those of contract Commercial Applicators 30 days after award of lease. Include copies of proof of insurance by Commercial Applicator.	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
3. Submit Soil Test and Nutrient Mgt. Plan 90 days after award of lease	Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist	90 days
4. Submit Pesticide Application Reporting Form (attachment 6) beginning April 1 of lease year continuing quarterly for the life of the lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	Quarterly
5. Pesticide Spill Report	Michael Wright, NAS Oceana Natural Resource Specialist Emergency Communication Center	Immediately
6. Approval of Aerial Pesticide application	Jack Markham, NAVFAC ATLANTIC Applied Biology Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist Michael Wright, NASO Natural Resources Specialist	72 Hrs prior

Send pesticide approval forms and reports to:
Commander
NAVFAC Atlantic
Attn: Mr. Jack Markham EV51
LRA Bldg A
6506 Hampton Blvd.
Norfolk, Virginia 23508-1278

ATTACHMENT 5

PESTICIDE APPROVAL SUBMISSION
(This list MUST be submitted and approval obtained
prior to initiation of work)

NOTES:

1. *LEGIBLE COPIES OF THE PESTICIDE LABEL AND MATERIAL SAFETY DATA SHEET FOR EACH PESTICIDE LISTED MUST BE ATTACHED.*
2. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA LICENSE AS AN APPLICATOR OF PESTICIDES MUST BE ATTACHED.*
3. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA COMMERCIAL GRADE CERTIFIED PESTICIDE APPLICATOR'S CERTIFICATE IN THE APPROPRIATE CATEGORY(S) MUST BE ATTACHED.*

PROPOSED PESTICIDE	**EPA REG.#**	**INTENDED USE** (EX: selective weed control, bare ground weed control etc.)	**INTENDED LOCATION** (EX: Area A, between rows, on crop etc.)

Note: Copy this form if you need more pages.

SOIL AND WATER CONSERVATION PLAN

Naval Auxiliary Landing Field
Fentress
Chesapeake, Virginia

Unit-F-3
Farmable Area: 263.2 Acres
November 12, 2014

GENERAL INFORMATION

This Plan was prepared by **Mr. Emmett Carawan the Natural Resources Specialist at the Environmental Planning and Conservation Division, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC), Building Z-144, Room 214 Virginia Avenue, Norfolk, VA 23511 phone 757-341-0495.** Mr. Carawan will be the Government Representative of the Navy in administering the Soil and Water Conservation Plan.

The Real Estate Contracting Officer, Mr. Paul Moomaw, Hampton Roads IPT, Naval Facilities Engineering Command (NAVFAC MID-ATLANTIC) Norfolk, Virginia Telephone 757-341-1509 will be the Government Representative for the Navy in administering the lease.

Daily operational conflicts or problems can be resolved by calling the **NASO Natural Resources Specialist at 757-433-3461 or the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.**

The unit of land available for agriculture leasing is located at Naval Auxiliary Landing Field Fentress, Chesapeake, Virginia. The gross area of 263.2 acres includes access roads and drainage ditches. Net farmable area will be less than the 263.2 acres; and is made up of two non-contiguous parcels of land. The unit is located on the western side of side of the Station, and is accessed off of Carter Road and Blue Ridge Road. A location map is found in Attachment "2".

Special Provisions

Current military use of the land is to provide buffer and peripheral areas to perform military air operations within an effective compatible use zone. **There is a strict prohibition of electronic interference with communications.**

The station requires that the lessee coordinate at least 72 hours prior to bringing equipment and/or chemicals onto the installation, with the NAS Oceana's Natural Resources Specialist at 757-433-3461.

In the event that the lessee experiences a delay or problem caused by the Navy, they must immediately notify the NAS Oceana Natural Resources Specialist to resolve the problem at 757- 433-3461.

Hunting on the leased lands is permitted. The Station is responsible for coordinating the programs with the lessee. Excessive damage caused by these activities must be reported immediately to the NAS Oceana Natural Resources Specialist at 757-433-3461.

Farming operations are to be restricted to the production of corn, soybeans, small grains, cotton, or hay/silage crops. When agreeing to the terms and conditions of the agricultural lease, special attention shall be paid to crop selection and its underlying impacts to the Bird/Animal Strike Hazard (BASH) program.

The Commanding Officer of NAS Oceana requests that crop location and planting schedules be provided to the NAS Oceana Natural Resources Specialist 757-433-3461 and the AODO at Oceana_aodo_kntu@navy.mil **or 757 433-2161/3 to help mitigate hazards at least a few days in advance. These schedules should be provided within 72 hours of field preparation and planting each season.** Tilling of soil prior to planting should be conducted at night whenever possible to reduce the affinity of exposed ground and food sources for birds. When harvesting crops, spillage should be minimized and cleaned up promptly.

No deviation in land use or drainage improvements, as outlined in this plan, shall be permitted without prior written consent of the Real Estate Contracting Officer.

Under Article 10B of the Lease General Provisions, cultivation of federally subsidized crops on the leased land is prohibited.

The Lessee is required to park and load all farm equipment and vehicles within leased property boundaries.

All equipment should be clean (no visible soil, plant or animal material) prior to arrival on the installation to minimize and avoid the spread of non-native invasive species. It is recommended that all equipment after utilization on the installation also be cleaned prior to utilization on other properties. If equipment is being utilized on one Navy installation and is transported to another Navy installation it must be cleaned prior to use on the other Navy property.

Cultural Resources

A "Phase I" archaeological survey has been partially completed at NALF Fentress. This survey has identified prehistoric and historic sites on the Station; many of these sites are found within the agricultural units. To alleviate any potential destruction of these sites the State Historic Preservation Officer (SHPO) recommends that the only ground-disturbing activity permitted will be the ongoing agricultural cultivation practices and be limited to the current plow zone. If the lessee anticipates a problem which would cause him to deviate from his current cultivation practices he shall notify Mr. Emmett Carawan, Government Representative at NAVFAC MID-ATLANTIC 757-341-0495.

Conservation Inventory

The 263.2 acres are considered a single farming unit. The land is wet and requires drainage. The land capability is Class IIIW for soil type 71 Acredale silt loam. The land capability is Class III when properly drained. Open ditch drainage is required to assure production.

Conservation Practices

All conservation practices shall be performed in accordance with standard specifications of the USDA **Natural Resources Conservation Service (NRCS)**. The Lessee shall utilize the technical services of the local Field Office located at the Municipal Center, Chesapeake, Virginia, in the design, layout, construction, and supervision of the conservation practices performed. All improvements shall become the property of the government at the expiration of the lease.

Soil fertility shall be maintained at the optimum level for the crops that are to be grown. USDA NRCS should be notified if nutrient deficiencies arise and resolved in accordance with their recommendations. USDA NRCS or the Virginia Tech Extension Service can assist in making fertilizer and lime recommendations that will be sufficient to maintain adequate pH levels and soil fertility.

Permission is granted to the lessee to take advantage of Hampton Roads Sanitation Division's pasteurized sludge disposal program. Co-ordination of this program shall be made, **30 days prior** to application with the NAVFAC MID-ATLANTIC and NAS Oceana Natural Resource Specialists.

Herbicides/Pesticides

Pesticides to be used by the Lessee must be coordinated and approved by Mr. Jack Markham (757-322-4882) at NAVFAC Atlantic's Applied Biology Section, within 30 days of award of the lease. Pesticide requirements are found in Attachments 3, 4 and 5 of this Plan. The pesticide approval submission form must include product labels and Material Safety Data Sheets (MSDSs) when submitted to NAVFAC Atlantic's Applied Biology Section, (Address and phone number is located in the Government Offices

section of this S&W Plan). Actual application of herbicides / pesticides shall be reported quarterly on the Pesticide Application Record keeping form. The quarterly report shall be submitted to Mr. Markham, no later than 15 April, 15 July, 15 October, and 15 December, of each crop year.

Application of pesticides will conform to the Environmental Protection Agencies "Worker protection standards" as stated on the Pesticide label.

Mixing of pesticides is allowed on site if the lessee uses spill containment equipment. Storing of pesticides on site is not allowed.

The Lessee shall report all farm chemical spills, leaks or releases to NAS Oceana via the emergency coordination number at 757-433-9111 and to the NAS Oceana's Natural Resources Specialist at 757-433-3461.

If the Lessee finds it necessary to apply pesticides by aerial application of pesticides, the Lessee must have approval of NAVFAC Atlantics Applied Biologist at 757-322-4882 and the NAS Oceana's Natural Resources Specialist at 757-433-3461, 72 hours in advance of the anticipated spray application. This approval / notification must be direct contact and not voice mail message. Notification shall include POC for the Crop Dusting pilot, date, time and location of the spray application.

The pilot of the crop dusting aircraft shall contact the NAS Oceana Air Operations Duty Officer (757-433-2163) prior to takeoff to update ETA and location, and coordinate with Air Traffic Control (757-433-3471).

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The Air Operations Officer will determine whether or not to cancel or reschedule the operation.

The control and/or eradication of Federal and State listed noxious weeds, particularly **Johnsongrass,** *Sorghum haleplense,* is required. Any pesticides and herbicides used for insect, disease, or weed control shall be approved and registered by the Environmental Protection Agency for the crops being grown. The lessee is responsible for removal of all debris, refuse, garbage, pesticide containers, and unused residue of farm operations from the leased area and the Installation. The Lessee is encouraged to use the City of Chesapeake's pesticide container recycling program (see back of pesticide form for information).

Additional requirements for pesticide use on the property are provided in Attachment 3, Pesticide Mixing, Storage and Use on Navy-Owned Property Leased for Agricultural Purposes.

Conservation Requirements

Non-Reimbursable work

Soil and water conservation goals on this property include control of surface run-off and concurrent reduction in soil erosion, sedimentation and nutrient loading. The following measures will achieve these goals and are the responsibility of the lessee:

1. A conservation cropping system shall be established to include minimum tillage.

2. Maintenance of ditches and culverts is the responsibility of the lessee (subject to inspection at any time during the term of the lease) and shall include the following:

a. Mowing of ditch banks is required every other year of the lease. Mowing must be completed by 31 December. If this poses a problem for the lessee, he should notify the NAVFAC MID-ATLANTIC Natural Resources Specialist at 757-341-0495.

b. **No-tilled strips/Vegetation buffer strips, a minimum of three (3) feet wide, shall be maintained along edges of ditch banks to prevent soil sloughing into ditches, and to serve as erosion control filter strips. Width of no-tilled strips will be strictly enforced. Width of no-tilled strips are measured from the top of the ditch bank and away from the ditch, towards the crop. Lessee shall avoid " scalping" ditch banks to avoid eroding ditch banks.**

c. Boundary ditches are considered lease area to the ditch center-line.

3. Any acreage not cropped shall be seeded to a cover crop of hay or silage for protection and erosion control. If land is left fallow crop residue shall be left on the soil surface as a winter cover to provide mulch and soil improvement until seedbed preparation the following spring. Minimum tillage practices are encouraged.

Yearly inspections by the Government Representatives of the Navy in administering the Soil and Water Conservation Plan will ensure compliance with these conditions and other environmental requirements.

Reimbursable Work

During the term of this lease, it is anticipated that reimbursable work will be requested. The reimbursable work will be based on a scope of work furnished by the Government. The Lessee will be requested to provide an estimate for the work based on the scope of work. If the Lessee decides not to do the work himself, he may contract with a third party to do so (to be approved by the Real Estate Contracting Officer), or inform the Government that he is not capable of performing the work.

If the proposal is acceptable the Real Estate Contracting Officer will either; (1) issue a letter of authorization to begin work or (2) will forward a lease modification to the lease authorizing the work. Work should not begin until the letter of authorization or lease modification has been received.

When work is completed, a joint inspection will be performed by the Lessee and Navy representatives. If the work is complete and acceptable, terms of the letter or modification will be activated (i.e., rent reduction granted).

GOVERNMENT OFFICES CONCERNED WITH THIS LEASE

Mr. Jack Markham
Code EV51
NAVFAC Atlantic
6506 Hampton, Blvd.
Norfolk, VA 23508-1278
(757) 322-4882

Ms. Michael Wright
NASO Oceana
953 Hornet Drive
Building 820
Virginia Beach, VA 23460-2273
(757) 433-3461

Mr. Paul Moomaw
Real Estate Contracting Officer
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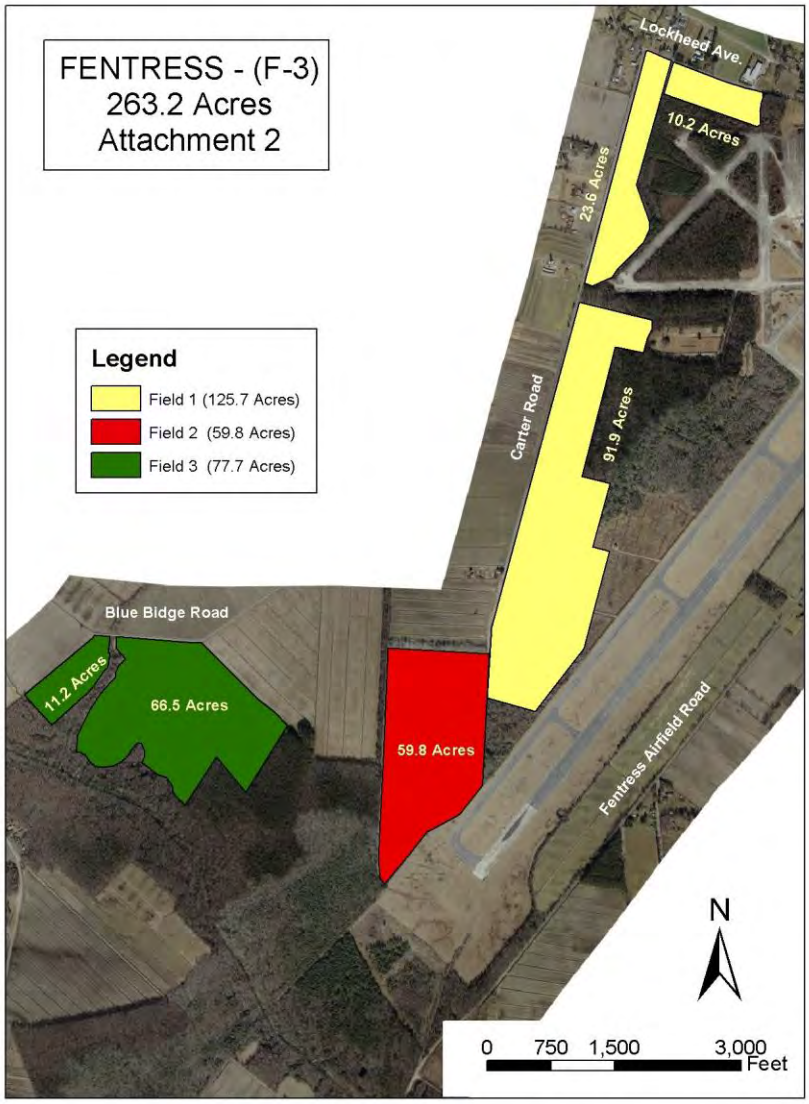
(757) 341-1509

Mr. Emmett Carawan
Natural Resources Specialist
NAVFAC Mid-Atlantic
Virginia and Taussig Ave.
Norfolk, VA 23511
757-341-0495

ATTACHMENT 2



ATTACHMENT 3

Pesticide Mixing, Storage, and Use
on
Navy-Owned Property
Leased for Agricultural Purposes

1. a. Certified Applicators Requirement

All pesticide applications shall be performed by a State-certified pesticide applicator. Private applicator's licenses are acceptable if the Lessee performs the work. Commercial grade license(s) are required if the Lessee hires (for fee) an application company to apply the pesticide(s). "Registered Technician" status is not considered "Commercial Grade" or "Private" pesticide applicator license grade. The pesticide applicator shall be certified in the category in which the work will be performed.

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2. SUBMITTAL REQUIREMENTS

a. Business License

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All pesticides must be approved within 30 days after award of lease. A list of the pesticide(s) proposed for use (by either a private and/or commercial applicator) shall be submitted to the designated Navy representative for approval before the pesticide application(s) are performed. The "Pesticides Approval Submission" form (attachment 2) shall be used. Any changes in pesticides to be used shall have prior approval before their use (Submittal for changes shall be on the pesticide approval form provided).

d. Pesticide Labels and Material Safety Data Sheets

Attached to the Pesticide Approval Form, submit legible copies of the pesticide label and material safety data sheets for each pesticide proposed for use.

e. Commercial Grade Pesticide Applicators Certificate(s) In the Appropriate Categories

Attached to the Pesticide Approval form, submit legible copies of State pesticide applicators certificate(s) in the appropriate applicator categories (the category in which the work will be performed).

f. Pesticide Label/MSDS Reference Book

The Lessee shall maintain a reference book of approved pesticide labels and Material Safety Data Sheets (MSDS), and have it readily available **ON-SITE** (in the truck or other vehicle that was used to

arrive on site) whenever any pesticides are on site. The reference book shall be readily available for inspection.

g. Reporting Pesticide and Fertilizer Use

The Lessee shall report all pesticide and/or fertilizer use on the Pesticide Application Record Keeping Form (attached to the contract) and forward the form to the Navy representative designated as responsible for oversight of the outlease.

3. PESTICIDE APPLICATION AND CONTROL OPERATIONS

All pesticides must be used in accordance with Federal, state, local, and installation publications and any requirements identified in attachments. All pesticides shall be procured, processed, handled, and applied in strict accordance with the manufacturer's label. All pesticides shall be registered with the U.S. Environmental Protection Agency and the cognizant State pesticide regulatory agency.

a. Pesticide Preparation and Use.

During preparation, and/or application of pesticides, the Contractor shall:

(1) Always store pesticides in original containers having EPA-registered labels or in containers meeting EPA label requirements; and
(2) Use application equipment appropriate for the nature and size of work, that is clean, calibrated, and in proper operational condition; and
(3) Never leave equipment unattended during filling and application/usage; and
(4) Use back flow preventers on hoses when connected to water outlets in filling operations, and
(5) Inspect equipment (per manufacturer's label) and the area during application to insure proper and safe treatment; and
(6) Keep safety equipment and spill kit available on site when pesticides are present.

b. Pesticide Mixing.

The Lessee shall mix pesticides on a portable containment device. The device shall be capable of containing the maximum amount of pesticide and diluent being mixed at one time.

c. Storage of Other Pesticides.

No other pesticides shall be stored overnight at the site. Any pesticide container and/or application tank shall be secured against theft and vandalism when the site is unattended during the day. Only those pesticides expected to be used that day should be imported to the site.

d. Pesticide Disposal.

The Lessee shall not dispose of any pesticides, pesticide containers, pesticide residue, pesticide rinse water, or any pesticide contaminated articles on government property.

e. Spill Management.

A pesticide spill containment kit shall be available on site if pesticides are being applied. The kit shall contain (at least) absorbent material capable of absorbing at least 25 gallons of liquid, rubber boots, rubber gloves, safety goggles, and a shovel.

f. **Safety Equipment.**

When pesticides are being mixed or applied, a portable eyewash station and at least 2 gallons of fresh water (in plastic jugs marked “emergency wash water”) shall be within 25 feet of the operation.

g. Pesticide Spills and Decontamination.

The Lessee is responsible for properly cleaning, decontaminating, and reporting pesticide spills to the Navy representative.

h. Pesticide Dispersal Equipment Markings.

All pesticide dispersal equipment shall be clearly and plainly marked with "DANGER"..."PESTICIDES".

4. SPECIFIC PESTICIDE USE PROVISIONS

a. The Lessee shall coordinate, 72 hours in advance, with the Navy representative designated as responsible for oversight of the outlease that pesticide(s) and/or application equipment will be brought onto the site.

b. All application of pesticides shall conform to the Worker Protection Standards CFR 170 as amended.

c. All pesticide applications shall conform to all label and supplemental labeling of the pesticide product.

d. All applicable laws and regulations regarding notification and posting shall be strictly adhered to.

5. HERBICIDE REQUIREMENTS

Only glyphosate herbicides may be used for bare ground vegetation management. Paraquat use is not permitted. Simizine or any simizine family herbicide use is not permitted. Selective herbicides may be approved for use. If lessee is growing cotton specialty defoliant herbicides will be authorized through the normal approval process.

ATTACHMENT "4"

REPORTING REQUIREMENTS

Item # Description	Submit To	Date Required
1. Submit Pesticide Approval Form, Labels and MSDS Sheets 30 days after award of lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
2. Submit copies of current State Certification for all employees that will be applying Pesticides, including those of contract Commercial Applicators 30 days after award of lease. Include copies of proof of insurance by Commercial Applicator.	Jack Markham, NAVFAC ATLANTIC Applied Biology	30 days
3. Submit Soil Test and Nutrient Mgt. Plan 90 days after award of lease	Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist	90 days
4. Submit Pesticide Application Reporting Form (attachment 6) beginning April 1 of lease year continuing quarterly for the life of the lease	Jack Markham, NAVFAC ATLANTIC Applied Biology	Quarterly
5. Pesticide Spill Report	Michael Wright, NAS Oceana Natural Resource Specialist Emergency Communication Center	Immediately
6. Approval of Aerial Pesticide application	Jack Markham, NAVFAC ATLANTIC Applied Biology Emmett Carawan, NAVFAC MID-ATLANTIC Natural Resources Specialist Michael Wright, NASO Natural Resources Specialist	72 Hrs prior

Send pesticide approval forms and reports to:
Commander
NAVFAC Atlantic
Attn: Mr. Jack Markham EV51
LRA Bldg A
6506 Hampton Blvd.
Norfolk, Virginia 23508-1278

ATTACHMENT 5

PESTICIDE APPROVAL SUBMISSION
(This list MUST be submitted and approval obtained
prior to initiation of work)

NOTES:

1. *LEGIBLE COPIES OF THE PESTICIDE LABEL AND MATERIAL SAFETY DATA SHEET FOR EACH PESTICIDE LISTED MUST BE ATTACHED.*
2. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA LICENSE AS AN APPLICATOR OF PESTICIDES MUST BE ATTACHED.*
3. *IF APPLICABLE, A COPY OF THE STATE OF VIRGINIA COMMERCIAL GRADE CERTIFIED PESTICIDE APPLICATOR'S CERTIFICATE IN THE APPROPRIATE CATEGORY(S) MUST BE ATTACHED.*

PROPOSED PESTICIDE	**EPA REG.#**	**INTENDED USE** (EX: selective weed control, bare ground weed control etc.)	**INTENDED LOCATION** (EX: Area A, between rows, on crop etc.)

Note: Copy this form if you need more pages.

PESTICIDE APPROVAL SUBMISSION
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Note: Copy this form if you need more pages.

Enclosure 3 NALFF Nutrient Management Plan Spray Fields


R
B
D
A
C
© 2015 Google
Google earth
Tour Guide
1990
Imagery Date: 4/23/2014 36°42'29.33" N 76°07'12.48" W elev 9 ft eye alt 845 ft

Soil Map—Chesapeake City, Virginia
(Naval Auxiliary Landing Field (NALF) Fentress)

Map Scale: 1:1,780 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

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Appendix I

Educational Outreach

Enclosure 1 **Hazards/Safety: Black Bear**
Enclosure 2 **Hazards/Safety: Diseases**
Enclosure 3 **Zoonotic Disease: When Humans and Animals Intersect**
Enclosure 4 **Feral Animal Control (Cats, Hogs, etc.)**
Enclosure 5 **Commander, Navy Region Mid-Atlantic (CNRMA) Environmental Management System**
Enclosure 6 **NASO, NASO Dam Neck Annex, NALFF, and Naval Security Activity Hampton Roads Northwest Annex Hunting, Fishing, and Archery Range**
Enclosure 7 **Naval Air Station Oceana, Oceana Pond Outdoor Recreation Area**
Enclosure 8 **Compliance: Wildlife**
Enclosure 9 **Poisonous Plants**
Enclosure 10 **Invasive Plant Species Brochure for Hampton Roads Installations**
Enclosure 11 **Venomous Snakes of Naval Facilities in Southeastern Virginia**
Enclosure 12 **Commanding Officer's Environmental Policy**

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Enclosure 1. Hazards/Safety: Black Bear

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Hazards/Safety: Black Bear

- Avoid Contact
- Don't get between an adult and their cub (see a cub look for an adult)
- Don't turn your back on the animal
- Don't run, back away slowly
- Make yourself look big (open wide arms)
- Speak in a loud, authoritative voice (not a scared voice)
- If attacked, fight back (most black bear will back down to resistance)

Photo credit: Dave Telesco. BBCC.

Photo credit: Cynthia L. Cunningham, USGS.

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Enclosure 2. Hazards/Safety: Diseases

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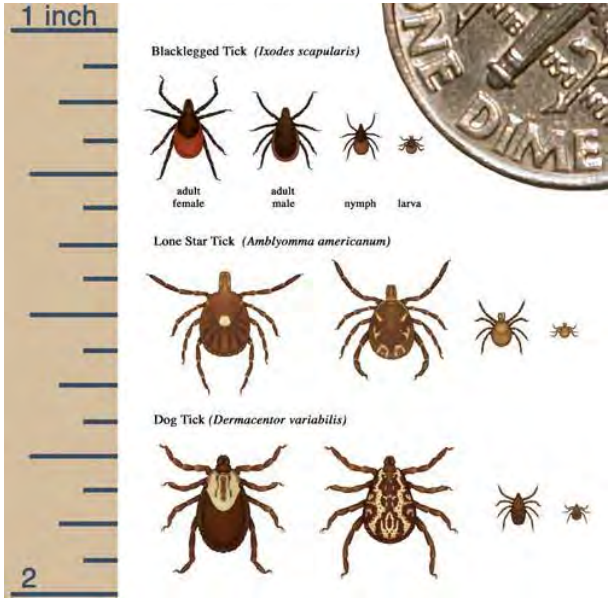
Hazards/Safety: Diseases

- Lyme's Disease
- West Nile Virus
- Equine Encephalitis
- Rabies
- Distemper



Protect yourself from mosquito-born illnesses: When working or playing outdoors, utilize Mosquito repellents; Cover as much of your body as possible with clothing; Reduce the amount of standing water that may be supporting breeding populations of mosquitoes.

Protect yourself from tick-born illnesses: When working or playing outdoors, utilize Tick repellents (spray all clothing, including hats); Cover as much of your body as possible with clothing; Tuck your pant legs into your boots and Tuck your shirt into your pants; Utilize duct tape around your pant bottoms and boots, your waist line, and your shirt sleeve arm openings (to seal potential openings for ticks to get to our skin); Wear a hat and tuck your hair into the hat.

Protect yourself from Rabies and other diseases by avoiding contact with wildlife. Admire from afar, do not try to pick up, touch, or come in contact with any animals (wild or domesticated).

Enclosure 3. Zoonotic Disease: When Humans and Animals Intersect

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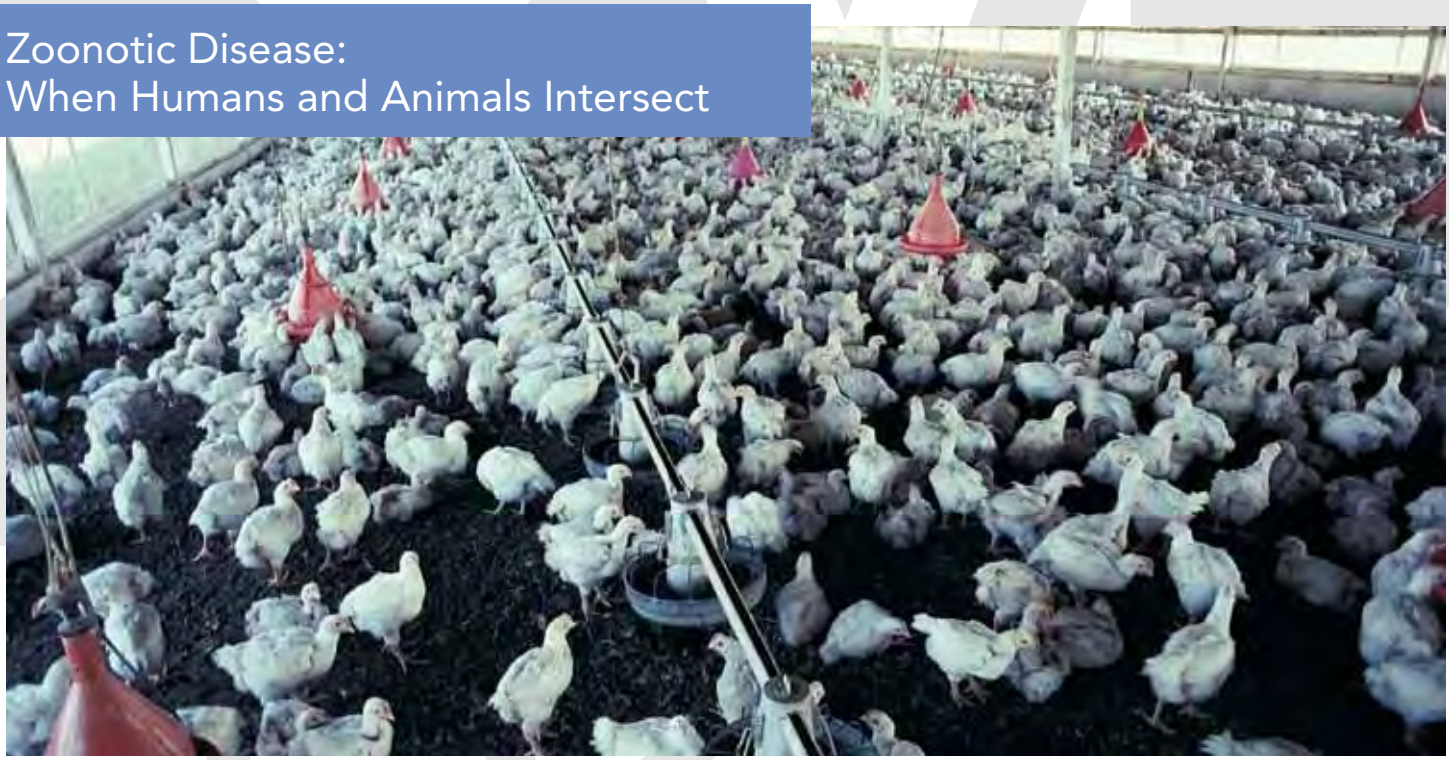
CDC 24/7 Saving Lives. Protecting People. Saving Money Through Prevention.

Zoonotic Disease: When Humans and Animals Intersect



What are zoonotic diseases?

Zoonotic diseases are contagious diseases spread between animals and humans. These diseases are caused by bacteria, viruses, parasites, and fungi that are carried by animals and insects. Examples are anthrax, dengue, Ebola hemorrhagic fever, Escherichia coli infection, Lyme disease, malaria, Plague, Rocky Mountain spotted fever, salmonellosis, and West Nile virus infection.

How do you get zoonotic diseases?

People can get zoonotic diseases from contact with infected live poultry, rodents, reptiles, amphibians, insects, and other domestic and wild animals. A common way for these diseases to spread is through the bite of a mosquito or tick. People can get diseases in most places where they might have contact with infected animals and insects, including:

- Animal displays
- Petting zoos
- Pet stores
- Nature parks
- Wooded and bushy areas
- Farms
- County or state fairs
- Child-care facilities or schools

Who can get zoonotic diseases?

- Anyone who has contact with animals can get a zoonotic disease, but people may be more at risk than others. These include people with a weakened immune system, children age 5, the elderly, and pregnant women.

Centers for Disease Control and Prevention
Office of the Director

CS226601K

Zoonotic Disease: When Humans and Animals Intersect

How to prevent zoonotic diseases

- Be aware of zoonotic diseases and your potential for infection
- Wash hands thoroughly and frequently
- Avoid direct contact with certain animals and their environment
- Closely supervise children to ensure they wash their hands properly and avoid hand-to-mouth activities (thumb-sucking, eating, and use of pacifiers) after animal contact
- Use EPA-registered insect repellents that contain 20% or more DEET (N, N-diethyl-m-toluamide) on the exposed skin for protection that lasts up to several hours.
- Use products that contain repellents (such as permethrin) on clothing. Treat clothing and gear, such as boots, pants, socks and tents.
- Look for and remove ticks from your body. Parents should check their children for ticks.
- Limit the number of places around your home for mosquitoes to breed by getting rid of items that hold water.

Interesting facts about zoonotic diseases

- About 75% of recently emerging infectious diseases affecting humans are diseases of animal origin, and approximately 60% of all human pathogens are zoonotic.
- Tick-borne diseases, including Lyme disease and Rocky Mountain spotted fever, are serious public health problems, infecting tens of thousands in the United States each year. CDC is working closely with local communities, developing innovative control approaches and researching improved diagnostics.
- Almost all persons infected by rabid animals will die if not treated appropriately. Dogs are responsible for most human rabies deaths worldwide, but the public health threat of canine rabies has been virtually eliminated in the United States.
- There have been 1.5 million West Nile virus infections since 1999. 2.5 billion people are at risk for dengue in more than 100 endemic countries with 50 million cases of dengue fever each year.

For more information on zoonotic diseases, visit www.cdc.gov/ncezid or call 1-800-CDC-INFO.
To view this fact sheet on the web, visit http://www.cdc.gov/24-7/CDCFastFacts/zoonotic.html

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Preventing Tick Bites

While it is a good idea to take preventive measures against ticks year-round, be extra vigilant in warmer months (April-September) when ticks are most active.

Avoid Direct Contact with Ticks

- Avoid wooded and bushy areas with high grass and leaf litter.
- Walk in the center of trails.

Repel Ticks with DEET or Permethrin

- Use repellents that contain 20 to 30% DEET (N, N-diethyl-m-toluamide) on exposed skin and clothing for protection that lasts up to several hours. Always follow product instructions. Parents should apply this product to their children, avoiding hands, eyes, and mouth.
- Use products that contain permethrin on clothing. Treat clothing and gear, such as boots, pants, socks and tents with products containing 0.5% permethrin. It remains protective through several washings. Pre-treated clothing is available and may be protective longer.
- Other repellents registered by the Environmental Protection Agency (EPA) may be found at http://cfpub.epa.gov/oppref/insect/. (http://cfpub.epa.gov/oppref/insect/) (http://www.cdc.gov/Other/disclaimer.html)

Find and Remove Ticks from Your Body

- Bathe or shower as soon as possible after coming indoors (preferably within two hours) to wash off and more easily find ticks that are crawling on you.
- Conduct a full-body tick check using a hand-held or full-length mirror to view all parts of your body upon return from tick-infested areas. Parents should check their children for ticks under the arms, in and around the ears, inside the belly button, behind the knees, between the legs, around the waist, and especially in their hair.
- Examine gear and pets. Ticks can ride into the home on clothing and pets, then attach to a person later, so carefully examine pets, coats, and day packs.
- Tumble clothes in a dryer on high heat for an hour to kill remaining ticks. (Some research suggests that shorter drying times may also be effective, particularly if the clothing is not wet.)

Page last reviewed: May 16, 2011
Page last updated: April 25, 2014
Content source: Centers for Disease Control and Prevention
National Center for Emerging and Zoonotic Infectious Diseases (NCEZID)
Division of Vector-Borne Diseases (DVBD)

Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Enclosure 4. Feral Animal Control (Cats, Hogs, etc.)

Keeping Cats Indoors Is Good For Birds

Isn't it natural for cats to kill birds?
No! Cats are not native to North America or many other parts of the world. Our wildlife did not evolve with this abundant and efficient predator, and thus have few defenses against them. Millions of animals may be killed each year by outdoor, pet cats in the U.S. Stray and feral cats add to the toll.

The Truth About Cats and Wildlife

- **Even well-fed cats kill wildlife.** This is because cats are born predators and the urges to hunt and eat are controlled by different parts of their brain.
- Belled cats kill wildlife. Cats quickly learn to silently stalk their prey. Wild animals don't necessarily know a ringing bell means danger.

Photo: Michael Stubblefield

Cats kill rare species such as this Piping Plover chick.

- Once caught by a cat, few small animals survive the ordeal. Even if the animal escapes, infection from a cat's teeth or claws, or internal injury usually result in death.

Tips for Happy Indoor Cats

Kittens who are kept indoors from the start usually show no desire to go outside as adults. With patience and time, most outdoor cats can become happy indoor pets. The following tips will help:

Photo: Dr. Jeff Price

An indoor cat is a safe and happy cat.

- Play with your cat for at least 15 minutes each day.
- Paper bags and cardboard boxes provide places to play when they are alone.
- Provide window shelves and bird feeders to keep your indoor cat entertained.
- Give your cat a nutritious diet, including constant access to clean water.
- If your cat must go outside, train him to wear a harness and leash or provide a safe outside enclosure such as a screened porch or cat run.
- Plant kitty grass in indoor pots so your cat can safely graze.
- Keep the litter box clean.

Indoor Cats Can Slip Out, So Remember To:

- Spay or neuter your kitten as early as eight weeks old, *before* it can breed. Your cat will be healthier and won't contribute to the overpopulation problem.
- Attach an ID tag to your pet's collar or get a microchip implanted containing your contact information.
- Provide routine veterinary care, including an annual check up and vaccinations.

Cat ownership is a responsibility, so please do your part.

For the Sake of Cats, Wildlife and People:

- *Never* abandon cats. If you are transferred and can't take your cat with you, find a good home or contact a veterinarian or local humane society for help.
- Do not feed stray cats—this only increases the cat overpopulation problem. Take them to a local shelter or call your base animal control officer for help.

For more information: contact your base veterinarian, local humane society, or **www.denix.osd.mil/DoDPIF.**

Produced by DoD Legacy Program
Prepared by American Bird Conservancy

Don't Let Your Cat Go AWOL!

Indoor Cats Are Safe Cats

Military bases often struggle with how to manage domestic cat populations. Frequent transfers of personnel often means cats are left behind, abandoned to fend for themselves. Lucky cats find a new human, but most are not so fortunate. Abandoned cats face many dangers: being hit by cars, starving, freezing temperatures, disease, and more. If not spayed or neutered, cat populations can explode.

Free-roaming cats kill native wildlife, including many rare and endangered species, and can also threaten the health and safety of military personnel and their children. Base commanders must deal with how to humanely and cost-effectively resolve the issue of too many free-roaming cats. ***As a cat owner, you are an important part of the solution.***

Photo: Dr. Gil Ewing

Cat killing a Yellow-rumped Warbler at a bird bath.

The Skinny on Cats

Domesticated in Egypt over 4,000 years ago, house cats are descendants of the European and African wild cat. Now considered a separate species, *Felis catus* was introduced all over the rest of the world by European explorers and settlers. Recent estimates place the U.S. pet cat population at 90 million. No one knows how many stray or feral cats are out there—best estimates range from 60 to 100 million.

- ***Stray* cats are lost or abandoned by their owners.**
- **Truly *feral* cats live entirely on their own without any human assistance.**
- **A female cat can have two to three litters per year, with four to eight kittens per litter.**

Photo: Microsoft

Cats kill small animals such as chipmunks.

Keeping Cats Indoors Is Good For People

Stray cats often congregate around a food source such as garbage dumps and mess halls, or where people leave food out for them. They can be a nuisance around base housing, where people may feed birds, tend flower gardens, or have children's sand boxes.

Outdoor cats are exposed to many diseases and parasites, some of which can be transmitted to people:

Rabies, a deadly virus, can infect cats, wildlife, and humans. Outdoor cats are more likely to contract rabies than any other domestic animal.

Cat-scratch Disease: is transmitted from cat to cat by fleas, and from cat to human by a scratch or bite. While cats show no symptoms of the disease, it can cause severe illness in people.

Toxoplasmosis is caused by a tiny parasite found in the intestines of cats and in the tissues of many animals. People can contract this disease by not washing their hands after coming into contact with cat litter or soil contaminated with cat feces. If contracted by a pregnant woman, abortion of the fetus or blindness or retardation in the newborn can result.

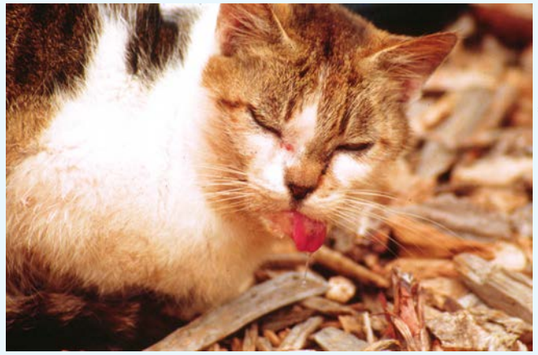


Photo: Alan Hopkins

Cats are not wildlife and struggle to survive outdoors.

Cats can also transmit fleas, roundworm, and hookworm to humans. In the southwest, cases of the most lethal form of plague in humans have been linked to outdoor cats.

Keeping Cats Indoors Is Good For Cats

Many people don't realize the daily hazards that outdoor cats face. The average life expectancy of a free-roaming cat is less than five years, while indoor cats commonly live to 12 - 20 years. Cats who roam are in constant danger from:

Cars: Millions of cats are run over by cars annually. In colder climates, cats may crawl into car engines to get warm and are killed or maimed when the car is started.

Disease: In addition to rabies, outdoor cats risk exposure to fatal diseases such as feline leukemia and feline immunodeficiency virus (FIV). While vaccines are available for some diseases, they are not 100 percent effective. A vaccine for FIV is not available.

Injuries: Abscesses, broken limbs, disease, torn ears, scratched eyes, internal injuries, parasites, and death can result from encounters with dogs, other cats, coyotes, raccoons, foxes, hawks, and owls.

Overpopulation: Cats who have not been spayed or neutered are the greatest cause of cat overpopulation. As a result, millions of cats must be euthanized each year because there are not enough homes for them.

Poisons and Traps: Pesticides, rodenticides, and antifreeze poison and kill thousands of outdoor cats yearly. Cats may be caught in traps set for furbearing animals.

Parasites: Outdoor cats suffer from debilitating parasites such as ear mites, fleas, ticks, and worms.

Human Cruelty: Unfortunately, it is not uncommon for animal shelters and veterinarians to have to treat cats who have been shot, stabbed, or set on fire.

Inclement Weather: Outside cats suffer from extreme weather conditions and natural disasters, such as hurricanes, floods, fires, and tornadoes.

Report Feral Swine

Help Protect Virginia's Agricultural and Natural Resources

1-855-571-9003

USDA

Please Report

Hog Sightings

Hog Damage

VIRGINIA

Department of Game & Inland Fisheries

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Enclosure 5. CNRMA Environmental Management System

CNRMA
Environmental Policy Statement

CNRMA's Environmental Policy Statement is the foundation of the EMS and reflects CNRMA's commitment to integrate mission accomplishment with environmental stewardship.

CNRMA's policy is communicated through the acronym, **"CARE"**, which summarizes the key concepts:

- **C – Comply with all rules**
- **A – Always improve**
- **R – Reduce waste**
- **E – Eliminate pollution**

Visit our website to see entire policy

CNRMA EMS facilities include:

- NAVSTA Norfolk
- NSA Norfolk
- NAS Oceana
- NAVPHIBASE Little Creek
- WPNSTA Yorktown
- NAVSUBASE New London
- NAVSTA Newport
- NAS Brunswick
- NAES Lakehurst
- NWS Earle
- NCTAMS LANT DET Cutler
- NAS JRB Willow Grove
- NSA Mechanicsburg
- NSA Philadelphia
- Philadelphia Naval Business Center
- NSGA Sugar Grove

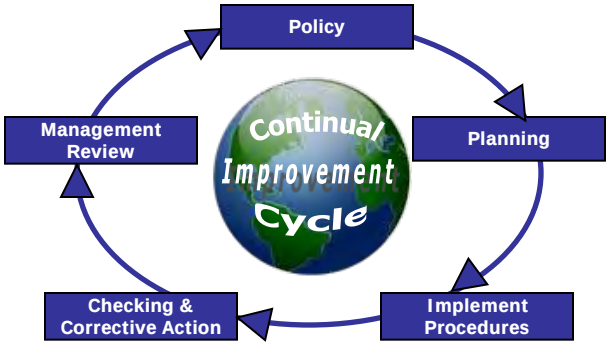
To learn more about CNRMA's EMS, please visit our Website: www.cnrma.navy.mil/environmental/Environmental_management_system.htm

Commander Navy Region Mid-Atlantic (CNRMA)

E nvironmental
M anagement
S ystem

www.cnrma.navy.mil/environmental/environmental_management_system.htm

CNRMA
Environmental Management System (EMS)



The EMS Cycle of Continuous Improvement

What is EMS?

EMS is a set of management processes and procedures that allows an organization to:

- analyze, control and reduce it's impact on the environment
- operate with greater efficiency and control

The EMS management tool is used to plan, implement, review, and improve the actions CNRMA takes to meet environmental goals. The CNRMA EMS must be:

- Mission focused
- Integrated into existing business processes
- Flexible in order to optimize mission performance while minimizing negative environmental impacts

The EMS is based on the International Organization for Standardization (ISO) 14001 Standard

CNRMA's EMS Goals include:


Reduce energy and water use


Increase purchase of alternative fuel vehicles, hybrid, and plug-in hybrid vehicles


Reduce greenhouse gas emissions


Reduce use of petroleum in fleet vehicles


Increase use of alternative fuels and renewable energy


Integrate green building concepts in major renovations and new construction


Expand purchase of green products and services; increase recycling


Procure, use, and dispose of electronic equipment in an environmentally-sound manner


Reduce purchase and use of toxic and hazardous materials

What is your role?

All personnel working for or on behalf of CNRMA have roles and responsibilities regarding CNRMA's EMS. Following are some examples:

- Know CNRMA's environmental policy, or the "CARE" acronym
- Know and comply with the environmental procedures that apply to your job
- Know how your job could impact the environment (i.e. potential spills, emission of air pollutants, material and energy use
- Know what your installation's significant environmental aspects are
- Incorporate concepts of conservation and pollution prevention in your day-to-day activities
- Know what to do in the event of a spill or environmental emergency:
  - * Contain the spill if safe to do so
  - * Notify your supervisor
  - * Call Emergency Communications Center

Think about activities you do everyday that may impact the environment:

- Do you recycle?
- Do you buy "green" office supplies?
- Do you print double-sided copies?
- Do you conserve energy and water?
- Do you comply with all environmental laws applicable to your job?

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Enclosure 6. NASO, NASO Dam Neck Annex, NALFF, and NSA Northwest Annex Hunting, Fishing, and Archery Range

Fishing: Questions & Answers

Q: What permits are needed to fish and where can they be purchased?

A: Authorized patrons and guests between the ages 16 and 65 must obtain as appropriate, Virginia (state or county) freshwater fishing licenses and Base fishing permits. Virginia Saltwater fishing licenses are required for anyone attempting saltwater fishing except when fishing from MWR piers that maintain pier licenses. Dependents and guests under the age of 12 must be directly supervised by an adult, 18 years of age or older, who holds a valid fishing licenses and station permits. Permits are sold at the NAS Oceana and NASO Dam Neck Annex MWR ITT offices and they are currently valid, in authorized locations only, at: NAS Oceana, NASO Dam Neck Annex, NSA Northwest Annex, JEB Little Creek, and JEBLC Fort Story. Permits are currently $8.00 for a full calendar year, but the cost is subject to change.

Q: When can I Fish?

A. Fishing is only authorized during state sanctioned seasons. Fishing is from sunrise to sunset (dawn to dusk), unless otherwise stipulated in the Base Fishing Instruction.

Q: With what can I Fish?

A. Fishing shall be conducted only by angling with a hook and line or rod and reel, held in hand. No more than two treble hooks are permitted on any fishing lure. In catch-and-release waters, barbed hooks are discouraged and treble hooks are prohibited. A hand-held landing net may also be used to remove legally hooked fish. No live bait fish are authorized.

Q: Where can I get more specific information regarding fishing on base?

A. Visit the Natural Resources Website and view the CNRMA Fishing Instruction. The general content of the instruction is still good, but there have been updates to fishing area locations, and ticket purchasing locations. Contact the NRC for the most current information.

Q: Can I use a boat?

A. Only at those locations authorized in the Fishing instruction. The boat and trailer should be cleaned, thoroughly flushing water through the motor's cooling system, live wells, and other areas that hold water and drying the boat and equipment for five days in a sunny location before transferring it to a new body of water.

Additional Information

WARNINGs:
No off-road or 4-wheel driving is authorized.

Be aware there are venomous snakes and poisonous plants on the premises.

It is unlawful and strictly PROHIBITED to harm, disturb, or collect plants and animals.

The release of fish of or other aquatic wildlife not caught on the premises is PROHIBITED.

The release of any animals or the planting of any plants without the written approval of the Base's Natural Resources Manager is PROHIBITED.

It is recommended that individuals recreating on site use insect repellent.

It is required to provide, when requested, appropriate identification, permits and passes to Base Security and Conservation Law Enforcement Officers.

Please enjoy yourself while recreating on base and help us maintain it by packing out your trash and placing your litter in appropriate receptacles.

Public Access

Hunting, Fishing & Archery range utilization is open to anyone with Base Access privileges. Members of the General Public that would like to recreate on base must have a qualified sponsor. Sponsors can be active or retired military or government civilians with current base access identification. Contact the Natural Resource Center (NRC) at 757-433-2151 or stop by the NRC, Building 78, to ensure you have all appropriate access documentation.

You may also visit the Natural Resources Website at:
http://www.cnic.navy.mil/Oceana/About/Departments/NaturalResources/index.htm

In case of an emergency call 911 or 757-433-9111.

Hunting, Fishing & Archery Range

NAS Oceana,
NASO Dam Neck Annex,
NALF Fentress &
NSA Northwest Annex

Hunting: Questions & Answers

Q: What do I need to do to hunt on the local bases?

A: (1) You must be Active Duty, dependent or retired. DoD Civilians are allowed and Non-DoD affiliated civilians are allowed with a qualified sponsor.

(2) You need a Hunter Safety Course Certificate valid in the state of Virginia.

(3) You need to attend the annual Basic Hunter Indoctrination (Indoc.) conducted by Navy Natural Resources Staff.

Note: The above will allow you to deer hunt with shotgun, buckshot only, at NASO Dam Neck Annex, NALF Fentress, and NSA Northwest Annex. The fee for the annual license as of 2010 is $20.00 (subject to change). This license is in addition to the required Virginia State Hunting Licenses.

(4) To hunt via Shotgun with Slugs, Muzzleloader, or Archery:

Shotgun Slugs?

You must qualify with your shotgun by shooting 3 out of 3 slugs within a 9" circle @ 50 yards. You will be allowed to shoot from a seated rest.
Note: Slugs are only allowed for use at NSA Northwest Annex.

Muzzleloader?

You must qualify with your muzzleloader by shooting 3 out of 3 slugs within a 9" circle @ 50 yards. You will be allowed to shoot from a seated rest. Flintock, Percussion Cap and In-Lines are allowed on NAS Oceana, NASO Dam Neck Annex, NALF Fentress, and NSA Northwest Annex only in designated hunting areas.

Archery?

You must have graduated from the International Bowhunter Education Program (IBEP) which is taught at the Natural Resources Center (NRC) Building #78 on NAS Oceana. Schedules will be posted by July 1st each year. You must qualify by shooting two arrows from an elevated platform into the kill zone of each of three 3D deer targets placed at varying ranges. The ranges will vary from directly beneath the platform out to 30 yards maximum. Your archery tackle will be inspected prior to any qualification attempt and can be grounds for rejection if determined to be unsafe. The qualification will be with Broadheads attached unless you will be hunting with Mechanical Broadheads; you will be allowed to shoot field points in this instance.

Q: Where do I purchase a permit?

A: You must have both the appropriate State Hunting Permit(s) and a Base Hunting Permit. Contact the appropriate state Wildlife Agency for information on purchasing their permits. Base Hunting Permit can be purchased from the NAS Oceana or NASO Dam Neck Annex MWR ITT ticket offices.

Q: Where and when are qualifications?

A: A schedule of qualifications will be posted at the NRC/NAS Oceana Bldg. 78, made available at the Basic Indoctrination Classes, and will be posted on the Natural Resources Program Website. Muzzleloader and shotgun qualifications will be conducted at the NASO Dam Neck Annex rifle range. Bow qualifications will be conducted at the NRC/Bldg. #78. All qualifications must be observed by designated NRC representatives on scheduled days to be valid.

Q: Where can I hunt on base?

A: The NAS Oceana Natural Resources Center controls and manages all hunting aboard NAS Oceana, NASO Dam Neck Annex, NALF Fentress, and NSA Norfolk Northwest Annex. Areas are designated at each base for Archery, Shotgun, and Muzzleloader as applicable. NAS Oceana allows Archery and Muzzleloader ONLY. NASO Dam Neck Annex and NALF Fentress allow Archery, Shotgun (Buckshot Only) and Muzzleloader. NSA Northwest Annex allows Archery, Shotgun (Buckshot and Slugs) and Muzzleloader. Maps of the exact hunting area are located on the Natural Resources website or can be obtained at the Natural Resources Center, Oceana building 78.

Q: Can I hunt anything else besides deer?

A: Yes. Small game hunting is authorized. Contact the NRC for more details.

Q: When can I deer hunt?

A: Within the State Hunting season dates, generally from Oct 1st through the 1st Saturday in January. NAS Oceana has an extended hunting season through the end of February. Operational Security and Threat Conditions will dictate closures but normally NAS Oceana, NASO Dam Neck Annex and NALF Fentress are open 6 days a week, closed only on Sundays. NSA Northwest is only open on Tuesdays, Thursdays, and Saturdays.

Q: Can I deer hunt from the ground?

A: Ground hunting or stalking is only allowed by Archers (except crossbow archers). No ground hunting is allowed on any base by Shotgun, Muzzleloader or Crossbow hunters.

Q: Do I need a tree stand?

A: Tree stands are required of all Shotgun, Muzzleloader and Crossbow hunters. These stands must be elevated at a shooting height of 15 feet. Climbers and clip-ons are allowed with minimal tree limb removal permitted. NAS Oceana, NASO Dam Neck Annex, and NALF Fentress have no permanent tree stands available. Any permanent tree stands found on these bases are not maintained and are unauthorized for use. NSA Northwest Annex has permanent tree stands available for use. Much work has gone into the stands at NSA Northwest Annex but they are still only available for use at your own risk and judgment. You can use your own tree stand at these locations but you must use it in the vicinity of the stand you have checked out.

Q: Where do I find the Base's Annual Hunting Rules & Regulations?

A: On the Oceana Natural Resources website. For questions regarding the R&Rs visit the Natural Resources Center, Oceana building 78, or call the NRC at 757-433-2151.

Archery Range: Questions & Answers

Q: Where is the Archery Range?

A: The range is located off of Oceana Blvd., across from the Oceana Stables, at/adjacent to the Natural Resources Center, NASO building 78.

Q: What do I need to do to use the archery range on NAS Oceana?

A. Obtain a permit from the Oceana MWR ITT ticket office and visit the NRC to fill out the appropriate paperwork and obtain required signatures and stamps. Contact the NRC if you have additional questions.

Q: Can I use the range if I purchased a base hunting permit?

A: Yes, the hunting permit and the archery range permit are all on 1 single permit. If you qualify to be a hunter you can use the archery range for the permitted calendar year. If you do not qualify to be a hunter or you do not want to hunt but just use the archery range you may get your permit stamped for archery range use only. You are not authorized to use this range until you have obtained the range or appropriate hunting stamps, signatures and card lamination. (To get your permit stamped for archery range use only visit the NRC, Oceana Building 78.)

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Enclosure 7. Naval Air Station Oceana, Oceana Pond Outdoor Recreation Area

Please enjoy yourself on the trail and help us maintain it by placing your litter in the marked receptacles along the way.

Additional Information

NAS Oceana sponsored Scout Troops may use the camping area on a reservation basis. Scouts utilizing these facilities contribute to this beautiful natural area by helping with regular maintenance.

WARNINGs:
No vehicles are authorized to drive past the gate without prior approval and appropriate passes and identification. Park in designated parking areas ONLY.

No off-road or 4-wheel driving is authorized.

Be aware this is a natural area and there are venomous snakes and poisonous plants on the premises. **It is unlawful and strictly PROHIBITED to harm, disturb, or collect plants and animals.**

The release of fish of or other aquatic wildlife not caught on the premises is PROHIBITED.

The release of any animals or the planting of any plants without the written approval of the Base's Natural Resources Manager is PROHIBITED.

Alcoholic beverages, glass bottles, and firearms are PROHIBITED.

Fishing and use of the archery range are by permit ONLY.

It is recommended that individuals recreating on site use insect repellent.

It is required to provide, when requested, appropriate identification, permits and passes to Base Security and Conservation Law Enforcement Officers.

Public Access

Oceana Pond is open to anyone with Base Access privileges. Members of the General Public that would like to recreate on Oceana Pond must have a Base Sponsor. Base sponsors can be active or retired military or government civilians with current base access identification. To recreate at Oceana Pond or for other questions regarding Natural Resources Programs please contact the Natural Resource Center (NRC) at 757-433-2151 or stop by the NRC, Building 78, to ensure you have all appropriate access documentation.

You may also visit the Natural Resources Website at:
http://www.cnic.navy.mil/Oceana/About/Departments/NaturalResources/index.htm

In case of an emergency call 911 or 757-433-9111.

Naval Air Station Oceana Oceana Pond Outdoor Recreation Area

Welcome to the NASO Oceana Pond – natural area preserved and restored through the collective efforts of the Navy's Construction Battalion Unit #415, the Chesapeake Bay Youth Conservation Corps, the City of Virginia Beach Habitat Enhancement Committee, NASO's Natural Resources Division and volunteers.

The pond area supports several natural habitat types including forested wetlands, freshwater wetlands, open water, and upland forests. Due to the diversity of habitats, the pond supports a variety of wildlife including various waterfowl, deer, songbirds, small mammals, reptiles, and amphibians.

The NASO Oceana Pond is one of the premier outdoor recreation areas on NASO were fishing, nature watching, hiking, picnicking, and canoeing are authorized.

Trails

Trail Map

The Oceana Pond Trail starts near the Natural Resources Center (at the wildflower meadow) and continues for nearly a mile through forested area. The naturally maintained trail then loops around the eight-acre Oceana Pond, providing hikers with a continuous circuit for observing the plants and animals within the area. The nature lover exploring the trail will encounter a host of native plants. Some of these plants are marked along the trail, while the location of others is noted on this trail map.

We hope that you will enjoy your visit and are able to apply some of the concepts utilized here in your own back yard. Some of these concepts include: the use of native plants for landscaping (which are more drought and disease tolerant than many ornamental plants), bluebird and wood duck boxes (with predator guards), bat boxes, the retention of some dead trees for woodpecker and squirrel nesting, and the use of fallen leaves, or "leaf litter," for compost. The following points of interest, which reflect many of these concepts, are identified along the trail:

1. WILDFLOWER MEADOW

The wildflower meadows may have a variety of flowers in bloom, depending on the time of year you visit. Wildflowers are not only beautiful, their nectar, leaves and seeds provide a valuable food source for a number of small creatures, including, birds, butterflies, and other insects.

2. BORROW PONDS

The footpath leading to the pond passes on the south side of two small ponds shaded by an assortment of forest trees. Typical trees in this area include ash, sweet gum, black cherry, oak, and poplar. These trees and their associated wetland habitat serve as a source of food and water for many species of birds and small mammals. The ponds are also home to a number of amphibians and reptiles.

3. LEAF LITTER

Underlying the forest canopy, you will note an abundance of dry leaves. Leaf litter provides natural organic compost in woodland settings. Within this leaf litter, fungi, bacteria, and small organisms, such as beetles and worms, break down the leaves into a nutrient-rich mulch. The small absorbing roots of trees and shrubs then proliferate in this mulch, accelerating the growth of the plants.

4. IRONWOOD

American hornbeam (*Carpinus caroliniana*) is also known as ironwood or musclewood due to the strong muscle-like appearance of its trunk and the density of its wood. Ironwood bears fruit, which is eaten by many birds such as cardinals, goldfinch, wood duck, bobwhite, pheasant, and wild turkeys. Rabbit and deer also nip and browse on new shoots. This pretty native tree, which is usually found along rivers and streams, serves as an excellent example of a tree species that provides abundant food for wildlife and can also be used in a naturalized landscape. Flowering dogwood (*Cornus florida*) is another native plant that makes a nice addition to the landscape while providing food and shelter for approximately 94 species of birds.

5. NATIVE FERNS

Late spring is an excellent time to observe ferns along the trail. Just south of the pond there is a wet depression with five different species of ferns, including royal fern and cinnamon fern. In the early spring, fern fiddleheads serve as a food source to deer, squirrels, and small mammals. Ferns are also an attractive native ground cover for partially shaded areas.

6. HIGHBUSH BLUEBERRY

Vaccinium corymbosum, or highbush blueberry is an excellent understory shrub. This species is an important food source for deer and birds. Highbush blueberry is well adapted to Virginia and makes an attractive native ornamental backyard plant. The shrub does very well in shaded corners of buildings and along the shady side of fences.

7. TREE SNAG

Many birds and small mammals, such as woodpeckers and squirrels, use the crevices of decaying trees as nesting sites and perches. Instead of cutting down damaged trees, Natural resources personnel encourage leaving some snags for wildlife.

8. WOOD DUCKS

Take a moment while viewing the pond to observe (but not disturb) our wood ducks. Wood ducks, which adapt to a variety of wetlands, including artificially constructed ponds and ditches, nest in both natural cavities and nest boxes. The wood duck boxes in the pond provide additional shelter during the nesting season. The round metal flashing around the underside of the boxes is installed to deter raccoons, opossums, and various snakes that will eat eggs and baby ducks if given an opportunity. If you install a wood duck box in a marsh or pond, remember to include this "predator guard." Other waterfowl that you may observe include the wigeon, mallard, gadwall, and hooded merganser.

9. WETLANDS MITIGATION AREA

The nature trail winds around to the east, through a wooded lane that opens into a marsh area on the southeast corner of the pond. This area was designed by the Natural Resources Division to compensate for minor wetland losses associated with construction projects on NAS Oceana. The marsh is an excellent place to view wetland plants. Wetland species in this area include those that were planted and many "volunteer" species. Trees planted in the mitigation area include Bald Cypress (*Taxodium distichum*) , Atlantic White-cedar (*Chamaecyparis thyoides*), and River Birch (*Betula nigra*).

10. BOAT RAMP

The ramp located on the northwest side of the Pond is for recreational use. Watercraft on the lake are limited to handpowered boats and canoes. A life jacket is required for each person in the boat and persons under the age of 10 years must wear jackets while aboard boats.

11. NATIVE SHRUBS

The understory around the Pond includes many native shrubs, such as dogwood, holly, blueberry, and pawpaw. Many of these species have the advantage of being shade-tolerant, which allows them to survive in the shaded understory. Many other tree/shrub species do not survive in the decreased sunlight environment of the forest floor.

12. DECAYED LOG

Over 85 bird species forage on decayed logs. Fungi often colonize on fallen trees and limbs, providing an additional food source for small mammals. Insects, such as beetles, grubs, and centipedes, live and breed in the logs, while slowly consuming the wood. Decayed wood provides lignin, which is an important nutrient source for these lower organisms.

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Enclosure 8. Compliance: Wildlife

Compliance: Wildlife

- Threatened & Endangered Species
- Marine Resources
- Migratory Birds
- Bald Eagles
- Code of Virginia
- Code of North Carolina


Bald Eagle, *delisted but still protected*


Small Whorled Pogonia


Loggerhead Sea-Turtle


Canebrake Rattlesnake

Endangered Species Act (ESA); Marine Mammal Protection Act (MMPA); Bald & Golden Eagle Protection Act; Code of Virginia; Migratory Bird Treaty Act (MBTA)...etc. (there are many laws which protect wildlife, several of which cross international/country borders)

Yes, even the dead remains of a protected species are protected and you are subject to federal or state penalties if found to be in violation of the law (possession without permit is a violation).

Assume all bird species are protected (since there are very few species that are not protected).

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Enclosure 9. Poisonous Plants

NIOSH

Fast Facts

Protecting Yourself from

Poisonous Plants

Any person working outdoors is at risk of exposure to poisonous plants, such as poison ivy, poison oak, and poison sumac. When in contact with skin, the sap oil (urushiol) of these plants can cause an allergic reaction. Burning these poisonous plants produces smoke that, when inhaled, can cause lung irritation.

Workers may become exposed through:

- Direct contact with the plant
- Indirect contact (touching tools, animals, or clothing with urushiol on them)
- Inhalation of particles containing urushiol from burning plants

Symptoms of Skin Contact

- Red rash within a few days of contact
- Swelling
- Itching
- Possible bumps, patches, streaking or weeping blisters
  NOTE: Blister fluids are not contagious

First Aid

If you are exposed to a poisonous plant:

- Immediately rinse skin with rubbing alcohol, poison plant wash, or degreasing soap (such as dishwashing soap) or detergent, and lots of water.
  - Rinse frequently so that wash solutions do not dry on the skin and further spread the urushiol.
- Scrub under nails with a brush.
- Apply wet compresses, calamine lotion, or hydrocortisone cream to the skin to reduce itching and blistering.
  - Oatmeal baths may relieve itching.
- An antihistamine may help relieve itching.
  - NOTE: Drowsiness may occur.
- In severe cases or if the rash is on the face or genitals, seek professional medical attention.
- Call 911 or go to a hospital emergency room if you have a severe allergic reaction, such as swelling or difficulty breathing, or have had a severe reaction in the past.

Poisonous plants, from left to right: poison ivy, poison oak, poison sumac.

Images courtesy of U.S. Department of Agriculture.

Protect Yourself

- Wear long sleeves, long pants, boots, and gloves.
  - Wash exposed clothing separately in hot water with detergent.
- Barrier skin creams, such as lotion containing bentoquatum, may offer some protection.
- After use, clean tools with rubbing alcohol or soap and lots of water. Urushiol can remain active on the surface of objects for up to 5 years.
  - Wear disposable gloves during this process.
- Do not burn plants or brush piles that may contain poison ivy, poison oak, or poison sumac.
  - Inhaling smoke from burning plants can cause severe allergic respiratory problems.

When exposure to burning poisonous plants is unavoidable, employers should provide workers with:

- A NIOSH-certified half-face piece particulate respirator rated R–95, P–95, or better. This recommendation does NOT apply to wildland firefighters, who may require a higher level of protection.
- These respirators should protect against exposure to burning poisonous plants, but will not protect against all possible combustion products in smoke, such as carbon monoxide.
- Respirators must be worn correctly and consistently throughout the time they are used.
- For respirators to be effective there must be a tight seal between the user's face and the respirator.
- Respirators must be used in the context of a written comprehensive respiratory protection program (see OSHA Respiratory Protection standard 29 CFR 1910.134).
- For more information about respirators, visit www.cdc.gov/niosh/npptl/topics/respirators/

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

www.cdc.gov/niosh/topics/outdoor/

DHHS (NIOSH) Publication No. 2010–118

Telephone: 1–800–CDC–INFO
TTY: 1–888–232–6348
E-mail: cdcinfo@cdc.gov

Enclosure 10. Invasive Plant Species Brochure for Hampton Roads Installations

Kudzu vine (*Pueraria montana*)

photo courtesy of Carolina Silvics

additional resources for invasive plant species information

DoD Natural Resources, Invasive Species Management (www.dodinvasives.org)

National Invasive Species Council (www.invasivespecies.gov)

USDA National Invasive Species Information Center (www.invasivespeciesinfo.gov/)

U.S. Fish and Wildlife Service (www.fws.gov/invasives/)

U.S. Forest Service (www.fs.fed.us/invasivespecies/index.shtml)

Virginia Department of Conservation and Recreation (www.dcr.virginia.gov/natural_heritage/vaisc/)

North American Invasive Species Network (www.naisn.org/generalinformation.html)

NAVFAC Mid-Atlantic
9742 Maryland Avenue
Norfolk, VA 23511

Last Update: Feb 2017

For more information, contact:

Naval Air Station Oceana
Department of Public Works
Environmental Program
953 Hornet Dr., Bldg. 820, Suite 206
Virginia Beach, VA 23460-2190
(757) 341-1700

TETRA TECH

invasive plant species

"...the homeland is vulnerable to a different type of asymmetric attack, a biological attack from invasive species."

— Col. Robert J. Pratt

Tree-of-heaven (*Ailanthus altissima*)

photo courtesy of L. Eiser

Common invasive plants at:

- Naval Air Station Oceana
- NASO Dam Neck Annex
- Naval Auxiliary Landing Field Fentress
- Naval Support Activity Hampton Roads Northwest Annex (NSAHR NWA)

The purpose of this brochure is to provide a basic understanding of the most common invasive plants occurring at four Navy installations in the Hampton Roads region, the threats they pose, and what you can do to help control and prevent their spread.

what are invasive species?

Invasive species are plants, animals, or micro-organisms that are non-native and are likely to cause economic or environmental harm or harm to human health. They are often spread by wind, wildlife, and intentional or unintentional actions.

The Department of Defense and other Federal and state agencies have instituted policies and guidelines to prevent and control the introduction and spread of invasive species.

why are invasive plants a problem?

Invasive species can interfere with military operations and readiness, kill or shade out native plants, harm fish and wildlife and their habitats, and have negative economic impacts on crop yields and forest productivity. Furthermore, invasive species are a threat to availability of training areas, increase risk of wildfires, and can pose serious health and safety issues for people.

Economic losses and control costs have been estimated to exceed $120 billion per year (Pimentel et al. 2005)

Common reed (*Phragmites australis*)

photo courtesy of Carolina Silvics

Invasive Plant Species Watch List

Invasive Plant Species	NAS Oceana	NASO DNA	NALF Fentress	NSAHR NWA
Alligator weed (*Alternanthera philoxeroides*)	■	■	■	■
Asian spiderwort (*Murdannia keisak*)	■			
Asiatic sand sedge (*Carex kobomugi*)		■		
Autumn olive (*Elaeagnus umbellata*)	■	■		■
Beach vitex (*Vitex rotundifolia*)				
Border privet (*Ligustrum obtusifolium*)	■	■		
Callery pear (*Pyrus calleryana*)	■	■	■	■
Chinese lespedeza (*Lespedeza cuneata*)	■	■	■	■
Chinese privet (*Ligustrum sinense*)	■	■	■	■
Chinese silvergrass (*Miscanthus sinensis*)	■			
Chinese wisteria (*Wisteria sinensis*)	■	■	■	■
Common dayflower (*Commelina communis*)	■	■	■	■
Creeping liriope (*Liriope spicata*)	■			■
Dwarf periwinkle (*Vinca minor*)			■	
English ivy (*Hedera helix*)	■	■	■	■
European water-milfoil (*Myriophyllum spicatum*)				
Gill-over-the-ground (*Glechoma hederacea*)	■	■	■	
Golden bamboo (*Phyllostachys aurea*)	■		■	■
Japanese honeysuckle (*Lonicera japonica*)	■	■	■	■
Japanese hops (*Humulus japonicus*)	■			
Japanese privet (*Ligustrum japonica*)	■			
Japanese stilt grass (*Microstegium vimineum*)	■	■	■	■
Johnson-grass (*Sorghum halepense*)	■	■	■	■
Kudzu vine (*Pueraria montana*)	■			
Lily turf (*Liriope muscari*)				■
Mimosa (*Albizia julibrissin*)	■	■	■	■
Multiflora rose (*Rosa multiflora*)	■	■	■	■
Pampas grass (*Cortaderia selloana*)	■	■		
Parrot feather milfoil (*Myriophyllum aquaticum*)	■	■		
Periwinkle (*Vinca major*)	■			
Phragmites (*Phragmites australis*)	■	■	■	■
Porcelain berry (*Ampelopsis brevipedunculata*)			■	■
Princess tree (*Paulownia tomentosa*)			■	
Shrubby bushclover (*Lespedeza bicolor*)	■			■
Tall fescue (*Festuca elatior* [*F. pratensis*])	■			
Thorny elaeagnus (*Elaeagnus pungens*)	■	■		
Tree-of-heaven (*Ailanthus altissima*)	■		■	
White mulberry (*Morus alba*)	■		■	
White poplar (*Populus alba*)	■			

Bold = High Priority Species

Additional resources for photos and detailed descriptions of these invasive plants are listed on the back of this brochure. Additional information on controlling invasive plants is available from Natural Resources Managers.

Chinese wisteria (*Wisteria sinensis*)

photo courtesy of K. Metcalf

what you can do about invasive plants

You can help stop invasive plants by identifying these species and taking actions to prevent their introduction and spread:

- Learn about the invasive species that are in your area and what is being done about them
- Be able to identify invasive plants
- Report new invasive species and infestations to the Natural Resources Manager
- Remove invasive plants from your property
- Plant non-invasive plants on your property
- Clean boats and trailers, off-road vehicles, boots, waders, and other pathways of spread to stop hitchhiking invasive species
- Use certified “weed-free” forage, firewood, hay, mulch, and soil
- Volunteer for organized efforts to remove invasive species from natural areas and support organizations that work with invasive species

Natural Resources Managers need your help to prevent and contain the spread of these invaders.

Early Detection and Rapid Response (EDRR) is critical to identify new areas of infestation, rapidly respond, and increase the chances of success.

The Department of Defense is a leader in natural resources management and controlling invasive species.

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Enclosure 11. Venomous Snakes of Naval Facilities in Southeastern Virginia

Characteristics of Venomous Snake

- Elliptical pupil (Figure 7)
- Pit organ: The pit organ is located on each side of the head between the eye and nostril (Figure 1) It detects heat from small mammals and other prey
- The scales under the tail form only a single row (Figure 8)
- The head is distinctly wider than the neck (However, this is also true for many nonvenomous snakes)

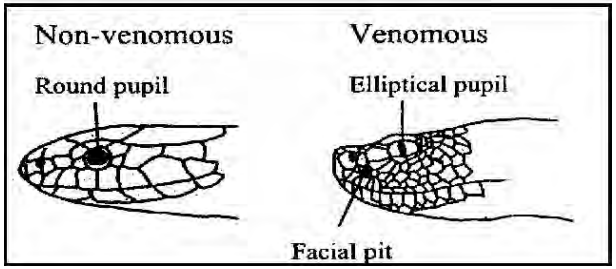


Figure 7. Facial characteristics of nonvenomous and venomous snakes of Virginia.

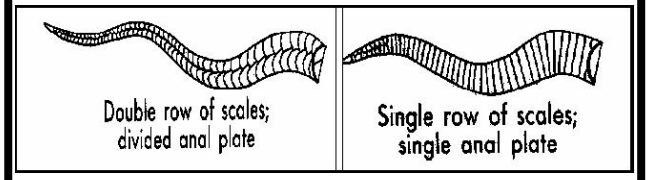


Figure 8. Undersides of tails of a nonvenomous and venomous snake.

Safety

• Wear long pants & hiking boots while in areas known to have snakes.

• Stay on hiking/designated trails.

•Avoid walking through dense piles of brush.

• Do not step over or move logs or rocks without checking for snakes first.

• Do not disturb any snakes you see. Most snakes will not strike unless provoked.

• If you are bitten by a snake seek medical attention immediately.

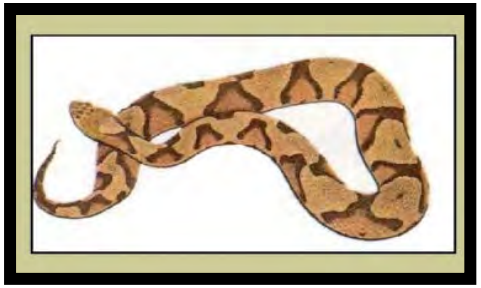
•DO NOT PANIC!!!

For any emergency, 1st call 911:
Notify Installation CDO
&/or
757-433-9111(NASO/NALFF; NASO DNA)
or
757-421-8000 (NSA NWA)
Report all wildlife incidences to your local Environmental Office, Safety Office, or Security Office.

Oceana Environmental and Natural Resources: 433-3461 or 433-2151.

Information provided by:
Chris Petersen
Atlantic Division, Naval Facilities Engineering Command
and
Dr. Alan H. Savitzky
Old Dominion University

Venomous Snakes of Naval Facilities in Southeastern Virginia



Canebrake Rattlesnake

(Crotalus horridus)

Figure 1. Canebrake Rattlesnake

Figure 2. Rattle of Canebrake. Shape of rattle and number of segments varies.

Description

•Black chevron-shaped markings on a dark yellow, gray or tan background color
•Orange or rust-brown stripe down the middle of the back
•Black tail with distinctive rattle
•Newborns look like adults, but rattle consists of only one segment

Size

Average length: 54 inches
Maximum length in Virginia: 67 inches

Remarks

This snake was listed as State Endangered in 1992, primarily due to habitat loss.

Copperhead

(Agkistrodon contortrix)

Figures 3, 4. Copperhead

Description

Chestnut to brown hourglass-shaped bands on a lighter brown to tan back-ground color
Hourglass markings on the sides may not always match up along the back
Newborns and young have a bright yellow tail.

Size

Average length: 45.3 inches
Maximum length in Virginia: 48 inches

Remarks

This snake is often confused with a juvenile rat snake.

Cottonmouth

(Agkistrodon piscivorus)

Figures 5, 6. Cottonmouth

Description

Black, olive or brown bands on a lighter olive to gray background
Some individuals may appear to be all back in color, especially when out of the water
Newborns and young have a bright yellow tail.

Size

Average length: 51.8 inches
Maximum length in Virginia: 61 inches

Remarks

Habitats used by this snake include: streams, lakes, rivers and ditches. It is often confused with three com-mon species of nonvenomous water snakes.

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Enclosure 12. Commanding Officer’s Environmental Policy

NAVAL AIR STATION OCEANA
ENVIRONMENTAL POLICY

1. Environmental stewardship is essential to the safe, healthful and compliant execution of our mission and the protection and preservation of our natural resources. I expect all commands and personnel onboard Naval Air Station (NAS) Oceana, Dam Neck Annex and Naval Auxiliary Landing Field Fentress to be active stewards of the environment in their day-to-day operations and planning

2. To that end, NAS Oceana will establish, maintain and communicate an Environmental Management System that will:

a. Comply with applicable laws, regulations and policies.

b. Integrate environmental stewardship with operational decisions.

c. Implement, modify and sustain practices that minimize and prevent creation of waste and pollutants at their source.

d. Develop objectives and targets to minimize environmental risk and monitor progress towards those goals.

e. Educate our workforce and supported commands on their responsibility to the environment.

f. Foster communication throughout the installation on our environmental commitments and performance.

g. Sustain our partnerships with public agencies and community organizations to mutually monitor and improve the quality of the environment.

3. These actions can be summarized through the acronym "CARE". We will:

a. Comply with the rules

b. Always improve

c. Reduce waste

d. Eliminate pollution

R. J. MEADOWS

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Appendix J

Urban Forestry, Grounds Maintenance, and Landscaping Management

Enclosure 1 **Tree City USA Recertification Application**
Enclosure 2 **Tree City USA Proclamation**
Enclosure 3 **Pruning and Planting Guidelines**
Enclosure 4 **Native Plants for Landscaping**
Enclosure 5 **NASO Instruction 5090.2E (Procedures for Cutting Firewood and Use of Tree Products)**

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Enclosure 1. Tree City USA Recertification Application

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Tree City USA

2016 Application for Certification

TREE CITY USA

The Tree City USA award is in recognition of work completed by the community during the 2016 calendar year.

As Mayor or Equivalent of the Community of NAS Oceana

I herewith make application for this community to be officially certified/recertified as a Tree City USA for 2016, having achieved the standards set forth by the Arbor Day Foundation as noted below.

Standard 1: A Tree Board or Department
Community has a Tree Board only

Tree Board Chair
Michael Wright Natural Resources Manager 757-433-3461 michael.f.wright@navy.mil

Standard 2: A Community Tree Ordinance
✔ Our community ordinance is on record

Standard 3: A Community Forestry Program with an Annual Budget of at Least $2 Per Capita

Total Community Forestry Expenditures	$751090.32
Community Population	12000
Per Capita Spending	$62.59

Standard 4: An Arbor Day Observance and Proclamation
✔ Official Arbor Day proclamation is on record

Mayor or Equivalent Signature	Title	Date
	CAPT, USN COMMANDING OFFICER	21 Oct 16

Application Certification

To Be Completed By The State Forester:

NAS Oceana

The above named community has made formal application to this office. I am pleased to advise you that we reviewed the application and have concluded that, based on the information contained herein, said community is eligible to be certified as a Tree City USA community, for the 2016 calendar year, having in my opinion met the four standards required for recognition.

State Forester Signature	Title	Date

Arbor Day Foundation®

Print this page

NAS OCEANA
ARBOR DAY
AGENDA
28 April 2016

Prior to 0900- Natural Resources (NR) staff will prepare the site for the tree planting activity.

0845- NR staff to escort Virginia Department of Forestry (VDOF) designated representative on base.

0900- All involved will arrive at the NASO Aviation Park, corner of 3rd St and F Ave…see attached map.

0905- Introduction of the NASO Commanding Officer (CO) and VDOF designated representative. *(Michael Wright, NR Manager)*

0910- Reading and signing of the proclamation. *(Captain Louis Schager, NASO CO)*

0915- History of Arbor Day, explanation of how to plant a tree, explanation of the importance of trees and their relationship to the environment, to celebrating Earth Day and celebrating International Migratory Bird Day. *(Mike Aherron, VDOF Forester and Michael Wright, NR Manager)*

0925- Presentation of the Tree City USA Award, if applicable. *(VDOF representative)* *…award flag will be taken by Command Representative to be flown a minimum of 1 week on the installation flag pole, previous flags not in use can be returned to the installation NR Manager.*

0930- Initiate planting of the tree. *(NASO CO, VDOF representative and Child Development Center/CDC children)…this year's tree is a Bald Cypress.*

0940- Photo ops with NASO CO, CDC children, VDOF designated representative, command reps. etc. Ceremony ends for NASO CO. *(Public Affairs Office representative and NR staff)*

0950- Finish planting the tree and post the new Tree City USA stickers. *(NR staff and volunteers)…ensure placement of tree guard around base of tree, tree is watered (5 gallon watering bucket or bag), mulch is placed around base of tree (no more than 3 inches), etc.*

Note: Event will start at 0905 hours. Length of event varies depending on audience participation.

Proposed Location for 28 April 2016 Arbor Day Tree Planting Ceremony (NAS Oceana)

Tree Planting Site, 2013

Tree Planting Sites, Prior to 2013

N W E S

0 20 40 80 Meters

0 70 140 280 Feet

2016 Urban Forestry Program – Naval Air Station Oceana
Annual Work Plan & Budget
(NASO and NALFF)

Regional Forestry Program Manager(s):

Emmett Carawan, NAVFAC MIDLANT Natural Resources Program Manager
Jack Markham, NAVFAC MIDLANT Natural Resources Forestry Program Media Manager
Taylor Austin, NAVFAC MIDLANT Natural Resources Specialist Intern

Installation/City Forestry Program Manager:

Michael Wright, Natural Resources Program Manager/Team Leader

Additional Forestry Program Affiliates/Consultants:

Mike Aherron, VA Dept of Forestry
Pete Acker, VA Dept of Game & Inland Fisheries
Timothy Craig, US Fish & Wildlife Service
Chris Petersen, US Navy, NAVFAC LANT Natural Resources Specialist
Jeff Gardner, US Navy, NAVFAC HQ Natural Resources Specialist & Forestry Program Manager
Lawrence McGrogan, US Navy, Installation Biological Science Tech. & Conservation Officer
Mark Edwards, US Navy, Installation Biological Science Tech.
Terry Chamberlain, US Navy, Installation Environmental Program Director
(These individuals are consulted regarding the development, management, and implementation of the Base's Integrated Natural Resources Management Plan, which includes the overall Forestry and Urban Forestry Programs.)

Tree Ordinance

A tree preservation and replacement standard operating procedure/instruction including pruning, planting, preservation and mitigation guidelines has been added to the installation's Integrated Natural Resources Management Plan (INRMP). The INRMP is a living and legally binding document required per the Sikes Act. The INRMP is reviewed annually for accuracy, functionality, enforcement, and update requirements. At a minimum of every 5 years the Navy, USFWS, State Wildlife Agency(ies), and NOAA-NMFWS (as appropriate) review the INRMP for operation and effect and issue letters or signatures of concurrence to implement the INRMP. The INRMP received its signatures from the following Agencies in June 2015: US Navy, USFWS Region 5, VA Department of Game & Inland Fisheries, and NOAA-National Marine Fisheries Service.

Community Forestry Program and Budget

The Regional and Installation Natural Resource Managers and staff consider all of the forest and landscape trees in planting and future development decisions. The INRMP Tree Preservation Instruction provides a framework for avoiding or mitigating tree loss due to development. The instruction also defines acceptable grounds maintenance practices with respect to proper tree protection, planting, and care. Execution of our hazardous tree removal plan, per a hazardous tree evaluation conducted by certified arborists, continued on NASO. The Facilities Engineering and Acquisitions Department (FEAD) accomplish the grounds maintenance contract quality assurance. Any tree work contracted to a private company is/was managed by the FEAD and any necessary technical advice provided by the Regional and Installation Natural Resources staff. Any tree work conducted in-house was coordinated through the Navy Natural Resources program managers. In 2016, sailors, marines, Department of Defense civilians, and children from the Base's Child Development Center participated in NASO's inaugural Clean the Base Day and Arbor Day Celebrations. The basewide events included trimming/planting/maintenance of trees and mulching along with other non-tree related activities. Additional tree maintenance was accomplished by 15 Natural Resources Program volunteers for various programmatic objectives throughout the year. In 2016 several storm events in the fall (Tropical Storm Hermine; Former Tropical Storm Julia; Hurricane Matthew; etc.) resulted in basewide tree damage, which was addressed via contracted, military, and MWR personnel actions.

NASO:

Forestry Program Statistics:

Current Estimated Installation Property Acreage: ~5,732 acres

Estimated Amount of Forest Cover upon/prior to Navy Acquisition: TBD

- Evergreen: TBD
- Deciduous: TBD
- Mixed: TBD

Estimated Current Amount of Forest Cover: ~1,400 acres

- Evergreen: ~147 acres
- Deciduous: ~584 acres
- Mixed: ~645
- Upland: TBD
    - 2016 Estimated Upland Forest Cover Lost: 17.5 acres (2,625 trees)
    - 2016 Estimated Upland Forest Mitigation: 0
- Wetland: TBD
    - 2016 Estimated Wetland Forest Cover Lost: 0
    - 2016 Amount of Forested Wetland Mitigation: 0

2016 Trees Planted: 5

2016 Trees Regenerating from Construction or Timber Harvest Activities: 0

- Since 2011, Airfield 5R Clearing: ~2.05 acres (~205 trees)
- Since 2012, Airfield Obstruction/BASH Compliance-Safety: ~2 acres (~400 trees)
- 2016, PAR Line of Sight Clearing for Airfield Compliance: ~17.5 acres (~2,625 trees)
    - Note: additional acreage/trees to be removed by 15 Jan 2017: ~2.35 acres (~875 trees)

2016 Merchantable Timber Trees Permanently Removed: ~5.3 acres (~1,059)

- 2016, PAR Line of Sight Clearing for Airfield Compliance:
    - Note: additional acreage/trees to be removed by 15 Jan 2017: ~1.76 acres (~352 trees)

2016 Non-merchantable Timber Trees Removed: ~1580 trees

2016 Trees Removed as a Forestry Action (currently re-foresting naturally): 0

2016 Trees Pruned: 1150 ≥ 150

2016 Firewood Sales: 0

Notes:

1. Living trees removed for non-construction purposes are replaced. Trees removed for construction purposes are replaced to the maximum extent practical. Trees removed for construction within a wetland area will be replaced or forested wetland banking credits purchased.
2. Currently, have Urban Forest Inventory, Invasive Species Projects and other Forest Resources related projects underway or getting ready to be awarded, which will update existing Forestry Program Information and answer TBD information as appropriate/available.
3. All forest clearing and naturally regenerating estimates are based on 200 trees per acre at maturity. Any areas that are not naturally regenerating and are being specifically managed as part of a forestry program project will be reflected accordingly.

2016 NASO Expenditures & Reimbursements:

Project Association	Acreage (in 2016)	# trees (in 2016)	Type of Action	Type of Funding	Expenditure/ Reimbursement (in 2016)	Info. Source
FY16 Award/FY17 Complete: Precision Aviation Radar Vegetation Maintenance	19.85 (17.5)	3,500 (2,625)	Tree Clearing	Contracted	-$526,025.00 (-$394,518.75)	FEAD
Bldg 820 Back Walk Safety Upgrades (cedar trees)	<0.1	2	Tree Clearing	Inhouse	(-$1000.00)	FMD
Salvage Yard Storm Damaged Trees (Hazard)	<0.1	3	Tree Clearing	Contracted	(-$3000.00)	Est.
B833 Compound Fenceline Maintenance (removal of trees growing in the fence and within the security/safety zone)	<0.1	3	Tree Clearing	Inhouse	(-$1000.00)	Transp.
Airshow Tree Maintenance	0.50	100	Trimming/ Pruning	Self-help	(-$5,000.00)	Est.
Utility Line Maintenance	3.12	624	Trimming/ Pruning	Contracted	(-$136,100.00)	Utilities
General Maintenance (after storm cleanup, etc.)	<0.1	10	Trimming/ Pruning	Self-help	(-$2,000.00)	Est.
Trail Maintenance (Recreation/Education/ Survey Site Access)	1.45	290	Trimming/ Pruning	CN/Self-help	(-$101,790.00)	NR
Chapel Tree Eagle Scout Project (Eastern Red-Buds)	<0.1	4	Planting/Care	Self-help	(-$1,200.00)	WP
ArborDay Celebration	<0.1	1	Planting/Care	CN/Self-help	(-$200.00)	NR
Natural Resources Manager - Forestry Program	5,732	...	Forest Mngt. Program	CN/Forestry	(-$8,340.00)	IEPD
Natural Resources Specialist	5,732	...	Forest Mngt. Program	CN/Forestry	(-$8,340.00)	IEPD
Biological Science Technician	5,732	...	Forest Mngt. Program	CN/Forestry	(-$8,340.00)	IEPD
Conservation Law-enforcement Officer	5,732	...	Forest Mngt. Program	CN/Forestry	(-$8,340.00)	IEPD
Equipment/Supplies/Maintenance	5,732	...	Forest Mngt. Program	CN/Forestry	(-$2,000.00)	NR
FY14 & 15 Award/FY17 Complete: Invasive Species Control	5,732	…	Invasive Species Mngt. Program	CN	-$127,678.73 (-$32,585.59)	NR
FY15 Award/FY17 Complete: Urban Forest Inventory	5,732	…	Forest Mngt. Program	CN	-$30,061.66 (-$16,606.93)	NR

Project Association	Acreage (in 2016)	# trees (in 2016)	Type of Action	Type of Funding	Expenditure/ Reimbursement (in 2016)	Info. Source
FY15 Award/FY17 Complete: Prescribed/Wildland Fire Management Plan/Assessment	5,732	…	Forest Mngt. Program	CN	-$46,303.33 (-$16,606.93)	NR

201 6 Total Urban Forestry Funding Expenditures/Transactions (*Requirement = $24,000.00 based on 12,000 population*) **= $746,968.20** *(Includes projects awarded in previous fiscal years, only those portions of funds executed in the current FY were reported. Includes funding associated with any Forest Resources action, including wildlife survey work.)*

2016 Total Urban Forestry Funding Reimbursements = $0.00 *(Includes funding received as payment for timber value, such as firewood permit sales, forestry program timber harvesting sales, or construction timber clearing timber value payments.)*

Arbor Day Observance and Proclamation

Due to poor weather conditions event was relocated to the Oceana Child Development Center (CDC) on 28 April 2016. A native Bald cypress (*Taxodium distichum*) was utilized has a fun educational tool for teaching children & adults about the importance of trees, the role of a tree in the cycle of life, and how to properly plant and care for a tree. Typically, the children get to assist with actually planting the tree; however due to the weather conditions they could not visit the tree's planting location. Though the children did not get to plant the tree, they did get to interact with the tree: touching the bark, touching the leaves, touching the exposed roots, etc. The tree was later planted by Natural Resources staff at the NASO Aviation Park on 28 April 2016.

CAPT Louis Schager, NASO Executive Officer; Michael Wright, Installation Natural Resources Manager; and Mike Aherron, Virginia Department of Forestry Representative led the interactive educational lessons. Approximately 30 children and 15 adults attended the tree planting ceremony. Many others contributed to the preparation for the ceremony and others provided continued care for the tree after the ceremony. The CDC classes adopted the tree to help nurse it into becoming a mature tree. The Natural Resources program, in addition to purchasing the tree, purchased tree gators, mulch, and tree protectors to help ensure adequate water supply during early development and to prevent landscaping (mowing & weedwhacking) practices from damaging/scaring the tree.

Event announcements were made: on the Installation's Facebook (https://www.facebook.com/NavalAirStationOceana/) and Twitter Accounts (https://twitter.com/nas_oceana); via community email & word of mouth; via a News Release by the Navy's Public Affairs Officer; and the local newspaper "Oceana Observer."

A map of Arbor Day Tree Celebration planting locations is available upon request from the installation's Natural Resources Manager, Mike Wright.

Installation received an award for its 22nd consecutive year as a Tree City USA community.

Attendees of the event received one or more of the following trees to take home and plant: hawthorn, persimmon, and gray dogwood. The trees were supplied by the Virginia Department of Forestry.

News Article on Event:

The Oceana Observer published an article on the event, 12 May 2016: <https://issuu.com/militarynews/docs/observer_finalpdf_05.12.16>.

NALFF (*note: info not included in Tree City USA Application***):**
Forestry Program Statistics:
Current Estimated Installation Property Acreage: ~2,576 acres

Estimated Amount of Forest Cover upon/prior to Navy Acquisition: TBD

- Evergreen: TBD
- Deciduous: TBD
- Mixed: TBD

Estimated Current Amount of Forest Cover: ~1100 acres

- Evergreen: ~67 acres
- Deciduous: ~622 acres
- Mixed: ~366 acres
- Upland: TBD
- Wetland: TBD

2016 Trees Planted: 0

2016 Trees Regenerating from Construction or Timber Harvest Activities:

- Since 2013, Airfield Obstruction Clearing: 19 acres (3,800 trees)

2016 Merchantable Timber Trees Permanently Removed: 0

2016 Non-merchantable Timber Trees Removed: 0

2016 Trees Removed as a Forestry Action (currently re-foresting naturally): 0

2016 Trees Pruned: 150 ≥ 10

2016 Firewood Sales: 0

Notes: (See aforementioned notes.)

2016 NALFF Expenditures & Reimbursements:

Project Association	Acreage	# trees	Type of Action	Type of Funding	Expenditure/ Reimbursement	Info. Source
Trail Maintenance (Recreation/Education/ Survey Site Access)	0.75	150	Trimming/Pruning	CN	-$72,000.00	NR
Natural Resources Manager - Forestry Program	2,576.00	...	Forestry Program	CN/Forestry	-$3,780.00	IEPD
Natural Resources Specialist	2,576.00	...	Forestry Program	CN/Forestry	-$3,780.00	IEPD
Biological Science Technician	2,576.00	...	Forestry Program	CN/Forestry	-$3,780.00	IEPD
Conservation Law-enforcement Officer	2,576.00	...	Forestry Program	CN/Forestry	-$3,780.00	IEPD
Equipment/Supplies/Maintenance	2,576.00	...	Forestry Program	CN/Forestry	-$2,000.00	NR
Invasive Species Control	2,576.00	…	Invasive Species Mngt. Program	CN	-$14,639.91	NR
Urban Forest Inventory	2,576.00	…	Forest Mngt. Program	CN	-$7,461.08	NR
Prescribed/Wildland Fire Management Plan/Assessment	2,576.00	…	Forest Mngt. Program	CN	-$7,461.08	NR

2016 Total Urban Forestry Funding Transactions *(Requirement = $100.00 based on 50 base population)* **= $118,682.07** *(Includes projects awarded in previous fiscal years, only those portions of funds executed in the current FY were reported. Includes funding associated with any Forest Resources action, including wildlife survey work.)*
2016 Total Urban Forestry Funding Reimbursements = $0.00 *(Includes funding received as payment for timber value, such as firewood permit sales, forestry program timber harvesting sales, or construction timber clearing timber value payments.)*

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Enclosure 2. Tree City USA Proclamation

DEPARTMENT OF THE NAVY
1750 TOMCAT BOULEVARD
NAVAL AIR STATION OCEANA
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:

Naval Air Station Oceana

Proclamation

Whereas, *In 1872, Arbor Day founder, J. Sterling Morton set aside a special day for the planting of trees; that first Arbor Day resulted in the planting of more than a million trees in Nebraska; and*

Whereas, *Naval Air Station Oceana is committed to managing and enhancing its natural resources for multiple uses while fulfilling its assigned missions in support of the Departments of Defense and Homeland Security; and*

Whereas, *Naval Air Station Oceana celebrates Arbor Day with the planting of a tree; and*

Whereas, *trees reduce erosion, clean the air, produce oxygen, cut heating and cooling costs, and provide habitat for wildlife; and*

Whereas, *the personnel assigned to Naval Air Station Oceana take great pride in their installation through participation in activities and programs designed to improve the appearance and the quality of life onboard Naval Air Station Oceana; and*

Whereas, *Naval Air Station Oceana takes pride in supporting various community environmental events and activities including Arbor Day, Earth Day, and National Public Lands Day; and*

Whereas, *I, Captain Louis J. Schager, Commanding Officer of Naval Air Station Oceana, do hereby proclaim 28 April 2016 as,*

"The Annual Naval Air Station Oceana Arbor Day Celebration"

In Witness Whereof, I sign this proclamation,

Louis J. Schager
Captain, U.S. Navy
Commanding Officer

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Enclosure 3. Pruning and Planting Guidelines

TREE PRESERVATION AND REPLACEMENT ON INSTALLTION

1. Purpose

a. This policy establishes a program for forest conservation and tree protection during development or maintenance activities. The hierarchy for tree protection initiatives begins with preservation of existing trees wherever practical, and ends with planting replacement trees at specified ratios to compensate for unavoidable loss.

b. The policy parallels the intent of local ordinances. Local municipalities have determined that the planting and preservation of trees is not only desirable but essential to the present and future health, safety and welfare of all citizens.

2. Policy

a. It is the intent of this policy to prevent the unauthorized destruction or disfigurement of existing trees. It is further intended to perpetuate tree growth, to encourage tree preservation and to provide adequate tree canopy and numbers.

b. Where tree preservation is not practicable, replacement tree establishment is required. The determination of justified loss will be made in concert with the appropriate installation and or Regional Environmental Natural Resources Manager, who will also assist with preparation of tree inventories at potential development areas. Such inventories and determinations will be made during the preliminary siting phase of a project.

c. Where concurrence with the finding of justified loss is received from the Natural Resources personnel, it is the intent to require the replacement planting of trees as mitigation. Previously planted and approved tree mitigation banks may be acceptable as replacement. The overall goal is “no net loss” of trees or tree canopy cover.

d. Commercial forestry operations, conducted under an approved Integrated Natural Resources Management Plan or Forest Management Plan are exempt from the requirements of this instruction.

3. Application

a. The terms and provisions of this policy shall apply to:

(1) Development and expansion of existing facilities, including roadway, utilities and other infrastructure development.

(2) Negligent grounds maintenance activities.

b. Actions involving tree removal necessary to meet critical military mission requirements are excluded from this instruction. All such projects will be reviewed for compliance with this instruction by the appropriate installation Natural Resources Manager who may recommend tree protection measures, mitigation for lost trees or selection of alternative sites. Forest products will not be given away, abandoned, carelessly destroyed, used to offset costs of contracts or traded for products, supplies, or services. Natural Resources personnel will review contracts involving removal of significant amounts of timber to ensure these conditions are met.

c. Maintenance activities within NAVFAC P80.3 standards for the airfield clear zones or required for maintenance of ordnance areas, communication systems, security, or right-of-ways are also exempt from the requirements of this instruction.

d. Special accommodations may be made to support Morale, Welfare and Recreation operations and improvements to comply with professional recommendations for the program involved and to assist in furthering these programs at a minimal cost to station personnel.

4. Tree Preservation Plans and Tree Protection

a. Proponents of all projects and activities, which may affect existing trees, shall team with the Natural Resources Manager to identify all trees in the affected area and to develop a project/activity-specific tree preservation plan in accordance with this policy. All trees designated in the plan to be preserved shall be identified on all applicable project drawings, and also shall be marked in the field. Existing trees designated for retention shall be protected in accordance with Attachment A.

b. Certain trees and forests are considered priority areas for tree protection, and shall be left in an undisturbed condition unless no practicable alternative is identified by the Natural Resources Manager. The following areas are designated as priority areas for tree protection:

(1) Trees in wetlands, floodplains, Chesapeake Bay Protection Areas and designated drainage ditches or riparian buffers. Drainage ditch flow routes are exempt from these requirements in order to maintain design flow volumes.

(2) Contiguous forests - forested corridors that connect with other forested tracts.

(3) Critical habitat - protection areas for rare, threatened or endangered species.

(4) Historic trees - associated with historic sites.

(5) Specimen trees - trees 30 inches in diameter or larger, or trees with 75 percent or more of the diameter of the state champion tree.

5. Compensation for Unavoidable Losses

a. Due to the difficulty and time required to replace the function provided by mature trees, replacement ratios shall be based on the size of the individual trees scheduled for removal. In lieu of performing tree replacement activities, the project proponent may elect to fund the replacement.

b. The ratio for determining the number of required replacement trees shall be one replacement tree for every 6" increment in the dbh (diameter breast height) of the tree to be removed, with the replacement ratio to be rounded upwards to the next increment. A minimum 1:1 replacement ratio shall be accomplished. As an example, the following replacement ratios shall be implemented:

(1) Removal of 1" to 5.9" dbh tree: 1:1 replacement
(2) Removal of 6" to 11.9" dbh tree: 2:1 replacement
(3) Removal of 12" to 17.9" dbh tree: 3:1 replacement

c. Replacement tree species and planting locations must be approved by the installation Natural Resources Manager. Replacement planting shall be conducted in accordance with the requirements set forth in Attachment (D). The following guidelines shall be used in developing appropriate tree replacement procedures for each project:

(1) Size. At the time of planting, replacement trees shall be a minimum of two (2) inches caliper.

(2) Siting. Tree locations shall be based on sound urban forestry practices, and shall ensure adequate distance from buildings, sidewalks, roads, utilities, and other development to preclude the need for future tree removal. The location of replacement trees shall favor the benefits provided by trees in an urban setting, including noise attenuation, shading of cooling units and buildings, storm water management benefits, and sensible placement with respect to turf management areas.

(3) Reforestation. In instances where space or conditions at the project site are undesirable for tree replacement, the Natural Resources Manager will assist in identifying priority reforestation locations on installation. Priority planting areas include buffers for drainage ditches, corridors to connect existing forests, buffers

between differing land uses, plantings to achieve energy conservation and expansion of existing forests.

(4) Planting Seasons. Trees shall be planted during the proper planting season to benefit survival rates. For most shade tree species this is the dormant season or leaf-off period and runs from November through March, except when the ground is frozen.

6. Unauthorized Destruction of Trees

a. Instances where trees have been willfully damaged or are found in physically or structurally poor condition as a result of improper protection shall be adjudged as destruction of government property.

b. In instances where compensation for destruction cannot be agreed upon based on the replacement criteria outlined in Section 5 of this enclosure, the Natural Resources Manager may use procedures detailed by reference (m) to calculate tree value. The appraisal process includes valuation of the tree species, size, condition and location. Tree replacement and reimbursement will be the responsibility of the person or persons who caused the destruction.

ATTACHMENT A
TREE PROTECTION STANDARDS

1. Purpose. Proper tree protection during construction and grounds maintenance activities is essential to the long-term survival of trees in development areas.

2. Construction. Existing trees to be saved shall be protected by measures outlined in Attachment (B) to enclosure (1). In addition the following conditions apply:

a. An inventory and map of trees within the footprint of construction activity must be completed. This data should be used to minimize impacts from structures and improvements.

b. Whenever possible, protection areas should include groups rather than individual trees.

c. Excavating equipment should not be used to prune roots inside a protection area. Roots should be severed using a root pruner. If roots outside the tree protection area are encountered during construction, they should be severed using a sharp chansaw, axe or handsaw.

d. Tunneling of utilities should be utilities whenever possible to reduce damage to tree roots. If tunneling or altering the route of utilities is not possible, roots should be pruned with a root pruner.

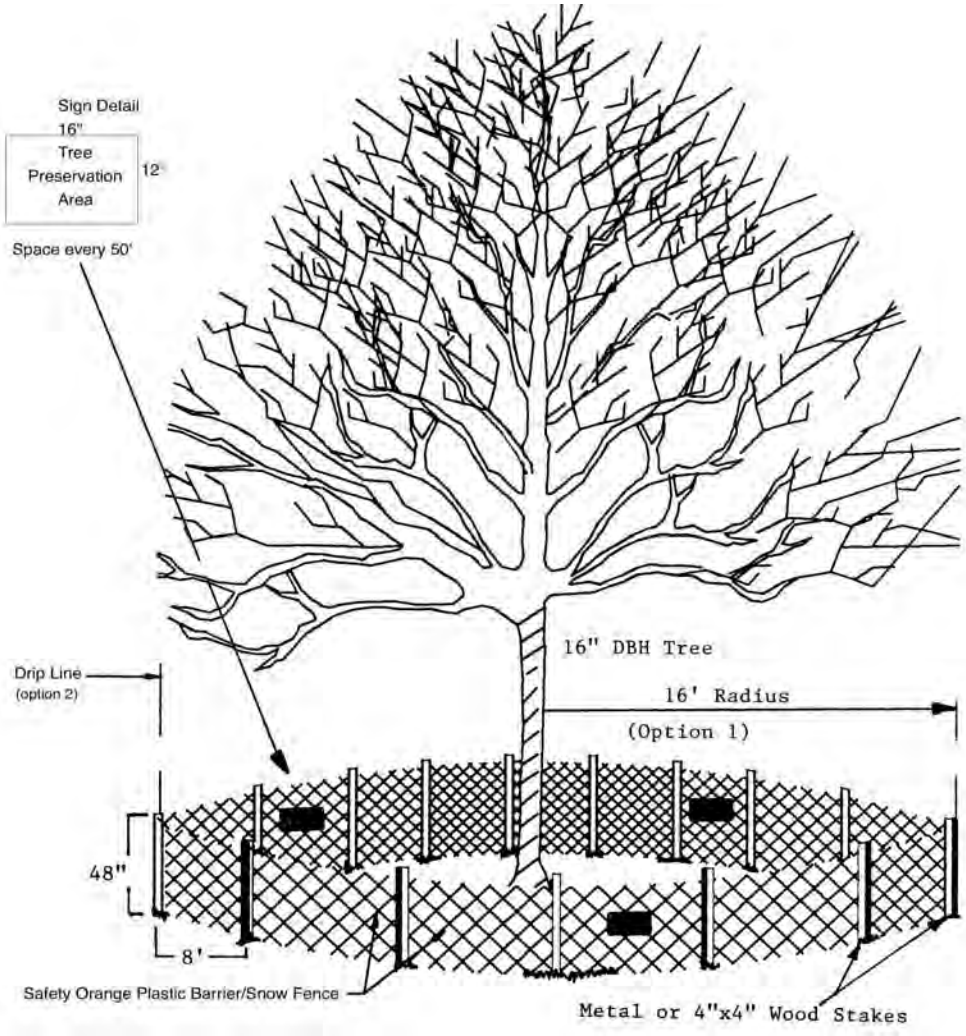
3. Grounds Maintenance. Grounds maintenance personnel shall be responsible for damage to trees and shrubbery in accordance with current grounds maintenance contract requirements. At a minimum, the following standards shall apply:

a. Contractors shall not subject trees, shrubs or hedges to damage by lawn mowers, string trimmers or other equipment. Damage includes wounds inflicted to bark, limbs or exposed roots.

b. Extreme care shall be exercised when performing grounds maintenance work around any of the defined priority areas for tree protection.

4. Tree planting and Care. All tree pruning shall be done in accordance with the information in Attachment (C) to enclosure (1). All tree plantings must be first approved by the installation Natural Resources Manager to ensure selection of proper species and siting. Planting of trees shall be done in accordance with procedures outlined in attachment (D) to enclosure (1). When determining planting locations, long-term survivability shall be considered based on sound forestry practices. Trees shall be planted in locations that favor the benefits of trees and to avoid future tree removal.

TREE PROTECTION DETAIL



1. Prior to any clearing, grading, or construction, tree protection fences (See Detail) shall be placed around all trees to be retained on the site to prevent the destruction or damaging of trees.

- Option 1. If site conditions permit, the radius of the tree protection fence shall be equal to 1 foot for every inch of tree diameter at breast height measured at four and a half (4½) feet above the surface of the ground.

- Option 2. If site conditions do not permit a fence system as large as described above then, the fence shall be located in a circular pattern with a radius equal to the length of the widest or longest branch, or drip line.

a. Fence material shall be made of polypropylene or similar plastic material, and the color shall be safety orange and shall not be less than 48 inches in height.

b. Metal fence stakes or 4-inch x 4-inch wood posts shall be used to erect the fence. Sufficient stakes shall be used to ensure that the fence material remains upright without sagging. Spacing between wood or metal stakes shall not exceed 8 feet.

c. Signs (16 inch x 12 inch) shall be spaced every 50 feet along the fence indicating the site is a tree preservation area.

2. Materials shall not be stockpiled within the tree protection area, and vehicles and other equipment shall be excluded to avoid soil compaction and root damage. Equipment operator shall not damage tree trunks, limbs and roots during clearing, grading or construction operations.

3. Protected trees shall be kept free of nails or other fastening devices, signs, survey makers, and electrical wires.

4. In cases where the construction drawings indicate that utilities, sidewalks or other structures enter the tree protection area, the following protection measures shall be implemented.

a. Minimize disturbance to the root area by adjusting the tree protection fence and staying as far away from the tree as possible. Disturbance shall be minimized within the critical zone, which are 3 to 10 feet from the tree trunk.

b. Place 16 to 20 inches of wood chips (from trees already removed) or bark mulch over the root zone to reduce soil compaction from equipment.

c. Bridge the root area with plates of steel supported on wood ties.

d. Spread a heavy plastic tarp over the roots prior to placing excavated material on the ground. The tarp will serve as a marker for equipment operators indicating the existing grade and roots systems as they place the spoil material back into the excavated trench.

e. Pump concrete through conveyor pipes instead of driving vehicles over the tree roots.

TREE PRUNING DETAIL

1. The Contractor shall contact the Natural Resources Manager prior to initiating pruning on the trees designated for protection. Additional pruning techniques may be provided.

2. All cuts shall be made as close as possible to the trunk or parent limb without cutting into the branch collar or leaving a protruding stub (see Figure 1). Bark at the edge of all pruning cuts shall remain firmly attached.

3. All branches too large to support with one hand shall be precut (see Figure 1) to avoid splitting or tearing the bark. Where necessary, ropes or other equipment shall be used to lower large branches or stubs to the ground.

4. Treatment of cuts and wounds with wound dressing or paint shall not permitted.

5. Equipment that will damage the bark or cambium layer shall not be used on or in the tree. The use of climbing spurs (hook, irons) shall not be permitted. Sharp tools shall be used so that clean cuts will be made at all times. Trucks and other support vehicles shall not be permitted inside the drip line of the tree canopy. Temporary removal of the tree protection fence shall be permitted to facilitate pruning, and removal of limbs and other woody material from under the drip line. The tree protection fence shall be erected immediately after pruning is complete.

6. All cut limbs and woody material shall be removed from the crown upon completion of pruning. All limbs, brush, leaves, and other woody material shall be removed from government property by the Contractor.

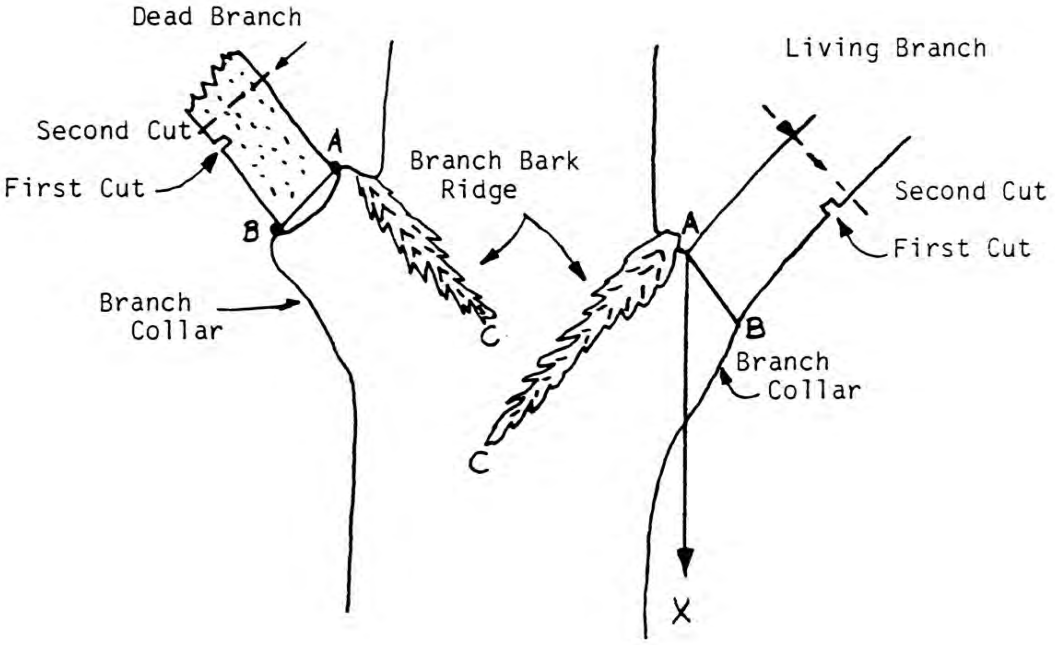
7. Pruning shall conform to the American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Maintenance - Standard Practices, ANSI A300-1995 and International Society of Arboriculture Tree-Pruning Guidelines. Copies of both documents can be purchased by contacting the International Society of Arboriculture, PO Box 3129, Champaign, IL 61826-3129, tel 217-355-9411 or http://www.isa-arbor.com.

8. All work performed shall adhere to the American National Standard for Tree Care Operations-Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush - Safety Requirements, ANSI Z133.1-1994. Contact the International Society of Arboriculture, PO Box 3129, Champaign, IL 61826-3129, phone 217-355-9411, fax 217-355-9516, or web site www.isa-arbor.com to obtain a copy of ANSI Z133.1.

9. Tree maintenance contractors shall have an ISA Certified Arborist on-site during all tree maintenance operations.

TREE PRUNING DETAIL

1. Locate the branch ridge
2. Find target a – outside of branch bark ridge
3. Find target b – swelling where branch meets branch collar
4. If b is hard to find – drop a line at ax. angle xac = to angle xab
5. Stub branch to be pruned
6. Make cut at line AB



Do not

- Cut behind the branch bark ridge
- Leave stubs
- Cut branch collar
- Paint cuts
- Use dull tools
- Use climbing spurs

TREE PLANTING DETAIL

Remember: Select a Native Tree.

1. Growing Stock Inspection

a. All trees and shrubs shall meet the American Standard for Nursery Stock, ANSI Z60.1-1996. Contact the American Nursery & Landscape Association, 1250 I Street NW, Suite 500, Washington, DC 20005, tel 202-789-2900 or web site www.anla.org to obtain a copy of ANSI Z60.1-1996.

b. All trees shall be true to type or name as ordered or shown on the plans and shall be individually tagged or tagged in-groups by species and cultivar.

c. All trees shall be healthy, have a form typical for the species or cultivar, be well rooted, and stand upright without support. Tree size shall be not larger than 1-1/2" to 2" in caliper diameter.

d. All trees shall comply with federal and state laws requiring inspection for plant diseases and insect pest infestations.

e. The rootball of all trees shall be moist throughout and solid with little or no movement at the trunk. The crown shall show no signs of moisture stress. Check that the tree is free of girdling roots (roots that develop and grow across or around other roots), and free of knees (roots protruding above the soil). The roots should be abundant and white. Brown or black roots indicate a health problem.

f. Except for small-growing, multistemmed ornamentals, select trees that have a single, straight trunk and leader, and spreading branches. Reject trees with double leaders (codominant stems) or vigorous, upright branches competing with the leader. Radial and vertical distribution of branches shall form a symmetrical crown. Foliage should be evenly distributed on the upper 2/3 of the tree, and not concentrated at the top. The Government shall reject trees that have been severely pruned or headed back, with trunk injury, and without an abundance of healthy, green leaves.

2. Planting

a. Planting season is from November through March, except when the ground is frozen.

b. Site factors that influence long-term survivability must be considered: overhead and underground utilities, sidewalks, signage conflict, traffic visibility, light poles, etc. Utilities must be marked prior to excavation.

c. Balled and Burlapped (B&B) Stock: All synthetic or non-degradable material such as nylon rope or treated burlap must be

removed from the root ball prior to planting. All material including biodegradable material must be remove from the upper 1/3 of the root ball. Prevent remaining pieces from extending above the soil or they will act as wicks, drying the soil. Take extra care not to loosen or break the soil ball. If trees are planted

with wire baskets around the root ball, cut and remove the top two tiers of the wire after the ball is set in the hole.

d. Container Grown and Containerized Stock: Carefully remove the container at the planting site. Cutting the containers may be necessary. Remove all containers, including biodegradable paper-mache pots. Newly containerized stock may be only slightly rooted; the container must be removed with care so as not to disturb the root ball. In contrast, container grown stock may be rootbound. If roots are growing in a spiral around the soil ball, the plant is root bound. These roots need to be separated or they will eventually girdle the plant. Make vertical cuts on the sides of the ball just deep enough to cut the net of roots. Also, make a criss-cross cut across the bottom of the ball.

e. Mark out a planting area 3-5 times the diameter of the root ball. Use a rototiller or shovel to loosen and mix the soil in this entire area to a depth of 12 inches. Organic matter can be added to the loosened soil as long as the new material is used uniformly throughout the area. In the center of the prepared area, dig a hole as only as wide enough and deep enough to accept the root ball. The hole should allow the root ball to sit on solid ground rather than on loose soil. Once the ball is set in the hole, its upper surface should be level with or slightly above the surrounding ground.

f. Position the tree so that it is vertical and plumb to the ground and the main stem is growing straight up.

g. Backfill with soil from the planting site if the soil is not contaminated. Remove large rocks and construction debris from the soil. Amending the backfill soil with organic matter does not increase survival or growth of woody plants.

h. When the hole is half full, slowly water to saturate the soil, then continue to fill the hole. Settle the soil by watering or lightly tamping to ensure that all air pockets are eliminated. Do not pack the soil by using equipment or feet. Do not create an earthen berm around the tree.

i. Water thoroughly to remove air pockets, secure the soil around the roots, and provide nourishment.

j. Rake soil evenly around the entire planting area.

3. Mulching

a. Mulch an area at least 3 times the diameter of the root ball to a depth of 2-4 inches with wood chips, bark mulch, shredded leaves, or pine needles. Do not mound the mulch around the base of the tree.

4. Staking

a. Only stake the tree if it will not stand on its own, and use only one stake on the opposite side of the leaning tree. The stake is to be placed outside of the root ball.

b. Do not use wire even if the wire is in-cased by hose. Use a flexible tie attached to a single stake. Biodegradable material is recommended.

c. Do not wrap tree with protective tape. If tree arrives on the site with a protective tree wrap, remove it immediately after the tree is planted.

d. Remove stakes and ties after 1 year.

5. Pruning

a. At the time of planting dead, damaged and rubbing or cross branches can be removed.

b. Do not remove any other living branches. Do not apply any type of wound dressing.

c. Remove sucker sprouts from the base of the tree.

6. Watering

a. During the first growing season, irrigate the root ball with 5 gallons of water every three days after a rain event. Slow deep watering is recommended. Soil should be moistened to a depth of 12-18 inches. Water the soil within the root zone. Do not water the tree trunk.

7. Fertilizing

Fertilizer must be phosphorus free.

a. Use no fertilizer during the establishment period. The establishment period is about one year for every 1 inch of caliper. So, a 2-inch caliper tree would require two years to reestablish the top:root ratio.

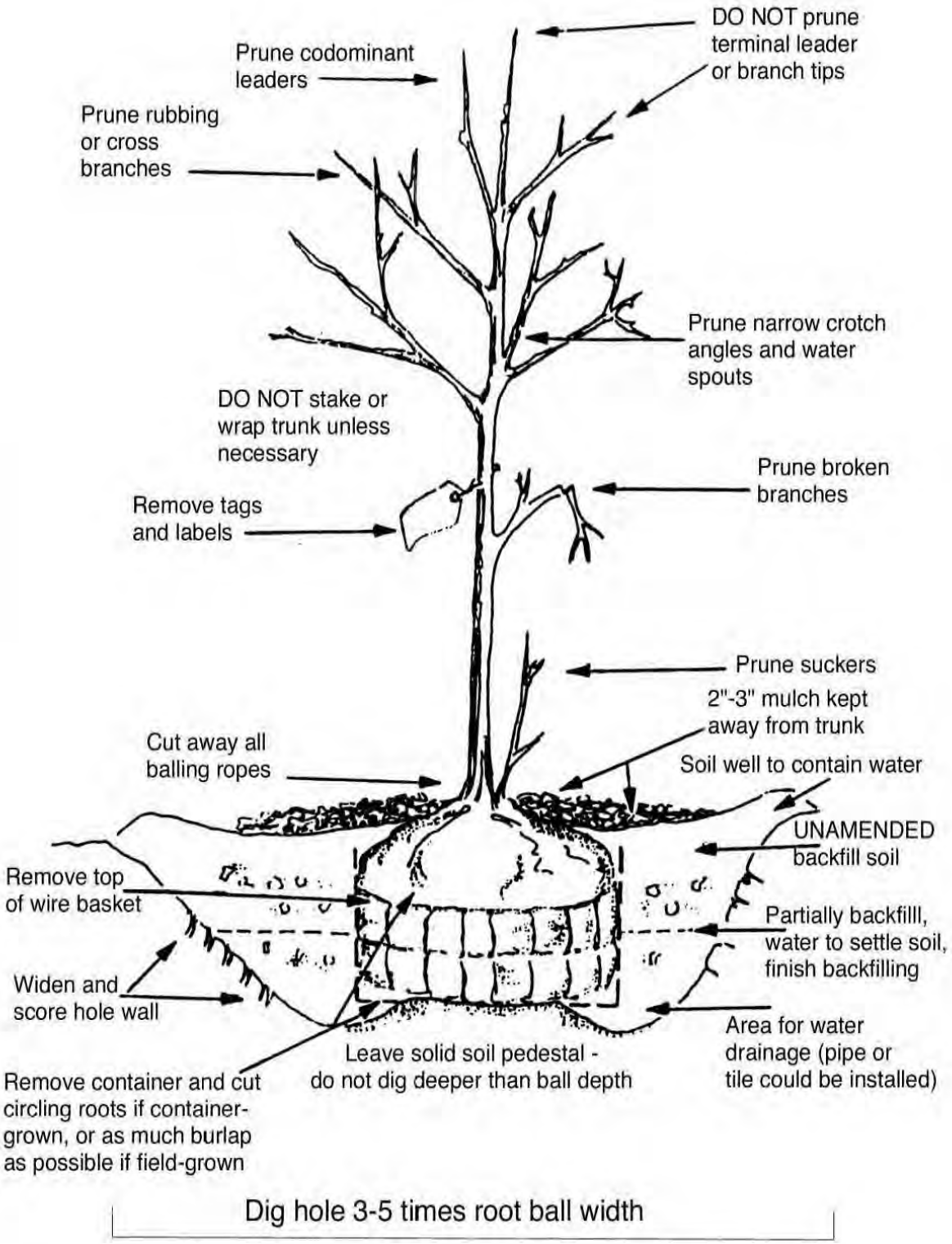
b. Once the trees are established, nitrogen fertilization should be applied at a rate of 2-lbs. N/1,000 square feet/year. Established, mature trees require minimal nitrogen, 1 lb. N/1,000 square feet/two to four years. All tree fertilizes must be slow or controlled release versus water-soluble.

c. Mature trees growing in fertilized turf should not be fertilized.

d. Apply fertilizers during October through April, except when the ground is frozen or covered with snow.

Reference: Principle and Practice of Planting Trees and Shrubs, 1997, Watson and Himelick, International Society of Arboriculture, PO Box 3129, Champaign, IL 61826-3129 or www.isa-arbor.com.

TREE PLANTING DETAIL



Pruning Trees

Pruning is the most common tree maintenance procedure. Although forest trees grow quite well with only nature's pruning, landscape trees require a higher level of care to maintain their safety and aesthetics. Pruning should be done with an understanding of how the tree responds to each cut. Improper pruning can cause damage that will last for the life of the tree, or worse, it will shorten the tree's life.

Reasons for Pruning

Since each cut has the potential to change the growth of the tree, no branch should be removed without a reason. Common reasons for pruning are to remove dead branches, to remove crowded or rubbing limbs, and to eliminate hazards. Trees may also be pruned to increase light and air penetration to the inside of the tree's crown or to the landscape below. In most cases, mature trees are pruned as a corrective or preventative measure.

When to Prune

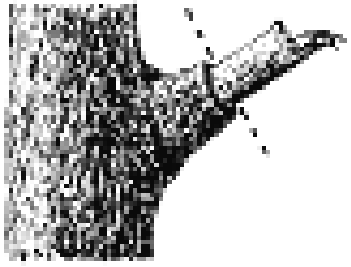
Most routine pruning to remove weak, diseased or dead limbs can be accomplished at any time during the year with little effect on the tree. As a rule, growth is maximized and wound closure is fastest if pruning takes place before the spring growth flush. Some trees, such as maples and birches, tend to "bleed" if pruned early in the spring. This may be unsightly, but is of little consequence to the tree.

A few tree diseases, such as oak wilt, can be spread when pruning wounds allow spores access into the tree. Susceptible trees should not be pruned during active transmission periods.

Heavy pruning just after the spring growth flush should be avoided. This is when trees have just expended a great deal of energy to produce foliage and early shoot growth. Removal of a large percentage of foliage at this time can stress the tree.

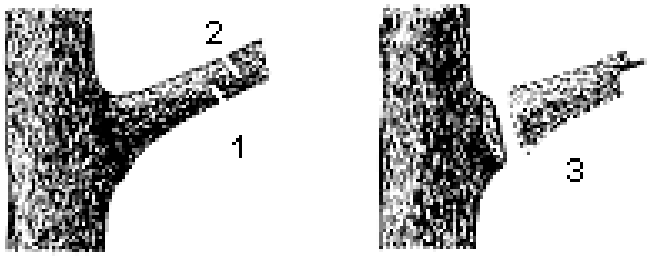
Making Proper Pruning Cuts to Mature Trees

Pruning cuts should be made just outside the branch collar. The branch collar contains trunk or parent branch tissue and should not be damaged or removed. If trunk collar has grown out on a dead limb to be removed, make the cut just beyond the collar. Do not cut the collar (see figure).



On a dead branch that has a collar of live wood, the final cut should be made just beyond the outer edge of the collar.

If a large limb is to be removed, its weight should first be reduced. This is done by making an undercut about 12-18 inches from the limb's point of attachment. A second cut is made from the top, directly above or a few inches further out on the limb. This removes the limb leaving the 12-18 inch stub. The stub is removed by cutting back to the branch collar. This technique reduces the possibility of tearing the bark



Use the 3-cut method to remove a large limb.

How Much Should be Pruned?

The amount of live tissue that should be removed depends on the tree size, species, and age, as well as the pruning objectives. Younger trees will tolerate the removal of a higher percentage of living tissue than mature trees. A common mistake is to remove too much inner foliage and small branches. It is important to maintain an even distribution of foliage along large limbs and in the lower portion of the crown. A widely accepted rule of thumb is never to remove more than one fourth of a tree's leaf bearing crown. In a mature tree, pruning even that much could have negative effects. Removing even a single, large-diameter limb can create a wound that the tree may not be able to close. The older and larger a tree becomes, the less energy it has in reserve to close wounds and defend against decay or insect attack. The pruning of large, mature trees is usually limited to the removal of dead or potentially hazardous limbs.

Wound Dressings

Wound dressings were once thought to accelerate wound closure, protect against insects and diseases, and reduce decay. However, research has shown that dressings do not reduce decay or speed closure, and rarely prevent insect or disease infestations. Most experts recommend that wound dressings not be used. If a dressing must be used for cosmetic purposes, then only a thin coating of a non-toxic material should be applied.

Newly Planted Trees

Pruning of newly planted trees should be limited to corrective pruning. Remove torn or broken branches. Save other pruning measures for the second or third year. The belief that trees should be pruned when planted to compensate for root loss is misguided. Trees need their leaves and shoot tips to provide food and the substances, which stimulate new root production. Unpruned trees establish faster, with a stronger root system than trees pruned at the time of planting.

(From International Society Arboriculture at *http://www.isa-arbor.com/consumer/pruning.html*)

New Tree Planting

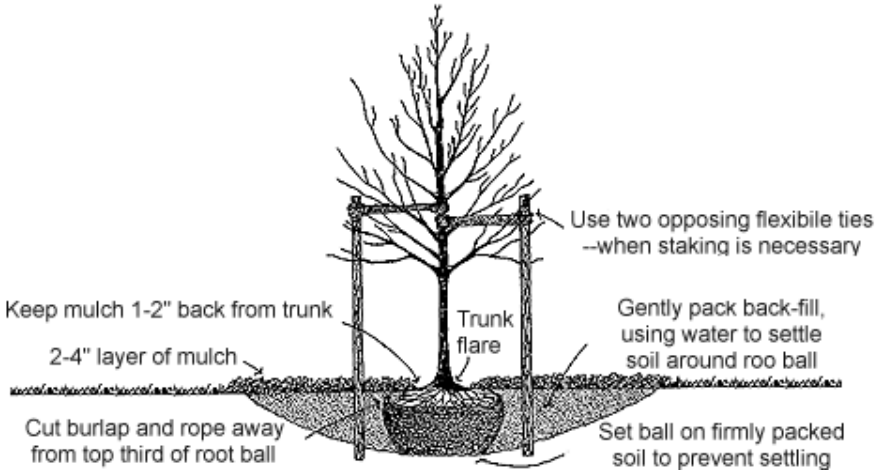
The ideal time to plant trees and shrubs is during the dormant season, in the fall after leafdrop or early spring before bud-break. Weather conditions are cool and allow plants to establish roots in the new location before spring rains and summer heat stimulate new top growth. However, trees properly cared for in the nursery or garden center, and given the appropriate care during transport to prevent damage, can be planted throughout the growing season. In either situation, proper handling during planting is essential to ensure a healthy future for new trees and shrubs. *Before you begin planting your tree, be sure you have had all underground utilities located prior to digging.*

If the tree you are planting is balled and burlapped, or bare rooted, it is important to understand that the tree's root system has been reduced by 90-95% of its original size during transplanting. As a result of the trauma caused by the digging process, trees will commonly exhibit what is known as **transplant shock.** Transplant shock is indicated by slow growth and reduced vigor following transplanting. Proper site preparation before and during planting, coupled with good follow up care will reduce the amount of time the plant experiences transplant shock and will allow the tree to quickly establish in its new location. Carefully follow eight simple steps and you can significantly reduce the stress placed on the plant at the time of planting.

1. **Dig a shallow, broad planting hole.** Make the hole wide, as much as three times the diameter of the root ball, but only as deep as the root ball. It is important to make the hole wide because the tree roots on the newly establishing tree must push through surrounding soil to establish. On most planting sites in new developments, the existing soils have been compacted and are unsuitable for healthy root growth. Breaking up the soil in a large area around the tree provides the newly emerging roots room to expand into loose soil to hasten establishment.

2. **Identify the trunk flare.** The trunk flare is where the roots spread at the base of the tree. This point should be partially visible after the tree has been planted (see diagram). If the trunk flare is not partially visible, you may have to remove some soil from the top of the root ball. Find it so you can determine how deep the hole needs to be for proper planting.

3. **Place the tree at the proper height.** Before placing the tree in the hole, check to see that the hole has been dug to the proper depth, and no more. The majority of the roots on the newly planted tree will develop in the top 12" of soil. If the tree is planted too deep, new roots will have difficulty developing due to a lack of oxygen. It is better to plant the tree a little high, 1-2" above the base of the trunk flare, than to plant it at or below the original growing level. This will allow for some settling (see diagram). To avoid damage when setting the tree in the hole, always lift the tree by the root ball, and never by the trunk.



4. **Straighten the tree in the hole.** Before you begin backfilling have someone view the tree from several directions to confirm the tree is straight. Once you begin backfilling it is difficult to reposition.

5. **Fill the hole, gently but firmly.** Fill the hole about 1/3 full and gently but firmly pack the soil around the base of the root ball. Then, if the tree is balled and burlapped, cut and remove the string and wire from around the trunk and top 1/3 of the root ball (see diagram). Be careful not to damage the trunk or roots in the process. Fill the remainder of the hole, taking care to firmly pack soil to eliminate air pockets that may cause roots to dry out. To avoid this problem, add the soil a few inches at a time and settle with water. Continue this process until the hole is filled and the tree is firmly planted. It is not recommended to apply fertilizer at the time of planting.

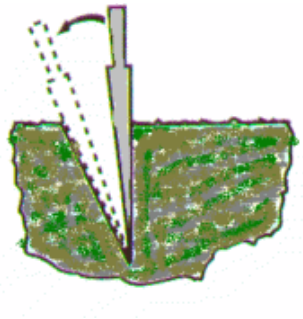
6. **Stake the tree, if necessary.** If the tree is grown and dug properly at the nursery, staking for support is not necessary in most home landscape situations. Studies have shown that trees will establish more quickly and develop stronger trunk and root systems if they are not staked at the time of planting. However, protective staking may be required on sites where lawn mower damage, vandalism or windy conditions are concerns. If staking is necessary for support, two stakes used in conjunction with a wide flexible tie material will hold the tree upright, provide flexibility, and minimize injury to the trunk (see diagram). Remove support staking and ties after the first year of growth. Leave protective staking in place as long as necessary.

7. **Mulch the base of the tree.** Mulch is simply organic matter applied to the area at the base of the tree. It acts as a blanket to hold moisture, protect against harsh soil temperatures, both hot and cold, and reduces competition from grass and weeds. Some good choices are leaf litter, pine straw, shredded bark, peat moss, or wood chips. A two to four inch layer is ideal. More that four inches may cause a problem with gas exchange. When placing mulch, care should be taken so that the actual trunk of the tree is not covered. This may cause decay of the living bark at the base of the tree. A mulch-free area, one to two inches wide at the base of the tree, is sufficient to avoid moist bark conditions and prevent decay.

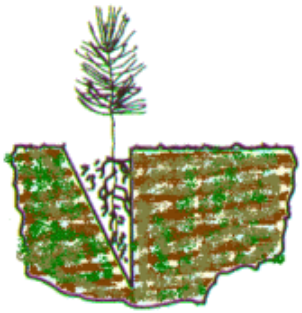
8. **Follow-up care.** Keep the soil moist but not soaked; overwatering will cause leaves to turn yellow or fall off. Water trees at least once a week, barring rain, and more frequently during hot weather. When the soil is dry below the surface of the mulch, it is time to water. Continue until mid-fall, tapering off for lower temperatures that require less frequent watering. Other follow-up care may include minor pruning of branches damaged during the planting process. Prune sparingly immediately after planting, and wait to begin necessary corrective pruning until after a full season of growth in the new location.

(Taken from the International Society of Arboriculture at http://www.isa-arbor.com/consumer/planting.htm)

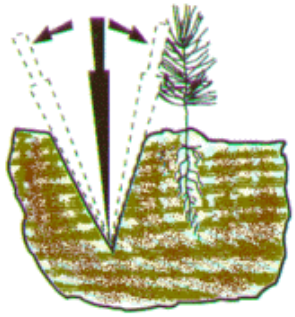
How to Plant with a Dibble Bar



1. Push the blade vertically into the soil then pull the handle toward you to open the hole.



2. Set the seedling 1 to 3 inches deeper than the nursery depth with the roots straight.



3. Push the blade into the soil just behind the planting hole then pull the handle back to close the bottom of the hole. Push the handle forward to close the top of the hole.

4. Pack the soil firmly with your heel.

(From South Carolina Forestry Commission at www.state.sc.us/forest/refplant.htm)

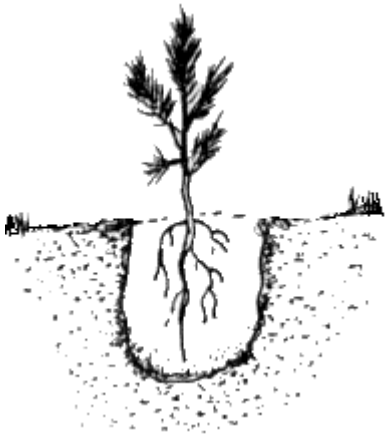
How to Plant Bare-root Trees

1. It is best to plant bare-root trees immediately, in order to keep the fragile roots from drying out. If you can't plant because of weather or soil conditions, store the trees in a cool place and keep the roots moist.

2. Unpack tree and soak in water 3 to 6 hours. Do not plant with packing materials attached to roots, and do not allow roots to dry out.

3. Dig a hole, wider than seems necessary, so the roots can spread without crowding. Remove any grass within a three-foot circular area. To aid root growth, turn soil in an area up to 3 feet in diameter.

4. Plant the tree at the same depth it stood in the nursery, without crowding the roots. Partially fill the hole, firming the soil around the lower roots. Do not add soil amendments.



5. Shovel in the remaining soil. It should be firmly, but not tightly packed with your heel. Construct a water-holding basin around the tree. Give the tree plenty of water.

6. After the water has soaked in, place a 2-inch deep protective mulch area 3 feet in diameter around the base of the tree (but not touching the trunk).

7. Water the tree generously every week or 10 days during the first year of establishment.

Recognizing Hazardous Trees

Hazardous Trees & Utility Lines. Trees that fall into utility lines have additional serious consequences. Not only can they injure people or property near the line, but hitting a line may cause power outages, surges, fires and other damage. Downed lines still conducting electricity are especially dangerous. A tree with a potential to fall into a utility line is a very serious situation.

Tree Hazard Checklist

Consider these questions . . .

1. Are there large dead branches in the tree?
2. Are there detached branches hanging in the tree?
3. Does the tree have cavities or rotten wood along the trunk or in major branches?
4. Are mushrooms present at the base of the tree?
5. Are there cracks or splits in the trunk or where branches are attached?
6. Have any branches fallen from the tree?
7. Have adjacent trees fallen over or died?
8. Has the trunk developed a strong lean?
9. Do many of the major branches arise from one point on the trunk?
10. Have the roots been broken off, injured or damaged by lowering the soil level, installing pavement, repairing sidewalks or digging trenches?
11. Has the site recently been changed by construction, raising the soil level or installing lawns?
12. Have the leaves prematurely developed an unusual color or size?
13. Have trees in adjacent wooded areas been removed?
14. Has the tree been topped or otherwise heavily pruned?

Managing Tree Hazards

One of these treatments may help make your tree safer. Reducing the risk associated with hazardous trees can take many forms.

1. **Prune the tree**. Remove the defective branches of the tree. Since in appropriate pruning may also weaken a tree,

2. **Provide routine care**. Mature trees need routine care in the form of water, fertilizer (in some cases), mulch and pruning as dictated by the season and their structure.

A number of treatments are best done by a Certified Arborist

1. **Cable and brace the tree.** Provide physical support for weak branches and stems to increase their strength and stability.

2. **Remove the tree.** Some hazardous trees are best removed. If possible, plant a new tree in an appropriate place as a replacement.

(From International Society of Arboriculture at *http://www.isa-arbor.com/consumer/hazards.html*)

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Enclosure 4. Native Plants for Landscaping

Integrated Natural Resources Management Plan (INRMP) & National Environmental Policy Act (NEPA) Review
Landscaping Guidance
(Vegetation and other Organic Materials)

Per OPNAVINST 5090.1D and associated manual M-5090.1, Navy installations shall comply with the goals of section 207 of E.O. 13423 (Greening the Government Through Leadership in Environmental Management) on all new or extended landscaped areas and shall use native plants to the maximum extent practicable, when replacement or rejuvenation of existing landscaping is required.

The installation is located within the Coastal Plains (C) of VA and as such species native to this zone should be utilized for vegetation/landscaping activities on base. A list of native-plant nurseries is maintained by the Virginia Native Plant Society: <www.vnps.org>. Warning: Not all plants sold at Native Plant Nurseries are necessarily native to the region in which you plan to plant and some of these nurseries also sell non-native plants in addition to the native plants. Below are additional links that can be used for researching native plants: <http://www.vaplantatlas.org/>; <http://plants.usda.gov/java/>; and <www.dcr.virginia.gov/natural_heritage/nativeplants.shtml>.

Plant selection and application should be done in a manor to minimize BASH concerns. If using seed it will be attractive to wildlife. If utilizing seed to minimize BASH concerns the seed should be applied utilizing a slit seed technique. Grass seed does best when spread in the fall or spring time frames. There is a native mix of grass available on the market consisting of: Virginia Wildrye (Elymus virginicus); Purpletop/redtop (Tridens flavus); and Broomsedge (Andropogon virginicus). They recommend 18 lbs./acre of seed and planting in spring or early summer. The NASO NRM has coordinated with USDA BASH Biologists to confirm that these species would be acceptable for use on the installation. Additional native grass species to consider include: Axonopus furcatus (Big Carpetgrass); Setaria parviflora (Knotroot Foxtail, Knotroot Bristlegrass); Danthonia spicata (Poverty Oatgrass); and Piptochaetium avenaceum (Eastern Needlegrass/Blackseed Speargrass).

Any vegetation planting lists should be submitted to the installation Natural Resources Manager for final approvals. (CAUTION: EXISTING PLANTS FOUND ON BASE, PLANTS IDENTIFIED in the INSTALLATION APPERANCE PLAN, or PLANTS IDENTIFIED in the LOW IMPACT DEVELOPMENT PLAN may NOT be Native Species. You must select Native Species.)

Invasive species & Noxious weed management/removal/spread avoidance is required by Navy Policy, EO 13751 and the Sikes Act via the Integrated Natural Resources Management Plan. Non-native invasive and noxious weed species commonly invade areas after land disturbance. If these species invade the area they must be removed due to the aforementioned policies. They should also be removed because certain species can become wildlife attractants that would pose an increased Bird/Animal Aircraft Strike Hazard for the airfield.

Due to the known presence of non-native invasive species & noxious weeds in the area, on base soil/sludge/organic material removed from any projects on base should be disposed of appropriately off base. Materials on base should not be relocated anywhere on base beyond its originating location unless it has been certified clean & noxious weed free. Soil/hay/sand/plants/mulch/etc. brought on base for this project should be certified clean (contaminate and noxious weed free).

Equipment should be clean prior to arriving on base to avoid introduction of new or spread of existing non-native invasive species to the base/location. After working at this site, equipment should also be cleaned prior to working in any other location/site on or off base.

Additional Recommendations for Native Alternative Vegetation for Use on the NASO Solar PV Array per Virginia Natural Heritage Program Botanists
(these are in addition to lists previously provided by the Navy and comments on the AMEC Proposed Planting Plan)

Native to Coastal Plains of Virginia Low Growing Plants

Grasses:
Axonopus furcatus (Big Carpetgrass) - has been used as a lawn, pasture or field binding grass in the south

Setaria parviflora (Knotroot Foxtail, Knotroot Bristlegrass) - tenacious in turf situations and along roadsides

Danthonia spicata (Poverty Oatgrass) - full shade to full sun; low to moderate moisture

Piptochaetium avenaceum (Eastern Needlegrass/Blackseed Speargrass) - full-moderate shade, low moisture

Flowering Plants:

Chamaecrista nictitans (Sensitive Partridge Pea)

Desmodium rotundifolium (Round-leaf Tick-trefoil)

Hylodesmum (Desmodium) nudiflorum (Naked-flowered Tick-trefoil)

Ionactis (Aster) linariifolia/linariifolius (Stiff-leaved Aster/ flaxleaf whitetop aster)

Lespedeza procumbens (Trailing Lespedeza)

Lespedeza repens (Creeping Lespedeza)

Lupinus perennis (Sundial Lupine) - (partial sun, low moisture

Stylosanthes biflora (Pencilflower)

Tephrosia spicata (Spiked Hoary Pea)

Centrosema virginianum (Spurred Butterfly Pea)

Clitoria mariana (Butterfly Pea)

Silene caroliniana (Wild Pink/sticky catchfly)

<u>Native to Coastal Plains of Virginia Taller than Low Growing Plants (would require some mowing during the year to keep short)</u>

Grasses:

Andropogon ternarius (Splitbeard Bluestem)

Andropogon virginicus var. virginicus (Broomsedge, Broomstraw)

Panicum anceps (Beaked Panic Grass)

Paspalum floridanum (Florida Paspalum) - A good soil binder.

Tridens flavus (Purpletop, Tall Redtop)

NOTE: Additional Species would be recommended; however, due to the height restriction requested were not included on this list. One would need to know level of mowing tolerance to provide additional options.

ABOUT THE NATIVE PLANTS FOR CONSERVATION, RESTORATION AND LANDSCAPING PROJECT

This project is a collaboration between the Virginia Department of Conservation and Recreation and the Virginia Native Plant Society. VNPS chapters across the state helped to fund the 2011 update to this brochure.

The following partners have provided valuable assistance throughout the life of this project:

The Nature Conservancy – Virginia Chapter • Virginia Tech Department of Horticulture • Virginia Department of Agriculture and Consumer Services • Virginia Department of Environmental Quality, Coastal Zone Management Program • Virginia Department of Forestry • Virginia Department of Game and Inland Fisheries • Virginia Department of Transportation

FOR MORE INFORMATION

Virginia Department of Conservation and Recreation
Natural Heritage Program
804-786-7951
www.dcr.virginia.gov/natural_heritage/nativeplants.shtml

FOR A LIST OF NURSERIES THAT PROPAGATE NATIVE SPECIES, CONTACT:

Virginia Native Plant Society
400 Blandy Farm Lane, Unit 2
Boyce, VA 22620
540-837-1600 | vnpsofc@shentel.net
www.vnps.org

FOR A LIST OF NURSERIES IN A PARTICULAR REGION OF VIRGINIA, CONTACT:

The Virginia Nursery and Landscape Association
383 Coal Hollow Road
Christiansburg, VA 24073
540-382-0943 | vnla@verizon.net
To search for species in VNLA member catalogs, visit:
www.vnla.org/search.asp

ILLUSTRATIONS COURTESY OF THE FLORA OF VIRGINIA PROJECT.

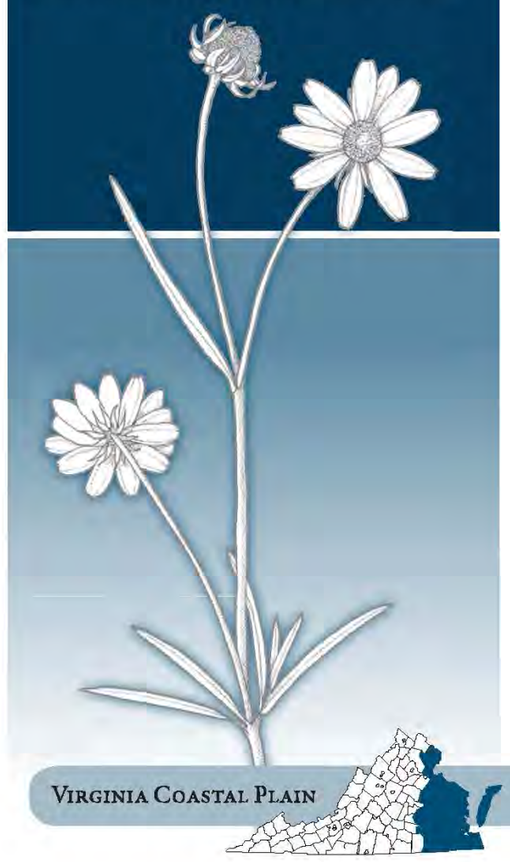
Illustrators: Lara Gastinger, Roy Fuller and Michael Terry. To learn more, visit:
www.floraofvirginia.org

DCR
Virginia Department of Conservation & Recreation

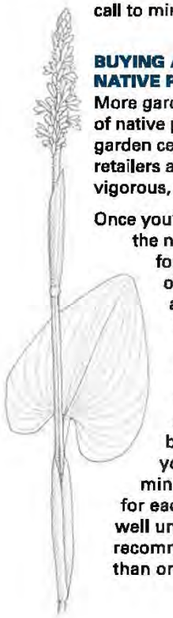
9/2011

Native Plants

for Conservation, Restoration & Landscaping



Virginia Coastal Plain



WHAT ARE NATIVES?

Native species evolved within specific regions and dispersed throughout their range without known human involvement. They form the primary component of the living landscape and provide food and shelter for native animal species. Native plants co-evolved with native animals over many thousands to millions of years and have formed complex and interdependent relationships. Our native fauna depend on native flora to provide food and cover. Many animals require specific plants for their survival.

BENEFITS OF NATIVE PLANTS

Using native species in landscaping reduces the expense of maintaining cultivated landscapes and minimizes the likelihood of introducing new invasive species. It may provide a few unexpected benefits as well.

Native plants often require less water, fertilizer and pesticide, thus adding fewer chemicals to the landscape and maintaining water quality in nearby rivers and streams. Fewer inputs mean time and money saved for the gardener.

Native plants increase the presence of desirable wildlife, such as birds and butterflies, and provide sanctuaries for these animals as they journey between summer and winter habitats. The natural habitat you create with native plants can become an outdoor classroom for children, or a place for you to find peace and quiet after a busy day.

Native plants evoke a strong sense of place and regional character. For example, live oak and magnolia trees are strongly associated with the Deep South. Redwood trees characterize the Pacific Northwest. Saguaro cacti call to mind the deserts of the Southwest.

BUYING AND GROWING NATIVE PLANTS

More gardeners today are discovering the benefits of native plants and requesting them at their local garden centers. Because of this increased demand, retailers are offering an ever-widening selection of vigorous, nursery-propagated natives.

Once you've found a good vendor for native plants, the next step is choosing appropriate plants for a project. One of the greatest benefits of designing with native plants is their adaptation to local conditions. However, it is important to select plants with growth requirements that best match conditions in the area to be planted.

If you're planning a project using native plant species, use the list in this brochure to learn which plants grow in your region of Virginia. Next, study the minimum light and moisture requirements for each species, noting that some plants grow well under a variety of conditions. Many of the recommended species are well-suited to more than one of these categories.

For more information, refer to field guides and publications on local natural history for color, shape, height, bloom times and specific wildlife value of the plants that grow in your region. Visit a nearby park, natural area preserve, forest or wildlife management area to learn about common plant associations, spatial groupings and habitat conditions. For specific recommendations and advice about project design, consult a landscape or garden design specialist with experience in native plants.

WHAT ARE NON-NATIVE PLANTS?

Sometimes referred to as "exotic," "alien," or "non-indigenous," non-native plants are species introduced, intentionally or accidentally, into a new region by humans. Over time, many plants and animals have expanded their ranges slowly and without human assistance. As people began cultivating plants, they brought beneficial and favored species along when they moved into new regions or traded with people in distant lands. Humans thus became a new pathway, enabling many species to move into new locations.

WHAT ARE INVASIVE PLANTS?

Invasive plants are introduced species that cause health, economic or ecological damage in their new range. More than 30,000 species of plants have been introduced to the United States since the time of Columbus. Most were introduced intentionally, and many provide great benefits to society as agricultural crops and landscape ornamentals. Some were introduced accidentally, for example, in ship ballast, in packing material and as seed contaminants. Of these introduced species, fewer than 3,000 have naturalized and become established in the United States outside cultivation. Of the 3,500 plant species in Virginia, more than 800 have been introduced since the founding of Jamestown. The Virginia Department of Conservation and Recreation currently lists more than 100 of these species as invasive.

In the United States, invasive species cause an estimated $120 billion in annual economic losses, including costs to manage their effects. Annual costs and damages arising from invasive plants alone are estimated at $34 billion.

NATIVE PLANTS VS. INVASIVE PLANTS

Invasive plants have competitive advantages that allow them to disrupt native plant communities and the wildlife dependent on them. For example, kudzu (*Pueraria montana*) grows very rapidly and overtops forest canopy, thus shading other plant species from the sunlight necessary for their survival. A tall invasive wetland grass, common reed (*Phragmites australis ssp. australis*), invades and dominates marshes, reducing native plant diversity and sometimes eliminating virtually all other species.

Invasive species can marginalize or even cause the loss of native species. With their natural host plants gone, many insects disappear. And since insects are an essential part of the diet of many birds, the effects on the food web become far reaching. Habitats with a high occurrence of invasive plants become a kind of "green desert." Although green and healthy in appearance, far fewer native species of plants and animals are found in such radically altered places.

Virginia Coastal Plain

Virginia's Coastal Plain extends from the sands of Virginia Beach west to the fall line. Formed by marine sediments eroded from the Appalachian Highlands, the Coastal Plain varies in topography from north to south. In the north, the Northern Neck is somewhat hilly and well-drained. On the Middle Peninsula and Lower Peninsula, hills are less steep. South of the James River, the landscape levels off to about a 1-degree slope toward the ocean. In places, streams cut easily through the sands, gravels and clays to form well-developed ravine systems, and tidal rivers widen as the topography flattens. The Eastern Shore, separated from the mainland by the Chesapeake Bay, exhibits relatively little topography across the uplands extending from the Atlantic on the east to the bay on the west. From white sand beaches of the barrier islands, to tidal freshwater marshes, to blackwater swamps, to upland mixed hardwood and pine forests, the Coastal Plain has a diverse array of habitats for many native plant species.

Recommended Uses
W = Wildlife
H = Horticulture & landscaping
C = Conservation & restoration
D = Domestic livestock forage

Minimum Light Requirements
S = Shade
P = Partial sun
F = Full sun

Moisture Requirements
L = Low moisture
M = Moderate moisture
H = High moisture

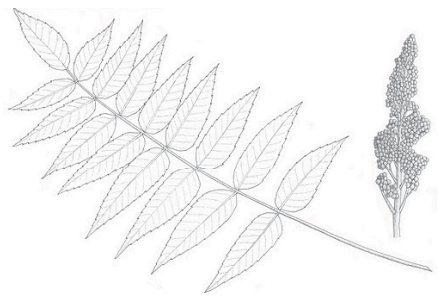
Some species are marked with the following footnote symbols:

\+ May be aggressive in a garden setting

* Due to the rarity and sensitivity of habitat in Virginia, these species are recommended for horticultural use only. Planting these species in natural areas could be detrimental to the survival of native populations.

Scientific Name	Common Name	Uses				Light			Moisture		
		W	H	C	D	S	P	F	L	M	H
Herbs											
Achillea millefolium	common yarrow		•				•	•	•		
Ageratina altissima	white snakeroot	•				•	•			•	
Amsonia tabernaemontana	blue star		•			•	•			•	•
Anemone quinquefolia	wood anemone		•			•	•	•		•	
Anemonella thalictroides	rue anemone		•			•				•	
Aquilegia canadensis	wild columbine	•	•				•	•	•	•	
Arisaema triphyllum	Jack-in-the-pulpit		•			•				•	
Aruncus dioicus	goatsbeard		•			•	•			•	
Asarum canadense+	wild ginger		•	•		•				•	
Asclepias incarnata	swamp milkweed	•	•	•			•	•			•
Asclepias syriaca+	common milkweed	•	•	•				•	•		
Asclepias tuberosa	butterfly weed	•	•	•				•	•		
Baptisia tinctoria	yellow wild-indigo	•	•				•	•	•		
Bidens cernua+	nodding beggar-ticks	•	•	•			•	•	•	•	•
Boltonia asteroides*	aster-like boltonia		•					•		•	
Caltha palustris	marsh marigold		•	•			•	•			•
Chamaecrista fasciculata+	partridge pea			•				•	•	•	
Chelone glabra	white turtlehead		•	•		•	•				•
Chrysogonum virginianum	green and gold		•	•		•				•	
Chrysopsis mariana	Maryland golden aster	•	•	•			•	•	•		
Cimicifuga racemosa	black cohosh		•			•	•			•	
Clitoria mariana	Maryland butterfly pea		•	•		•	•		•		
Conoclinium coelestinum	blue mistflower	•	•	•			•	•		•	
Coreopsis lanceolata	longstalk coreopsis	•	•						•		
Coreopsis tinctoria	golden tickseed	•	•				•	•		•	
Coreopsis tripteris	tall coreopsis		•	•			•	•		•	
Coreopsis verticillata	threadleaf coreopsis		•	•			•	•	•		
Desmodium paniculatum	narrow-leaf tick trefoil	•		•		•			•		
Equisetum hyemale	horsetail			•		•	•	•		•	•
Eupatoriadelphus fistulosus	Joe-pye weed	•	•	•			•	•		•	•
Eupatorium perfoliatum	common boneset			•			•	•		•	•
Helenium autumnale	sneezeweed	•	•	•			•	•		•	
Helianthus angustifolius	narrow-leaf sunflower	•	•	•			•	•		•	•
Helianthus decapetalus	ten-petaled sunflower	•	•	•			•	•		•	
Helianthus divaricatus	woodland sunflower	•	•	•			•		•		
Heliopsis helianthoides	oxeye sunflower	•	•	•			•	•	•	•	
Hepatica nobilis var. obtusa	round-lobed hepatica		•			•			•	•	
Heuchera americana	alumroot		•			•			•		
Hibiscus moscheutos	Eastern rosemallow	•	•	•				•			•
Iris prismatica	slender blueflag		•				•	•		•	•
Iris virginica	Virginia blue flag		•	•			•	•			•
Kosteletskya virginica	seashore mallow	•		•				•			•
Lespedeza capitata	round-head bush clover	•		•				•	•		
Liatris pilosa var. pilosa	grass-leaf blazing star	•	•	•			•	•	•	•	
Lilium superbum	Turk's cap lily		•				•	•		•	•
Lobelia cardinalis	cardinal flower	•	•	•			•	•			•
Lobelia siphilitica	great blue lobelia	•	•	•		•	•				•
Lupinus perennis	lupine		•				•	•	•		
Maianthemum racemosum	false Solomon's seal		•	•		•	•			•	
Mimulus ringens	monkeyflower		•	•				•			•
Monarda fistulosa	wild bergamot	•	•	•			•	•	•	•	
Monarda punctata	Horse-mint	•	•					•	•		
Nymphaea odorata	American water lily	•	•	•				•			•
Oenothera fruticosa	sundrops	•	•	•				•		•	•
Opuntia humifusa	Eastern prickly-pear	•	•	•				•	•		
Packera aurea+	golden ragwort	•		•		•	•			•	•
Peltandra virginica	arrow arum	•	•	•				•			•
Penstemon laevigatus	smooth beardtongue		•			•	•	•		•	
Phlox paniculata	summer phlox		•	•			•	•		•	
Podophyllum peltatum+	mayapple	•	•	•			•	•		•	
Polemonium reptans	Jacob's ladder		•			•	•			•	
Polygonatum biflorum	Solomon's seal		•			•	•		•	•	
Pontederia cordata	pickerel weed	•	•	•				•			•
Pycnanthemum incanum	hoary mountain mint	•		•		•			•		
Pycnanthemum tenuifolium	narrow-leaved mountain mint	•	•	•			•	•	•	•	
Rhexia virginica	Virginia meadow-beauty	•		•				•			•
Rudbeckia hirta	black eyed Susan		•	•			•	•	•	•	
Rudbeckia laciniata	cut-leaved coneflower	•	•	•			•	•		•	
Rudbeckia triloba	three-lobed coneflower	•	•	•			•	•		•	
Sagittaria latifolia	broadleaf arrowhead	•	•	•				•			•
Salvia lyrata+	lyre-leaf sage			•			•	•	•		
Sanguinaria canadensis	bloodroot		•			•				•	
Saururus cernuus	lizard's tail		•	•			•	•			•
Saxifraga virginiensis	early saxifrage		•			•	•	•	•	•	
Sedum ternatum	wild stonecrop		•			•	•			•	
Senna marilandica	Maryland wild senna		•	•			•		•	•	
Solidago caesia	bluestem goldenrod	•	•	•		•	•			•	
Solidago odora	sweet goldenrod	•	•	•			•	•	•		
Solidago pinetorum+	pineywoods goldenrod	•		•			•	•	•		
Solidago puberula	downy goldenrod	•	•	•				•	•		
Solidago rugosa+	rough-stemmed goldenrod	•		•			•	•		•	
Solidago sempervirens	seaside goldenrod	•	•	•			•	•		•	
Symphyotrichum concolor	Eastern silvery aster	•	•	•				•	•		
Symphyotrichum cordifolium	heart-leaved aster		•	•			•	•		•	
Symphyotrichum novi-belgii	New York aster	•	•	•			•	•		•	
Symphyotrichum pilosum	frost aster	•	•	•				•	•		
Tradescantia virginiana+	Virginia spiderwort		•	•		•	•	•		•	
Vernonia noveboracensis	New York ironweed	•	•	•			•	•			•
Viola cucullata	marsh blue violet	•	•	•			•	•			•
Viola pedata	bird's foot violet	•	•				•	•	•		
Yucca filamentosa	common yucca	•	•					•	•		
Zephyranthes atamasco	Atamasco lily		•	•			•	•		•	•
Ferns & Fern Allies											
Adiantum pedatum	maidenhair fern		•	•		•				•	
Asplenium platyneuron	ebony spleenwort		•			•	•			•	
Athyrium asplenioides	Southern ladyfern		•	•		•				•	•
Botrychium virginianum	rattlesnake fern		•				•	•	•	•	
Dennstaedtia punctilobula+	hay-scented fern			•			•	•	•	•	
Dryopteris intermedia	evergreen wood-fern		•	•		•	•		•	•	•
Onoclea sensibilis+	sensitive fern		•	•			•	•		•	•
Osmunda cinnamomea	cinnamon fern		•	•		•	•			•	•
Osmunda regalis	royal fern		•	•			•			•	•
Polystichum acrostichoides	Christmas fern		•	•		•				•	
Thelypteris palustris	marsh fern		•				•	•		•	•
Woodwardia virginica+	Virginia chain fern		•	•			•	•		•	•
Grasses, Sedges & Rushes											
Agrostis perennans	autumn bentgrass			•		•	•	•	•	•	•
Andropogon glomeratus	bushy bluestem		•	•			•	•		•	•
Andropogon virginicus	broomsedge		•	•			•	•	•	•	•
Arundinaria tecta	switch cane	•		•		•	•	•		•	•
Carex crinita	long hair sedge	•	•	•				•		•	•
Carex lurida	sallow sedge	•		•				•		•	•
Carex pensylvanica	Pennsylvania sedge	•		•		•	•	•	•	•	
Carex stricta	tussock sedge	•		•				•		•	•
Chasmanthium latifolium+	river oats, spanglegrass		•	•		•	•	•		•	
Danthonia sericea	silky oatgrass	•		•				•	•	•	
Danthonia spicata	poverty oatgrass	•		•		•	•	•	•	•	
Dichanthelium clandestinum	deer-tongue	•		•	•			•	•	•	•
Dichanthelium commutatum	variable panicgrass	•	•	•		•	•		•	•	
Dulichium arundinaceum	dwarf bamboo	•		•	•			•			•
Elymus hystrix	bottlebrush grass	•	•			•	•	•	•	•	
Elymus virginicus	Virginia wild rye	•		•		•	•		•	•	
Juncus canadensis	Canada rush	•		•				•		•	•
Juncus effusus	soft rush	•		•				•	•	•	•
Leersia oryzoides	rice cutgrass	•		•				•	•		•
Panicum amarum	coastal panic grass	•	•	•				•	•		
Panicum virgatum	switch grass	•	•	•				•	•	•	•
Saccharum giganteum	giant plumegrass	•	•	•				•		•	•
Schizachyrium scoparium	little bluestem	•	•	•	•			•	•	•	
Scirpus cyperinus	woolgrass bulrush	•	•	•				•		•	•
Sorghastrum nutans	Indian grass	•	•	•	•			•	•	•	
Sparganium americanum	American bur-reed	•		•				•			•
Tridens flavus	redtop	•	•	•	•			•	•	•	
Tripsacum dactyloides	gama grass	•	•	•	•			•		•	•
Typha latifolia	broad-leaved cattail	•		•				•		•	•
Zizania aquatica	wild rice	•	•	•				•			•

Scientific Name	Common Name	Uses				Light			Moisture		
		W	H	C	D	S	P	F	L	M	H
Vines											
Bignonia capreolata	crossvine		•	•		•	•			•	•
Campsis radicans	trumpet creeper		•	•				•	•	•	
Celastrus scandens	climbing bittersweet		•	•		•	•	•		•	
Clematis virginiana	virgin's bower			•			•	•		•	
Decumaria barbara	climbing hydrangea			•	•	•	•			•	•
Gelsemium sempervirens	Carolina jasmine	•	•			•	•	•	•	•	•
Lonicera sempervirens	trumpet honeysuckle			•	•		•			•	
Parthenocissus quinquefolia	Virginia creeper	•	•	•			•	•		•	
Passiflora incarnata	Purple passionflower	•	•				•	•	•	•	
Wisteria frutescens	Atlantic wisteria			•			•	•		•	•
Shrub & Small Trees											
Alnus serrulata	hazel alder	•	•	•		•	•	•			•
Aronia arbutifolia	red chokeberry			•	•	•	•			•	•
Aronia melanocarpa	black chokeberry			•	•		•	•	•	•	•
Baccharis halimifolia	high tide bush			•	•			•	•	•	•
Callicarpa americana	American beautyberry	•	•			•	•			•	
Castanea pumila	Allegheny chinkapin	•	•	•		•	•	•	•		
Ceanothus americanus	New Jersey tea	•	•	•			•	•	•		
Cephalanthus occidentalis	buttonbush			•	•		•	•			•
Clethra alnifolia	sweet pepper-bush	•	•	•		•	•			•	•
Cornus amomum	silky dogwood	•		•		•	•			•	•
Crataegus crus-galli	cockspur hawthorn	•	•	•			•	•	•	•	
Eubotrys racemosa	fetterbush			•	•		•	•			•
Euonymus americanus	American strawberry-bush	•	•				•				•
Gaultheria procumbens	wintergreen	•	•			•	•		•	•	
Gaylussacia baccata	black huckleberry	•	•	•		•	•			•	
Gaylussacia frondosa	dangleberry	•	•	•		•	•	•	•		
Hamamelis virginiana	witch hazel			•	•		•	•		•	•
Hydrangea arborescens	wild hydrangea			•			•	•			•
Ilex decidua	deciduous holly	•	•	•		•	•				•
Ilex glabra	inkberry	•	•	•		•	•		•	•	
Ilex verticillata	winterberry	•	•	•			•	•		•	•
Ilex vomitoria	yaupon holly	•	•	•		•	•	•	•		
Itea virginica	Virginia willow	•	•	•		•	•				•
Iva frutescens	marsh elder			•	•			•	•	•	
Kalmia latifolia	mountain laurel	•	•	•		•	•			•	
Leucothoe axillaris	coastal dog-hobble			•		•				•	
Lindera benzoin	spicebush	•	•	•		•				•	
Lyonia lucida	shining fetterbush			•	•	•	•			•	
Morella caroliniensis	Southern bayberry	•	•	•		•	•		•	•	
Morella pensylvanica	Northern bayberry	•	•	•				•	•	•	•
Myrica cerifera	Southern wax myrtle	•	•	•		•	•			•	•
Rhododendron atlanticum	dwarf azalea	•	•				•			•	
Rhododendron periclymenoides	pinxter flower			•	•	•	•			•	•
Rhododendron viscosum	swamp azalea			•	•		•	•		•	•
Rhus copallinum	winged sumac	•	•	•		•	•		•		
Rosa carolina	pasture rose	•		•			•	•	•	•	
Salix humilis	prairie willow			•	•			•	•		
Salix sericea	silky willow			•	•		•	•		•	
Sambucus canadensis	common elderberry	•	•	•				•		•	•
Stewartia malacodendron*	silky camelia			•		•	•			•	
Vaccinium corymbosum	highbush blueberry	•	•	•		•	•	•	•	•	•
Vaccinium stamineum	deerberry	•					•			•	•
Viburnum dentatum	Southern arrow-wood viburnum	•	•	•			•	•	•	•	
Viburnum nudum	possum-haw viburnum			•	•	•	•				•
Viburnum prunifolium	black-haw viburnum	•	•	•			•	•		•	
Medium Trees											
Amelanchier arborea	downy serviceberry	•	•	•			•	•		•	
Amelanchier canadensis	Canada serviceberry	•	•	•				•		•	•
Aralia spinosa	devil's walkingstick	•	•				•			•	
Asimina triloba	paw paw	•	•	•		•	•			•	
Carpinus caroliniana	American hornbeam	•	•				•	•		•	
Cercis canadensis	Eastern redbud		•	•		•	•			•	
Chionanthus virginicus	fringetree		•				•	•		•	
Cornus florida	flowering dogwood	•	•	•		•	•		•	•	
Crataegus viridis	green hawthorn	•	•	•			•	•		•	•
Ilex opaca	American holly	•	•	•		•				•	
Magnolia virginiana	sweetbay magnolia		•	•		•	•			•	•
Morus rubra	red mulberry	•	•	•		•	•			•	
Ostrya virginiana	Eastern hop-hornbeam		•			•	•			•	
Persea borbonia	redbay		•	•		•	•			•	•
Prunus americana	American wild plum		•	•			•			•	
Rhus glabra	smooth sumac	•	•	•				•	•	•	
Rhus typhina	staghorn sumac	•	•	•				•	•		
Salix nigra	black willow			•			•	•		•	•
Viburnum rufidulum	rusty blackhaw	•	•				•			•	
Large Trees											
Acer negundo	ash-leaf maple	•	•					•		•	
Acer rubrum	red maple		•	•				•		•	•
Betula nigra	river birch	•	•	•				•		•	•
Carya cordiformis	bitternut hickory	•					•	•		•	•
Carya glabra	pignut hickory	•	•	•			•	•	•		
Carya ovata	shagbark hickory			•				•		•	
Carya tomentosa	mockernut hickory			•			•	•		•	•
Chamaecyparis thyoides*	Atlantic white cedar	•	•				•	•		•	•
Diospyros virginiana	persimmon	•	•	•			•	•	•	•	
Fagus grandifolia	American beech	•	•				•	•	•	•	
Fraxinus americana	white ash	•	•					•		•	
Fraxinus pensylvanica	green ash	•	•	•				•		•	
Juglans nigra	black walnut	•		•				•		•	
Juniperus virginiana	Eastern red cedar	•	•					•	•	•	
Liquidambar styraciflua	sweetgum			•	•		•	•		•	•
Liriodendron tulipifera	tulip poplar	•	•	•				•		•	
Nyssa aquatica	water tupelo	•	•	•				•	•	•	
Nyssa sylvatica	black gum	•	•	•				•	•	•	
Oxydendrum arboreum	sourwood		•					•		•	
Pinus echinata	shortleaf pine		•				•	•	•		
Pinus serotina	pond pine	•	•	•				•		•	•
Pinus strobus	white pine		•	•				•	•	•	
Pinus taeda	loblolly pine	•	•	•				•	•		•
Pinus virginiana	Virginia pine			•				•	•		
Platanus occidentalis	sycamore			•			•	•		•	•
Prunus serotina	wild black cherry	•		•			•	•	•		
Quercus alba	white oak	•	•	•				•	•		
Quercus bicolor	swamp white oak	•		•		•	•				•
Quercus coccinea	scarlet oak	•	•					•	•		
Quercus falcata	Southern red oak	•	•	•		•	•			•	•
Quercus laurifolia	swamp laurel oak	•		•				•	•		•
Quercus michauxii	swamp chestnut oak	•	•					•			•
Quercus muehlenbergii	chinkapin oak	•						•	•		
Quercus nigra	water oak	•		•		•	•			•	•
Quercus palustris	pin oak	•	•	•		•	•				•
Quercus phellos	willow oak	•	•	•				•		•	•
Quercus prinus	chestnut oak	•		•		•	•			•	
Quercus rubra	Northern red oak	•	•	•				•	•	•	
Quercus stellata	post oak	•	•	•				•	•		
Quercus velutina	black oak	•		•		•	•			•	
Quercus virginiana	live oak	•	•					•	•	•	
Robinia pseudoacacia	black locust			•				•		•	
Sassafras albidum	sassafras			•				•	•	•	
Taxodium distichum	bald cypress		•	•				•			•
Tilia americana	American basswood			•			•			•	



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Enclosure 5. NASO Instruction 5090.2E (Procedures for Cutting Firewood and Use of Tree Products)

DEPARTMENT OF THE NAVY
1750 TOMCAT BOULEVARD
NAVAL AIR STATION OCEANA
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:

NASOCEANAINST 5090.2E
18
25 OCT 1999

NAS OCEANA INSTRUCTION 5090.2E

Subj: PROCEDURES FOR CUTTING FIREWOOD AND USE OF TREE PRODUCTS

Ref: (a) OPNAVINST 5090.1B
(b) NAVFAC P-73

Encl: (1) Chainsaw Safety

1. Purpose. To establish procedures governing cutting of trees for firewood and obtaining other forest products on board Naval Air Station (NAS) Oceana, Fleet Combat Training Center (FCTC) Dam Neck and Naval Auxiliary Landing Field (NALF) Fentress.

2. Cancellation. NASOCEANAINST 5090.2D. Because of numerous revisions, paragraph markings have been omitted.

3. Definition. Forest products, for the purpose of this instruction include: Pine straw, live and felled trees and scrap lumber or pallets.

4. Policy. It is the continuing policy of the Secretary of the Navy that all Navy facilities and installations having land areas with a potential for timber production have an active program for the conservation and management of forest resources as outlined in reference (a).

5. Responsibilities

a. Natural Resources Manager, Regional Environmental Group Oceana shall administer and oversee the Firewood Program by designating areas for cutting, issuing permits, collecting fees and monitoring cutting. Methods of dispersal, sales and handling of funds shall be per references (a) and (b). Reference (a) notes that forest products will not be given away, abandoned, carelessly destroyed, used to offset costs of contracts or traded for products, supplies or services.

b. Base Security, with support from the designated Game Wardens, shall be responsible for enforcing this instruction and any conditions of firewood permits. At NALF Fentress woodcutters shall sign out in the visitor's logbook at the Crash Captain's Desk, Building 100.

c. Cutters and Gatherers shall comply with this instruction, applicable state and federal regulations and enclosure (1).

6. General

a. Authorized Personnel. The following persons are authorized to cut firewood and obtain other forest products on NAS Oceana, FCTC Dam Neck and NALF Fentress:

(1) Active duty military personnel

(2) Retired military personnel

(3) Federal civilian employees of NAS Oceana or FCTC Dam Neck

(4) Reservists

b. Utilization. All purchased wood is for the sole benefit of the purchaser's personal home use and is not to be resold.

7. Procedures

a. Permits. All persons cutting or collecting firewood or other wood products on NAS Oceana, FCTC Dam Neck or NALF Fentress shall have a firewood permit.

(1) Firewood permits are obtainable only from the Regional Environmental Group Oceana, Building 830 or Natural Resources Center, Building 78. A permit will be issued for a specific day and area and displayed on the vehicle dashboard. Cutting outside of designated days or areas may constitute a charge of trespassing.

(2) At the time of permit issuance, individuals shall be required to complete and sign a general release statement which relieves the federal government of all liability in case of accident or injury.

(3) There is a nominal charge for tree products. Prices may vary due to changes in marketability of a product. Loads larger or smaller than the standard fees listed below shall be priced by the Natural Resources Manager according to seasonal demand and availability.

Firewood - $20.00/small pickup truck load (cut-your-own)

Firewood - $30.00/small pickup truck load (cut and split, when available)

Firewood - $25.00/standard 8 foot bed pickup truck load (cut-your-own)

Firewood - $40.00/standard 8 foot bed pickup truck load (cut and split, when available)

Scrap lumber, crates, and pallets - $ 10.00/pickup truck load

Pine straw - $ 5.00/pickup truck load

Live trees - $ 10.00 - $25.00/tree. Varies with species and availability. Requires prior approval from the Natural Resources Manager.

(4) Permits shall specify the date of harvest and/or collection and can be used only for the specified number of loads.

(5) Individuals may not remove more than three cords of wood per calendar year.

b. Harvesting

(1) Individuals shall provide their own cutting and hauling equipment.

(2) Wood shall be cut only in locations on NAS Oceana, FCTC Dam Neck and NALF Fentress designated by the Natural Resources Manager.

(3) Firewood shall be cut during daylight hours only.

(4) Unless otherwise specified on the permit, only trees within the designated area that have been previously felled may be taken.

(5) No minors (under the age of 18) shall be allowed to operate a chainsaw or any other sharp tools, such as a saw, hatchet or axe.

(6) Limbs and/or brush shall be removed at least twenty feet away from any road or firebreak and removed from any stream or standing body of water.

(7) Young trees shall be protected and there shall be no ground disturbances that could cause erosion.

(8) Littering is prohibited at all times. Individuals found littering shall have their woodcutting privileges suspended.

(9) Operating a chainsaw while under the influence of alcohol is prohibited. Individuals found guilty of consuming alcoholic beverages while on the worksite shall have their privileges revoked.

8. Violations. Individuals found violating the provisions of this instruction may have wood cutting privileges suspended or revoked.

W. C. ZOBEL

Distribution:
NASOCEANAINST 5216.1U
List I (Case A), III and IV

CHAINSAW SAFETY

1. Wear snug fitting clothes, gloves, and heavy boots.

2. Wear ear and eye protection.

3. Avoid kick-back. Never cut with the nose of the guidebar.

4. Avoid over reaching and cutting above shoulder height.

5. Have non-alcoholic beverages on hand to prevent dehydration in hot and cold weather.

6. Use a sharp chain, set at the proper tension.

7. Stay clear of the cutting path of the chainsaw.

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Appendix K

Wildlife Management

Enclosure 1	**Wildlife Hazard Assessment for Naval Air Station Oceana (2011)**
Enclosure 2	**Wildlife Hazard Assessment for Naval Auxiliary Landing Field Fentress (2012)**
Enclosure 3	**NAS Oceana Bird Animal Strike Hazard (BASH) Program (NASOCEANAINST 3750.2A) and Airfield Obstruction Vegetation Management Zones Maps**
Enclosure 4	**USFWS Migratory Bird Depredation & VDGIF Kill Permit**
Enclosure 5	**USFWS Eagle Depredation Permit**
Enclosure 6	**Commander, Navy Region Mid-Atlantic Instruction (COMNAVREG MIDLANT INST) 11015.3 (Natural Resources Management for Fish and Wildlife, Feral Animals, Invasive Species, and Certain Pests)**
Enclosure 7	**Chief of Naval Operations (CNO) Policy Letter on Feral Cats and Dogs**
Enclosure 8	**Naval Air Station Oceana, Naval Auxiliary Landing Field Fentress, and Naval Air Station Oceana Dam Neck Annex Prescribed Burn and Smoke Management Plan (2010)**
Enclosure 9	**Hunting Regulations and Information**
Enclosure 10	**Commander, Navy Region Mid-Atlantic Instruction (COMNAVREG MIDLANT INST) 11015.1 (Fishing)**
Enclosure 11	**Pollinator Management**

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Enclosure 1. Wildlife Hazard Assessment for Naval Air Station Oceana (2011)

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WILDLIFE HAZARD ASSESSMENT

For

NAVAL AIR STATION OCEANA

June 1, 2010 through May 31, 2011

Prepared by

United States Department of Agriculture

Animal and Plant Health Inspection Service

Wildlife Services

Timothy J. Linder, Wildlife Biologist

July 20, 2012

Table of Contents

EXECUTIVE SUMMARY

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program (WS) conducted a 12-month wildlife hazard assessment (WHA) to identify wildlife hazards to aviation safety at Naval Air Station Oceana (NASO) from June 2010 through May 2011. To assess daily and seasonal patterns of wildlife use, we conducted bird surveys twice per month throughout the airfield and twenty-two night-time surveys to observe deer abundance and distribution. Data collected included species abundance, behavior, and habitat use. In addition, WS identified and monitored areas outside of the airfield that may attract hazardous wildlife species to NASO. Bird species observed were grouped into guilds (species that display similar behavioral characteristics) for analysis. Data collected during surveys were analyzed and compared with records from the Navy Safety Center Web Enabled Safety System (WESS) BASH database, control efforts by NASO and WS personnel, and a wildlife hazard ranking list (Dolbeer and Wright 2009) to identify the species that are most hazardous to aviation safety at NASO.

Based on information collected during the WHA, 1 mammal group and 7 guilds identified at NASO from June 2010 through May 2011 presented the greatest threats to aviation safety. These group/guilds included deer, gulls, raptors (hawks, vultures, eagles), waterfowl (ducks and geese), pigeons/doves, crows/ravens, starlings, and blackbirds/orioles. Though blackbirds/orioles were the most abundant guild, deer were the most hazardous due to their large size, strike record, availability of habitat at or near NASO, and general abundance in the area. There were 4 species observed during the WHA that ranked as an extremely high hazard to aviation safety, and one species ranked as very high.

WS recommends a variety of methods to reduce or eliminate the threat of wildlife strikes from the group and guilds observed during the WHA. Habitat management can include: eliminating or excluding areas of standing water; vegetation management in the airfield; reducing or excluding bird perching/loafing areas; reducing abundance of prey species (such as small rodents and insects) in the airfield; installation of an Air Operations Area (AOA) fence, and ensuring that the perimeter fence is in good repair and prevents mammals such as deer from entering the airfield. WS also recommends harassment methods such as pyrotechnics, sirens, paintballs, propane cannons and other acoustic dispersal devices to disperse birds from the airfield. Lethal control of hazardous species should be exercised when necessary utilizing firearms and/or traps. Permits for lethal control of species protected under Federal and State laws should be maintained from the U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries.

Additional recommendations include updating the NASO's Bird/Animal Aircraft Strike Hazard (BASH) Plan, establishment of a formal BASH Working Group (BWG), establish a Bird Detection and Dispersal Team (BDDT), establish formal BASH training and evaluating potential wildlife hazards when planning new construction or land use changes. It is recommended that NASO continue to monitor wildlife abundance and habitat use in order to provide insight into wildlife use of the airfield and aircraft hangars to gauge the effectiveness of control efforts.

1.0 INTRODUCTION

1.1 Purpose and Need for Action

Birds and other wildlife in the vicinity of airports are an increasing threat to aviation safety (Dolbeer et al. 2011). Since 1980, the Navy's national wildlife/aircraft strikes database accounted for 440 A, B, C and D Class-rated incidents that included two fatalities to Naval pilots and over $372 million dollars in damages (Naval Safety Center). Based on the Naval Safety Center analysis and statistics, the average damage cost over the last 31 years is one million dollars per month. It is estimated that wildlife/aircraft strikes cost the U.S. civil aviation industry more than $614 million annually, while worldwide the total cost is over $1.2 billion per year (Keirn et al. 2010). In addition to costly aircraft repairs and down time, wildlife strikes sometimes result in serious injury or death. In January 2009, the wildlife/aircraft strike issue was dramatically illustrated when U.S. Airways Flight 1549 crash landed in New York's Hudson River after ingesting Canada Geese into both engines shortly after takeoff from LaGuardia Airport (Dolbeer 2009). This incident has been referred to in the media as "The Miracle on the Hudson" since all 155 passengers and crew survived despite the aircraft being a total loss. Less than two weeks prior to this incident, eight people were killed and one was seriously injured when a helicopter transporting workers to an offshore site in Louisiana struck a Red-tailed Hawk and crashed into a marsh (Wright 2011).

The Commander, Naval Installations Command (CNIC) established the Navy Bird/Animal Strike Hazard Program Implementing Guidance (CNICINST 3700, Appendix A). This instruction establishes the guidance for all installations that conduct or support air operations to conduct a Wildlife Hazard Assessment (WHA). Although the U.S. Navy is not required to follow the regulations set down by the FAA, the Navy does implement the FAA's guidance and expertise whenever practical and appropriate.

The Federal Aviation Administration (FAA) is responsible for setting and enforcing the Federal Aviation Regulations (FAR) and policies to enhance public safety at civil airports. To ensure compliance with Code of Federal Regulations (CFR) 14 Part 139.337, the FAA requires certificated airports to conduct a wildlife hazard assessment (WHA), and if necessary, establish a wildlife hazard management plan (WHMP) when any of the following triggering events occur on or near an airport:

(1) An air carrier aircraft experiences multiple wildlife strikes;

(2) An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph, substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component;

(3) An air carrier aircraft experiences an engine ingestion of wildlife; or

(4) Wildlife of a size, or in numbers, capable of causing an event described above are observed to have access to any airport flight pattern or aircraft movement area.

The WHA must be conducted by a qualified wildlife biologist (see FAA Advisory Circular 150/5200-33B) and should include the following information:

(1) An analysis of the events or circumstances that prompted the assessment;

(2) Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences;

(3) Identification and location of features on and near the airport that attract wildlife;

(4) A description of wildlife hazards to air carrier operations; and

(5) Recommended actions for reducing identified wildlife hazards to air carrier operations.

Naval Air Station Oceana

In June 2010 NASO entered into a cooperative service with the United States Department of Agriculture, Animal and Plant Health Services, Wildlife Services (hereafter referred to as WS) to initiate bird and deer surveys, evaluate current Wildlife Damage Management (WDM) program and provide direct control of hazardous wildlife using the airfield and hangars. The initial efforts focused on direct reduction of deer populations on and around the airfield. In August 2010, CNIC entered into a cooperative service agreement with WS to conduct a WHA and to establish and continue an Integrated Wildlife Damage Management program (IWDM) at NASO. Oversight and direction of the IWDM will fall under direct supervision of the NAS Oceana Air Operations Department. Prior to 2010 a WHA had not been conducted at NASO. In March of 1999 Geo-Marine, Inc. provided NASO with a BASH Plan. This BASH Plan did not include a formal evaluation of airfield specific hazards.

1.2 Legal Authority of Wildlife Services

The U.S. Navy, Commander Navy Installations Command (CNIC) and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program (WS) have entered into a Work/ Financial Plan where WS will provide assistance to mitigate potential and realized wildlife hazards at USN air stations in the continental United States (Appendix B). The Plan establishes WS as the appropriate agency to conduct wildlife hazard management at Navy installations.

The primary statutory authority by which WS operates is the Animal Damage Control Act of March 2, 1931, as amended (7 U.S.C. 426-426c; 46 Stat. 1468). WS has the authority to manage migratory bird damage as specified in the CFR. In addition, the

Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 authorizes and directs the Secretary of Agriculture to cooperate with States, individuals, public and private agencies, organizations, and institutions in the control of nuisance mammals and birds deemed injurious to the public.

The Plan and legislation authorizes WS to conduct initial on-site investigations, biological assessments (short-term studies), WHA, and wildlife management techniques to assist USN air stations.

1.3 Legal Status of Wildlife Species

Most species of wildlife are protected by one or more Federal, State, and/or local laws and regulations. As such, several agencies may be responsible for implementation of these regulations and specific permits may be required prior to taking action to reduce wildlife threats to aviation safety.

Federal laws passed by Congress to protect wildlife include (but are not limited to) the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and the Endangered Species Act (ESA). Federal wildlife laws are generally administered by the U.S. Fish and Wildlife Service (USFWS), which is the lead agency responsible for migratory birds protected under the MBTA, BGEPA, and ESA. The USFWS may issue depredation permits to take or harass migratory birds when those species are causing damage to various resources or threaten human health and safety (Appendix C).

The Commonwealth of Virginia defers to the Federal depredation permit for take of non-game migratory bird species, though a separate permit is required to take mammals and game bird species managed by the Virginia Department of Game and Inland Fisheries (VDGIF). As detailed in § 29.1-529 of the Code of Virginia, airport operators may obtain authorization from VDGIF to take wildlife (that are not federally protected) as necessary to protect aviation safety (Appendix D).

The Commonwealth of Virginia hosts a number of threatened and endangered (T&E) species that are granted protection under Federal and State regulations (Appendix E). Prior to conducting operational control work such as harassment, shooting, trapping, or habitat manipulation, the list of species of concern should be reviewed to ensure compliance with Federal and State regulations.

2.0 OBJECTIVES

The objectives of this WHA were to:

1. Identify wildlife species, numbers, locations, behavior, and habitat use in and around the airfield, with particular emphasis on species most hazardous to aircraft safety;
2. Identify and locate features on and in the vicinity of the airport that attract wildlife;
3. Describe wildlife hazards to aviation safety at NASO;
4. Provide NASO with management recommendations to reduce or eliminate wildlife hazards to aviation safety and serve as a basis for updating the current BASH Plan.

3.0 DESCRIPTION OF STUDY AREA

Figure 1: Aerial view of NASO (photo from GoogleEarth, 2010).

Naval Air Station Oceana is located within the City of Virginia Beach, VA. NASO's 4 runways, 2 sets of parallel runways (5R/23L, 5L/23R, 14R/32L, and 14L/32R), supported 76,296 aircraft operations in calendar year 2010. There are 19 squadrons based at NASO housing approximately 315 military aircraft. NASO property incorporates approximately 5,900 acres, of which 3,200 acres makeup the airfield. The airfield is comprised of open grassland (~920 acres), agricultural leases (~720 acres), woodlots, and areas of secondary growth (~1,560 acres). The woodlots are primarily comprised of mixed hardwoods and evergreens. The remaining 2,700 acres of base not included in the airfield are comprised of facility buildings, two 18-hole golf courses, woodlots, agricultural areas, wetland mitigation sites, and open grasslands. A 7-foot fence with a three strand barbed-wire outriggers surrounds the perimeter of the base. NASO is bordered by a mixture of residential, woodland, industrial, agricultural, and open water areas.

4.0 METHODS

Data collection for the WHA began June 1, 2010 and continued through May 31, 2011. Bird survey procedures were based on the North American Breeding Bird Survey methodology. Surveys were conducted twice per month for 12 months at 18 observation points on the airfield (Figure 2). The beginning observation point for each survey was randomly selected, with 2 repetitions of the survey route per day (1/2 hour after sunrise and 2-3 hours prior to dusk).

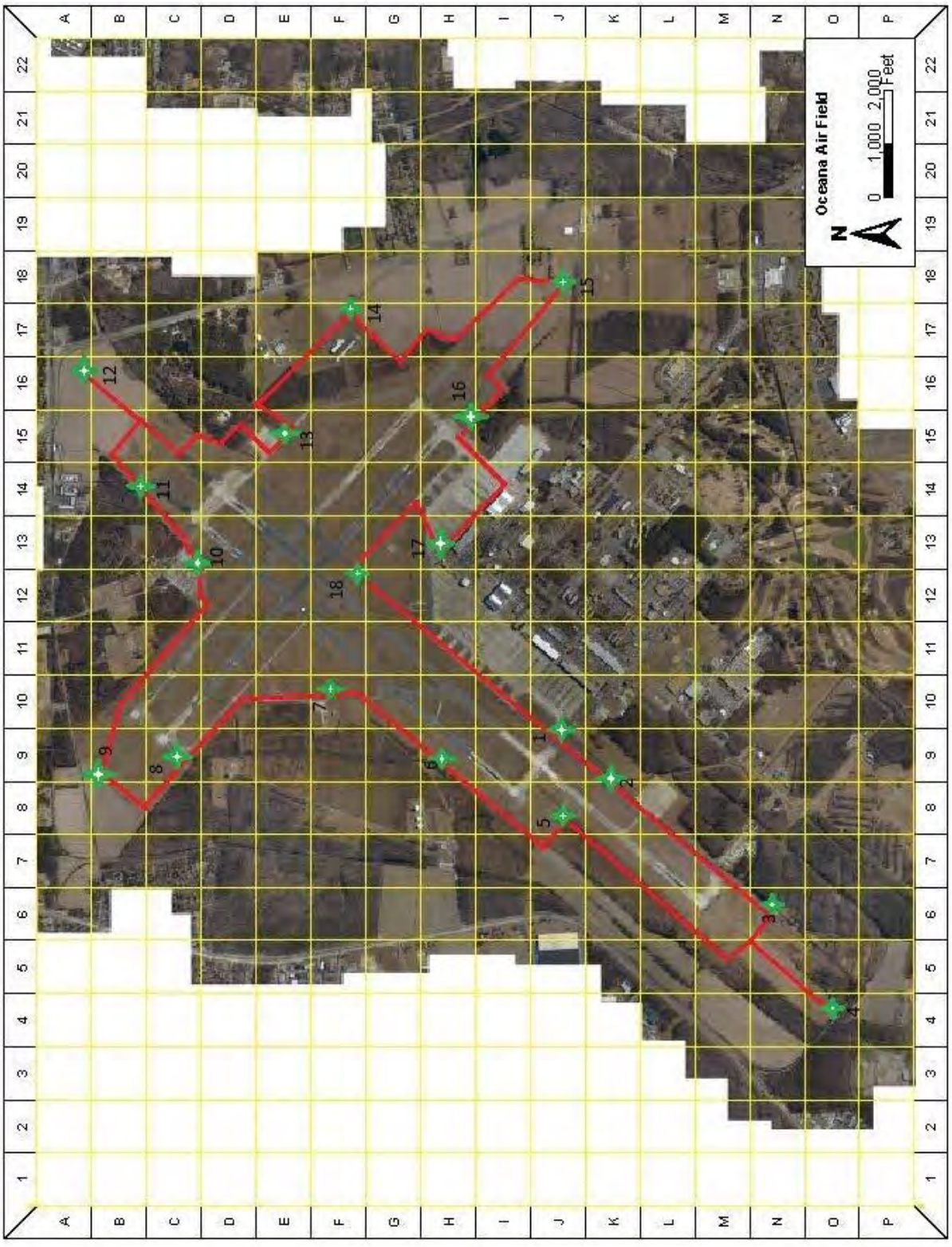

Figure 2: NAS Oceana Bird Observation Points and Survey Route.

Birds were observed from a vehicle for 3 minutes at each point, with approximately ¼ mile distance between points. At each observation point, the following data were recorded: weather, temperature, time, location, species, number observed, activity (behavior), habitat type, direction of flight, and comments on any other significant information (i.e., freshly mowed grass, approaching weather, change in flight activity, agricultural crop on fields, etc.). A map overlain with a 1000-foot grid system was used to record location. Bird species were located without the aid of binoculars, though binoculars were used to identify species that could not be readily identified with the naked eye or in low light conditions. Alpha species codes from the North American Bird Banding Manual were used to record birds observed during surveys.

In addition to bird surveys, 22 night-time deer surveys were conducted in the airfield over the course of the study period. Beginning 1 hour after sunset, night surveys were conducted by driving an established route 15.5 miles long around the airfield (Figure 3). Observations were made using spotlights and forward looking infra-red (FLIR) equipment to determine primarily deer and other mammal use of the airfield. Information recorded included: weather, temperature, time, location, species, number observed, activity, and habitat type.

Data were analyzed with descriptive statistics and frequency distributions per month using the Wildlife Hazard Management Information System (WHMIS) software developed by WS to determine trends in species abundance, habitat use, and behavior. For analysis purposes, common species were categorized into groups or guilds. Species were placed into their respective guilds based on similar behavioral characteristics, not taxonomic relationships (although guilds often parallel taxonomic lines). This approach was selected because behavioral attributes play a significant role in predisposing some species of wildlife to collisions with aircraft. In addition, wildlife control strategies are often selected based on their ability to exploit an animal's specific behavior(s), therefore species that exhibit similar behaviors and life history attributes generally require similar control methods.

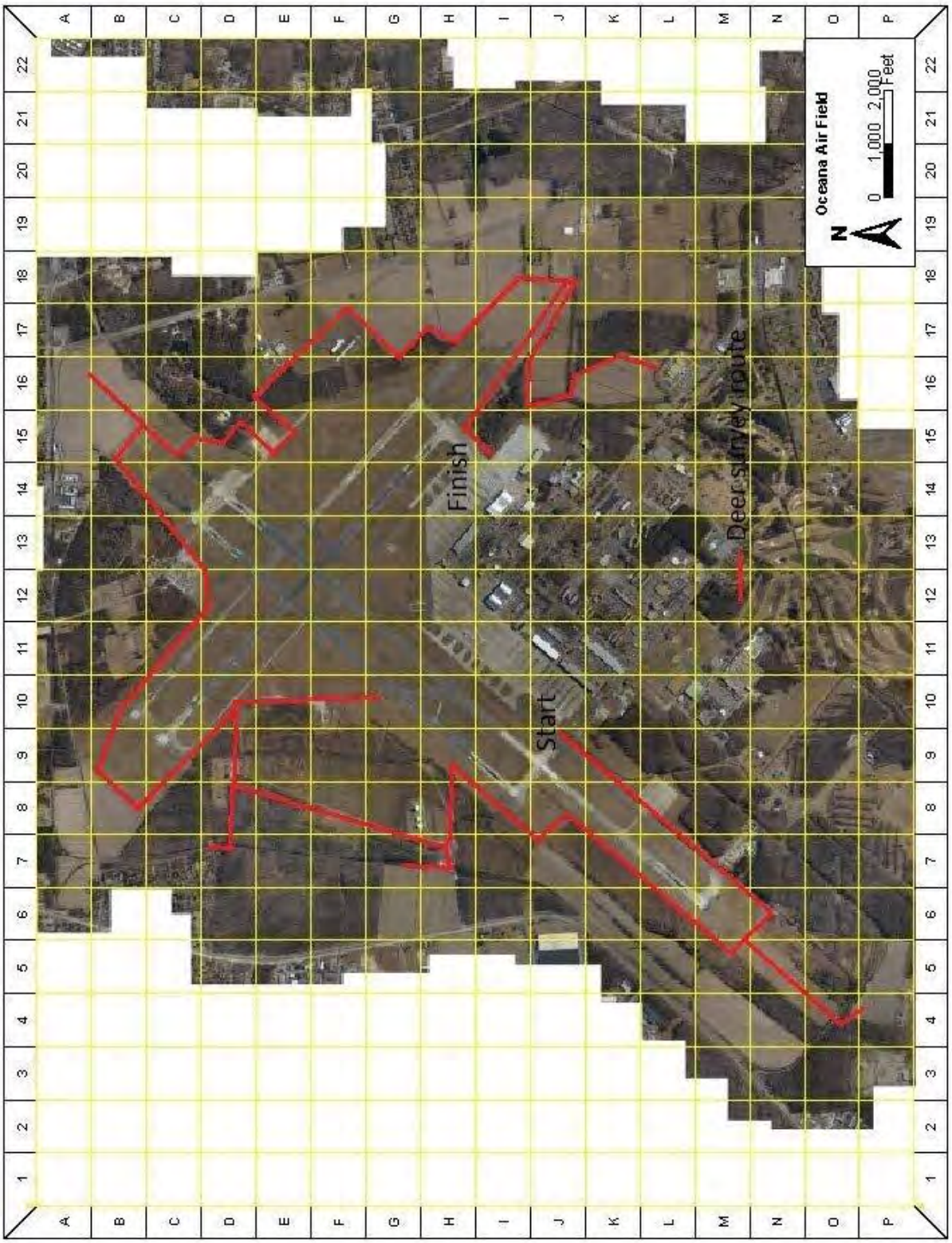

Figure 3: NAS Oceana Deer Survey Route.

5.0 RESULTS

5.1 Wildlife/Aircraft Strikes

According to criteria outlined in FAA Advisory Circular 150/5200-33A, a wildlife strike has occurred when:

1. A pilot reports striking 1 or more birds or other wildlife;
2. Aircraft maintenance personnel report aircraft damage as having been caused by a wildlife strike;
3. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;
4. Bird or other wildlife remains, whether in whole or in part, are found within 250 feet of a runway centerline, unless another reason for the animal's death is identified; and
5. An animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high speed emergency stop, aircraft left pavement area to avoid collision with an animal, etc.).

Wildlife strike data provide valuable information about wildlife hazards on or near airfields, including the species that are struck, seasonal trends, and time of day when strikes occur. Nationwide, the number of reported wildlife strikes has shown a five-fold increase from 1990 through 2009 (Dolbeer et al. 2011). Despite the increase in reported strikes, the number of strikes resulting in damage during this same time period has declined by 21% (Dolbeer et al. 2011). This important fact is attributed to successful wildlife hazard management programs and improved reporting at many certificated airports (Dolbeer et al. 2011).

Data obtained from the Navy Safety Center WESS and Smithsonian Feather ID Lab revealed that there have been 327 reported wildlife strikes at NASO from 1981 through 2010 (Figure 4). Wildlife strikes peaked in 2010 with 45 reported strikes (Figure 4). The upward trend in wildlife strikes at NASO may be attributed to factors such as increases in wildlife populations, changing land uses on and adjacent to the airbase, and an increase in reporting. The Navy Safety Center estimates that only 25% of all strikes are reported. Much of the increase may be attributed to better reporting of wildlife strikes due to greater awareness of the wildlife strike issue and greater cooperation within the aviation industry to report strikes (Dolbeer et al. 2011).

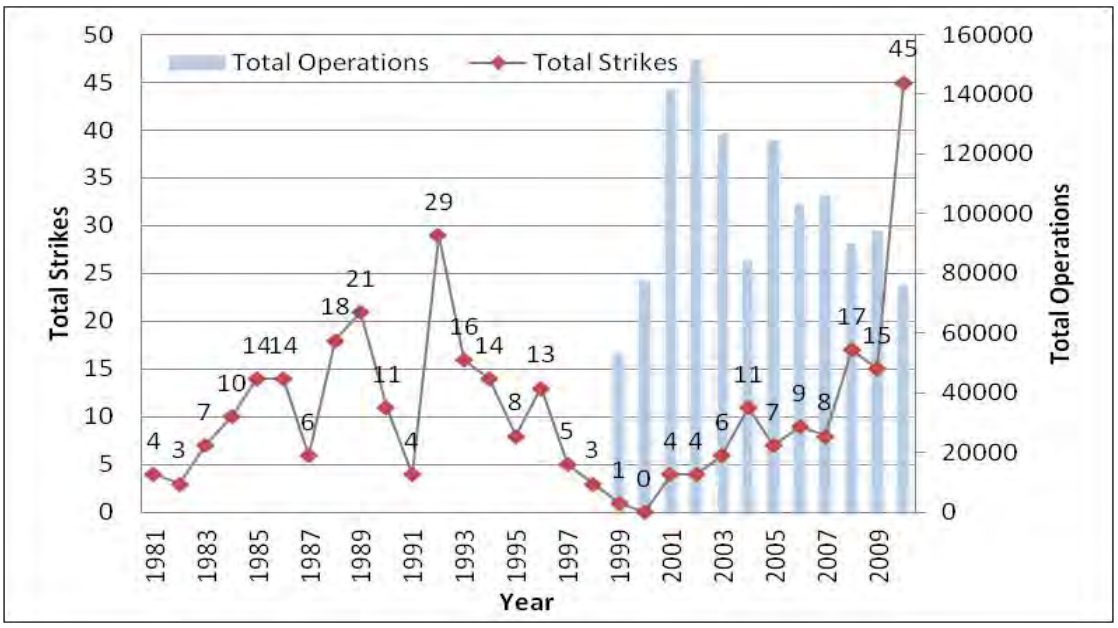

Figure 4: Reported wildlife strikes (1981-2010) and aircraft operations (1999-2010) at NASO.

Of the 327 reported strikes at NASO from 1981 through 2010, over 80% were unknown species (263), 11.9% involved birds (39), 7.3% were white-tailed deer (24), and less than 1% involved bats (1). Most of the unknown strike reports were bird species (270, or 82.5%). Of the strikes where the species was identified, white-tailed deer (24), and gulls (5) were the most frequently reported species. Consistent with national trends (Dolbeer et al. 2011), most strikes at NASO occur in the late summer through early fall (Figure 5). Strikes during these periods coincide with the dispersal of naïve juveniles and fall migration.

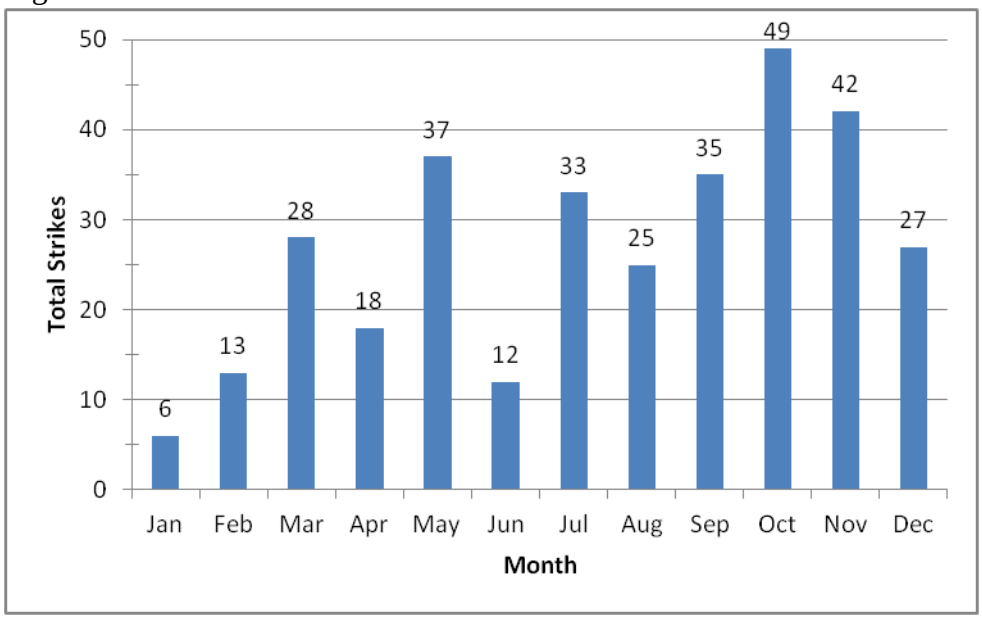

Figure 5: Number of strikes reported by month at NASO, 1981-2010.

For all strikes reported at NASO only 0.9% (3 of 327) reported damage >$10,000 (Table 1). All 3 strikes were * Class C Mishaps (1 deer $15,000, 1 deer $12,258, and 1 unknown gull $19,999).

Table 1: Strikes with reported damage at NASO, 1981-2010.

Species	N	A	B	C	Total
Unknown	263				263
White-tailed Deer	22			2	24
Passerine Species	5				5
Ring-billed Gull	3				3
Herring Gull	3				3
Blackpoll Warbler	3				3
Eastern Meadowlark	2				2
Red-tailed Hawk	2				2
American Kestrel	2				2
Barn Swallow	2				2
Chimney Swift	2				2
Tree Swallow	1				1
Upland Sandpiper	1				1
Horned Lark	1				1
Baltimore Oriole	1				1
Fox Sparrow	1				1
Unknown Seabird	1				1
Unknown Gull				1	1
Broad-winged Hawk	1				1
Morning Dove	1				1
Northern Parula	1				1
Black-throated Blue Warbler	1				1
Yellow-rumped Warbler	1				1
Common Yellowthroat	1				1
Swainson's Thrush	1				1
Pectoral Sandpiper	1				1
Bat	1				1
Total	**322**	**0**	**0**	**3**	**327**

* **Damage Classes: N = No damage Reported or <$10,000**
A = >$1,000,000
B = $200,000 to <$1,000,000
C = $10,000 to <$200,000

5.2 Wildlife Surveys

Birds

From June 2010 through May 2011, WS recorded 32,037 bird observations at NASO during bird surveys. Sixty-nine bird species representing 29 different bird guilds were observed throughout the study year (a complete table listing each guild and species observed throughout the study year may be found in Appendix F). The 6 most abundant guilds were Blackbirds/Orioles (15,454), Starlings (6,046), Waterfowl (1,701), Pigeons/Doves (1,571), Crows/Ravens (1,472), Meadowlarks (1,244), and Gulls (1,139. The 10 most abundant species observed are listed below[1]:

1.) European Starling (*Sturnus vulgaris*) = 6,046
2.) Canada Geese (*Branta canadensis*) = 1,618
3.) American Crow (*Corvus Brachyrincos*) = 1,472
4.) Eastern Meadowlark (*Sturnella magna*) = 1,244
5.) Mourning Dove (*Zenaida macroura*) = 952
6.) Laughing Gull (*Larus atricilla*) = 766
7.) Rock Pigeon (*Columba liva*) = 619
8.) Tree Swallow (*Tachycineta bicolor*) = 510
9.) Red-winged Blackbird (*Agelaius phoeniceus*) = 441
10.) Killdeer (*Charadrius vociferous*) = 432

Birds were observed in 14 different habitat types during surveys at NASO. Birds were most commonly observed utilizing the large, open areas of short grass (32%) that makeup the dominant habitat feature on the airfield (Figure 6). Woodland areas were the next most commonly used habitat (21%), followed by structures (13%) such as towers, fences, and buildings where birds were often observed loafing.

Bird activity was classified into 12 categories: flying locally (short, random flights); perched (loafing on a structure); vocalizing; feeding (actively consuming food); standing; flying passing (flying in a continuous path beyond the survey area); loafing (staying in one area, on a structure for a length of time without engaging in another activity); towering (flying in a circular pattern, often while utilizing thermal currents); hawking insects (flying erratically while attempting to catch insects); walking; roosting (perched in a single location for the night); and swimming. Sixty-three percent of all observations fell into three activities: flying locally (31%), perched (19%) and vocalizing (13%) for all species during the study year (Figure 7).

[1] Total abundance is derived by summing all bird observations throughout the study year. Therefore, the total number of bird observations includes individuals that may have been present on the airfield day after day and were recorded on multiple occasions.

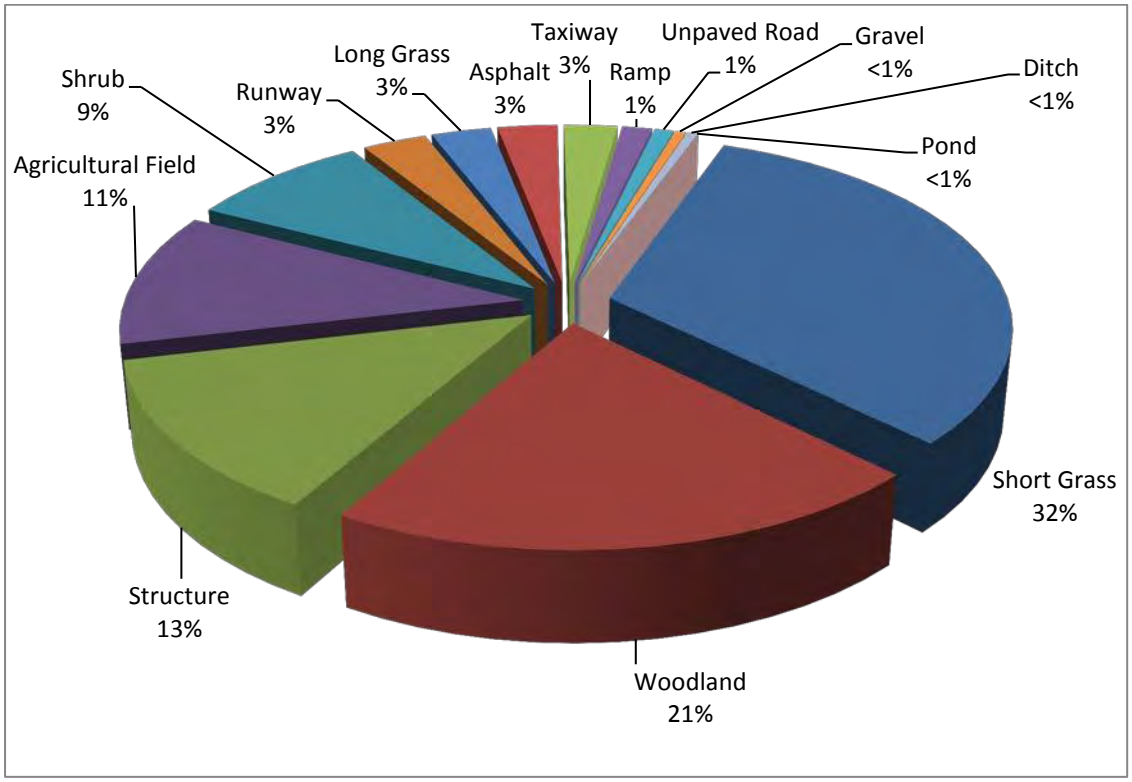

Figure 6: Habitat use by birds at NASO, June 2010 through May 2011.

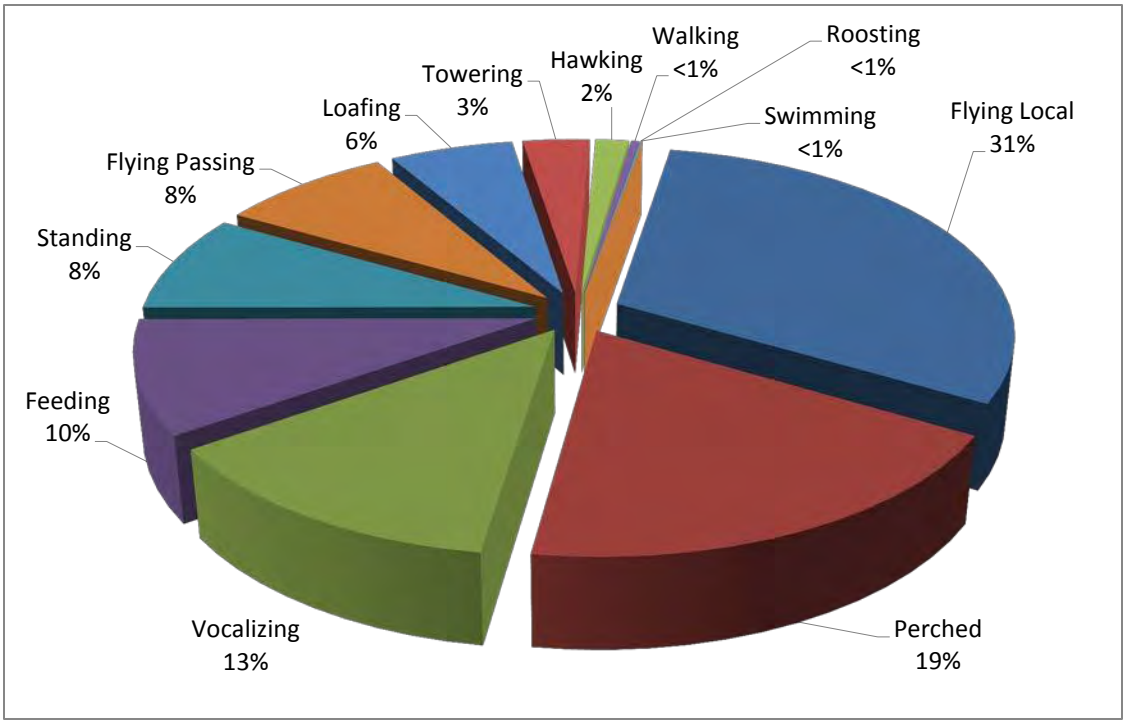

Figure 7: Bird activity at NASO, June 2010 through May 2011.

Mammals

WS completed 22 night surveys of the NASO airfield during the study year. Three hundred and seventy-nine medium to large mammals were observed during night surveys throughout the study year, with white-tailed deer (*Odocoileus virginianus*) being the most frequently observed species (Table 2). Observations recorded during night surveys may have been multiple observations of the same individuals throughout the survey year. Most mammal species were observed in the agricultural fields or in short grass (Table 2).

Table 2: Mammal species and cover type observed during night surveys at NASO.

Species	Ag. Fields	Grass, Short	Grass, long	Woodland	Shrub	Asphalt/Unpaved Road	Total
White-tailed Deer	143	134	31	28	29	0	**365**
Coyote	1	3	0	0	0	1	**5**
Red Fox	0	0	1	1	0	1	**3**
Gray Fox	2	0	0	0	0	0	**2**
Bobcat	1	0	0	0	1	1	**3**
Total	**147**	**137**	**32**	**29**	**30**	**3**	**378**

Small mammal surveys were not included in this WHA. Small mammal surveys are conducted bi-annually in the fall and spring to determine abundance and preferred habitat for species such as voles and mice inhabiting the airfield. The data is beneficial for evaluating predator-prey relationships on the airfield by comparing relative rodent abundance to wildlife activity and strike information. Small mammal surveys were conducted in the fall of 2011 and spring of 2012. The data collected from these surveys will be evaluated and included in the first annual update to this WHA.

6.0 DISCUSSION

Although almost all wildlife species commonly found at airports can pose some hazard to aircraft safety, not all species are equally hazardous to aviation (Dolbeer and Wright 2009). For example, large bird species such as Canada Geese (*Branta canadensis*) are more likely to cause damage if struck by aircraft than species the size of a sparrow. Utilizing the FAA wildlife strike database, Dolbeer and Wright (2009) developed a ranking of 89 wildlife species that pose the greatest threats to aircraft safety. The ranking was based on the percentage of strikes causing damage to aircraft from 1990 through 2007, and species were classified into 6 hazard severity levels ranging from extremely high (>40% of strikes causing damage) to very low (<1% of strikes causing damage). Combined with wildlife surveys conducted locally at an airbase, this hazard ranking list can be used to prioritize management actions to species posing the greatest risk to aircraft safety (Dolbeer and Wright 2009).

Though there were 76 species observed from 29 different guilds and 4 mammal groups during the study year (Appendix F), for this discussion emphasis will be placed on those guilds/groups that pose the greatest threats to aviation safety at NASO. For this analysis the following criteria was used:

Primary Consideration:

1. Number of individuals observed during surveys.

2. The individuals' associated hazard ranking according to Dolbeer and Wright.
3. Evaluation of NAS Oceana's strike record.

Secondary consideration was given for the following conditions:

- Location and behavior of individuals within each guild/group.
- Amount of control effort attributed to remove the specific hazard from the airfield (i.e. did the species easily disperse or not).

Using this information, guilds/groups were ranked in order of the threat level that they pose to aviation safety at NASO from the most severe to the least. This comparison helps to show that the most abundant species at an airfield (Blackbirds/Orioles, in this case) are not necessarily the most hazardous to aircraft safety due to abundance alone. The 8 guilds/group identified as most hazardous to aircraft safety at NASO from June 2010 through May 2011 were deer, Gulls, Raptors, Waterfowl, Pigeons/Dove, Crows/Ravens, Starlings, and Blackbirds/Orioles (Table 3), respectively. There were four species observed at NASO that ranked as extremely high hazards to aviation safety, one as very high, and six as high hazards (Table 3). The following discussion and management recommendations will focus on the 8 most hazardous guilds/groups listed in Table 3. However, most if not all of the management recommendations (habitat modification, dispersal methods, etc.) will be effective for managing the majority of species observed at NASO.

Table 3: Guild hazard ranking and total observations at NASO, June 2010 through May 2011.

Guild/Group	Species	Hazard Level and percentage of strikes causing damage in the U.S.[1]	Total Observed at NASO[2]	Reported Strikes at NASO, 1981-2010	Strikes at NASO with reported damage, 1981-2010[3]
Artiodactyls	White-tailed Deer	Extremely High (82%)	365	24	2
Gulls	Laughing Gull	Moderate (7%)	766	0	0
	Ring-billed Gull	High (10%)	346	3	0
	Herring Gull	High (12%)	23	3	0
	Unknown Gull	n/a	4	1	1
	Totals		**1139**	**7**	**1**
Raptors	Red-tailed Hawk	High (17%)	279	2	0
	American Kestrel	Very Low (1%)	171	2	0
	Northern Harrier	Low (2%)	171	0	0
	Turkey Vulture	Extremely High (52%)	99	0	0
	Osprey	Very High (22%)	11	0	0
	Cooper's Hawk	n/a	8	0	0
	Bald Eagle	Extremely High (42%)	4	0	0
	Sharp-shinned Hawk	n/a	1	0	0
	Broad-winged Hawk	n/a	0	1	0
	Totals		**744**	**5**	**0**

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Table 3 (Cont.): Guild hazard ranking and total observations at NASO, June 2010 through May 2011.

Guild/Group	Species	Hazard Level and percentage of strikes causing damage in the U.S.[1]	Total Observed at NASO[2]	Reported Strikes at NASO, 1981-2010	Strikes at NASO with reported damage, 1981-2010[3]
Waterfowl	Canada Goose	Extremely High (51%)	1618	0	0
	American Brant	n/a	67	0	0
	Tundra Swan	n/a	12	0	0
	Hooded Merganser	n/a	3	0	0
	Mallard	Very High (26%)	1	0	0
	Totals		**1701**	**0**	**0**
Pigeon/Doves	Mourning Dove	Moderate (4%)	952	1	0
	Rock Pigeon	High (12%)	619	0	0
	Totals		**1571**	**1**	**0**
Crows/Ravens	American Crow	High (10%)	1472	0	0
Starlings	European Starling	Moderate (4%)	6046	0	0
Blackbirds/ Orioles	Mixed Flock	n/a	14925	0	0
	Red-winged Blackbird	Low (3%)	441	0	0
	Common Grackle	Moderate (9%)	84	0	0
	Brown-headed Blackbird	Low (2%)	4	0	0
	Baltimore Oriole	n/a	0	1	0
	Totals		**15454**	**1**	**0**

1. Ranking based on strike reports from 1990-2007 (Dolbeer and Wright 2009); "n/a" indicates that species was not individually ranked.
2. Total observations obtained by summing all observations during surveys (day and night) from June 2010-May 2011. Total may include individuals that were present day after day and were recorded on multiple occasions.
3. Reported damage >$10,000.

6.1 Artiodactyls

Artiodactyls (i.e., deer) rank as the most hazardous mammal species to aviation safety in the United States, with 82% of strikes resulting in damage from 1990 through 2007 (Dolbeer and Wright 2009). The large size of species such as white-tailed deer and the percentage of strikes involving multiple animals make them especially hazardous to aircraft during the takeoff and landing phases of flight. From 1990 through 2009, Artiodactyls, primarily white-tailed deer, have been involved in 847 damaging strikes in the U.S., resulting in over $36 million in reported costs (Dolbeer et al. 2011).

General Abundance

Deer were the twelfth most abundant group observed at NASO from June 2010 through May 2011 (Appendix F). White-tailed deer (*Odocoileus virginianus*), the only species observed in this group, rank as an extremely high hazard to aviation safety, with 82% of strikes causing damage from 1990 through 2007 on civil airfields (Table 3, Dolbeer and Wright 2009). From 1981 through 2010, twenty-four deer were struck by aircraft at NASO, and account for two out of only three reported Class C mishaps (WESS Database) on base. A total of 365 deer were observed during 22 night surveys. Night surveys were conducted by driving a predetermined 15.5 mile route around the airfield, using spotlights and/or FLIR to locate deer. The initial two surveys in June of 2010 surveyed 61 and 66 deer. While the deer surveys in May of 2011 surveyed only five and seven deer, respectively. Large numbers of deer are routinely observed in areas surrounding the base property located outside the perimeter fence, on both Navy and private properties.

Attractants

The NASO airfield contains ideal habitat for deer, including agricultural fields, mature timber (especially white oak, a preferred food source), edge/shrub areas, emergent vegetation, and open grassland.

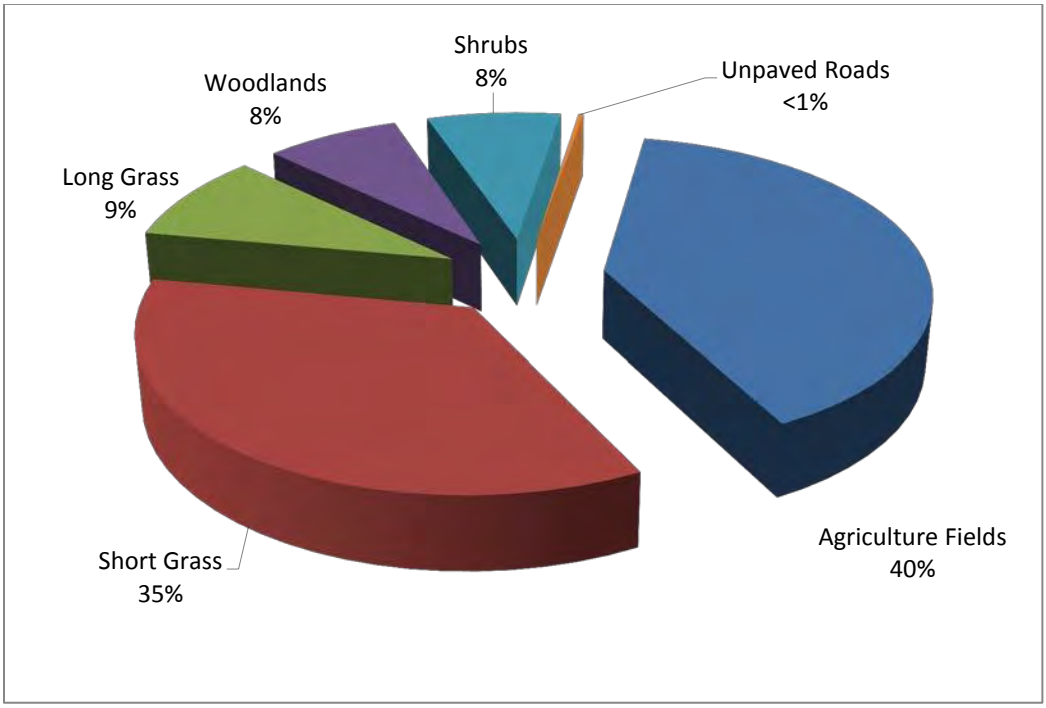

Figure 8: Deer habitat use at NASO, June 2010 through May 2011.

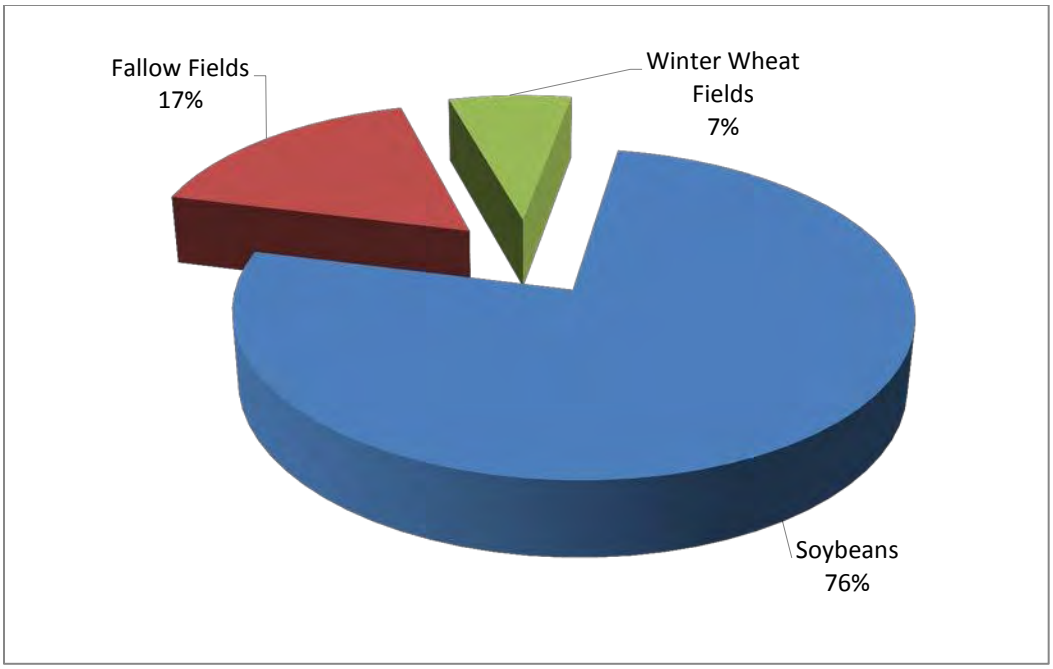

Figure 9: Deer agricultural field use at NASO, June 2010 through May 2011.

Deer were most often observed utilizing two habitat features at NASO: agricultural fields (40%) and short grass (35%, Figure 8). Soybeans accounted for 76% of all deer surveyed in agricultural fields (Figure 9).

NASO contains areas outside of the airfield within the base perimeter fence that contain ideal habitat for deer including: agricultural fields, mature timber, edge/shrub areas, emergent vegetation, wetland mitigation site, two 18-hole golf courses, and open grassland. Deer are often seen utilizing these habitat features by WS and base personnel. These areas outside of the airfield are not fenced off from the airfield. WS personnel have identified several travel corridors utilized by deer to gain access to the airfield (Figure 10). Travel corridors were identified by direct and indirect observations. The travel corridors are identified in yellow below.

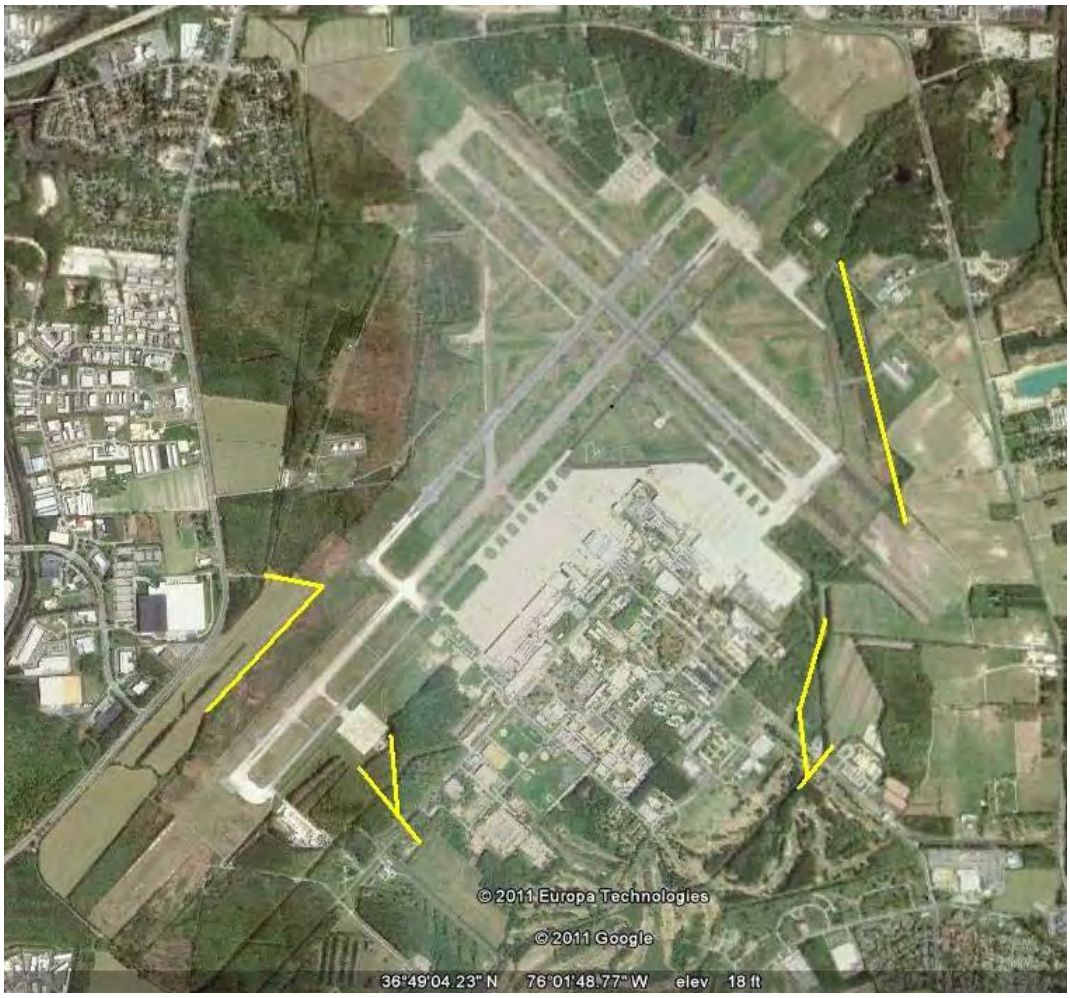

Figure 10: White-tailed deer travel corridors aerial view (photo from GoogleEarth, 2011).

Management Recommendations

Habitat management, installation of an airfield fence, maintenance of the perimeter fence, and removal of deer within the perimeter fence are the most important methods for reducing the threat of deer strikes at NASO. Airfield management is currently converting areas of optimal deer habitat (i.e., secondary growth and security cover) adjacent to the runways to maintained open grassland. After these areas have been cleared, it is important that they are properly maintained (regular mowing) to prevent them from reverting back to woody habitat. This site conversion has decreased the number of deer observed in close proximity to runways. Airfield Operations is currently pursuing a Clear Zone Management Plan that will continue to reduce optimal deer habitat adjacent to runways.

The entire base perimeter fence should be inspected frequently. Any gaps large enough to allow deer and any medium sized mammals access to the base should be repaired immediately by installing bars, wire, stone, or patching with sections of fence. Gates should be inspected regularly and personnel should ensure that gates are secured tightly so that there are no spaces between or under gates, large enough to allow deer to pass between or through them. Sections of fence that cross water drainage ditches/culverts

should be inspected for possible deer access points. If these areas are large enough to allow deer access to the base, they should be affixed with a swing gate or other similar devices that would allow high water to flow from the base while excluding deer access.

NASO should continue to actively remove deer from the base. Removal is currently being accomplished through WS personnel and a base hunting program utilizing VDGIF Deer Population Reduction Program (DPOP). Currently, there are additional base properties that could utilize the DPOP program to reduce the deer threats to aviation safety and provide recreational opportunities for Navy personnel. These areas include old base housing, Boy Scout area, base property behind Natural Resource building located on Oceana Boulevard, and all other areas that could be hunted safely.

WS recommends that any deer present in the airfield be removed immediately via shooting or trapping. While not an immediate threat to aircraft safety, deer present on base property can and do gain access to the airfield. Deer on base, off of the airfield also serve as a source population for deer to annually disperse to the airfield. Lethal removal of deer requires a permit from the VDGIF, and it is recommended that NASO keep its permit current.

6.2 Gulls

From 1990 through 2009, gulls were the most frequently struck bird guild in the United States (for strikes where the species was identified), with 24% of the 7,894 reported civil strikes resulting in damage (Dolbeer et al. 2011). Gulls threaten aircraft safety due to their tendency to form large flocks, size, flight characteristics, and their foraging and loafing behaviors.

General Abundance

While gulls were the seventh most abundant guild observed at NASO from June 2010 through May 2011 with 1,160 observations (Appendix F), 2 species observed at NASO in the gull guild pose a high risk to aviation safety (Table 3), making gulls the second most hazardous guild to aircraft safety at NASO (Table 3). As shown in Table 3, Laughing Gulls (*Larus atricilla*) were the most commonly observed species in the Gull guild, followed by Ring-billed Gulls (*Larus delawarensis*), Herring Gulls (*Larus argentatus*), and unknown gulls (i.e., gull species that could not be identified during the survey). Gulls were most often observed in or over agricultural and long grass areas of the airfield (Figure 11).

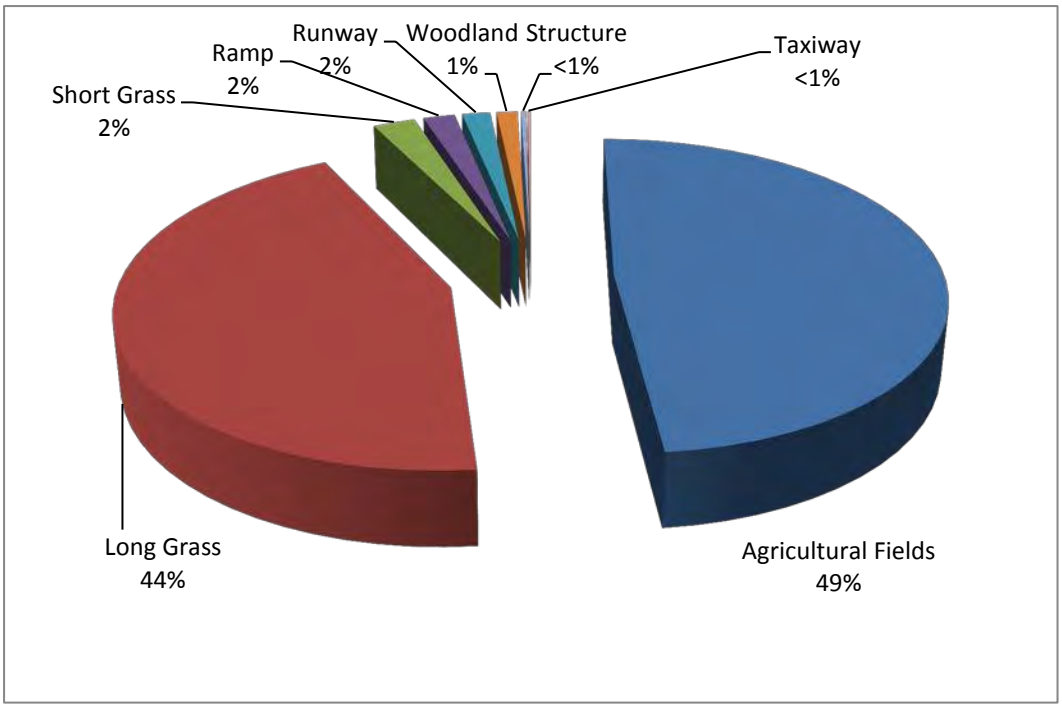

Figure 11: Gull habitat use at NASO, June 2010 through May 2011.

Gull use of agricultural fields occurred most frequently on or over winter wheat and fallow fields (Figure 12).

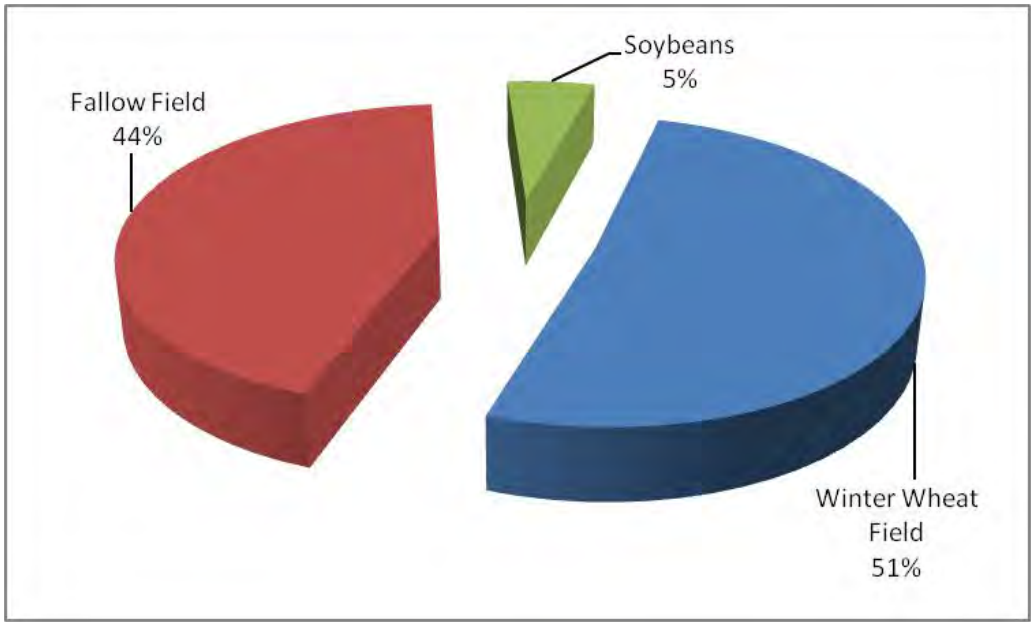

Figure 12: Gull agricultural habitat use at NASO, June 2010 through May 2011.

Flying locally, loafing and feeding accounting for 88% of all gull activity observed (Figure 13).

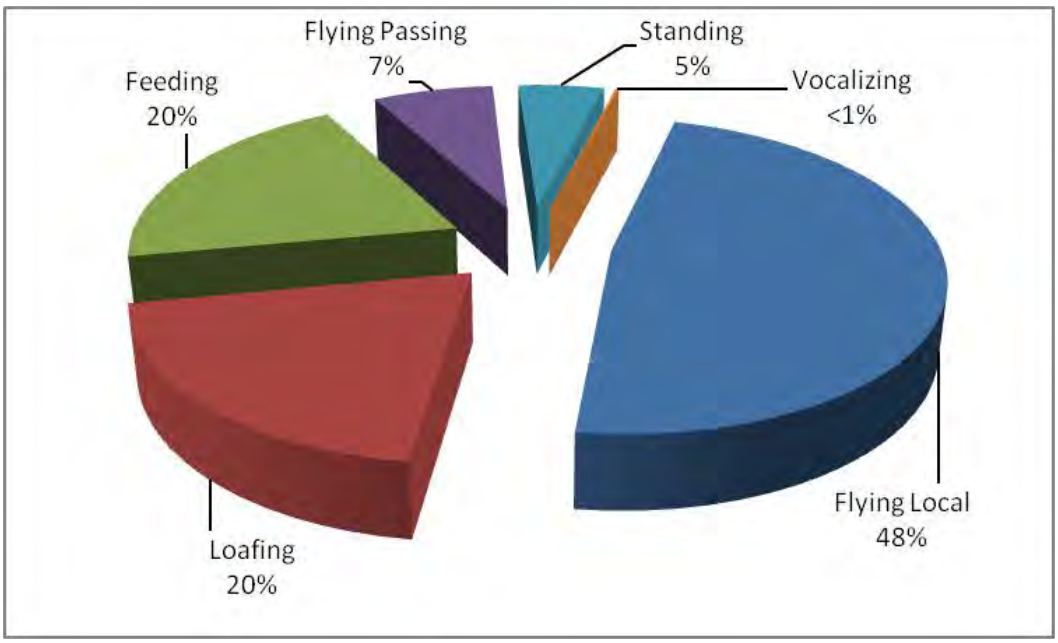

Figure 13: Gull activity at NASO, June 2010 through May 2011.

Attractants

Gulls are most commonly attracted to NASO during periods of inclement weather where they fly locally, loaf and forage throughout the airfield. During surveys, gulls were observed over agricultural and long grass areas. Outside of these survey periods, WS personnel observed gulls using paved areas of the airfield. Gulls may find an abundance of food such as earthworms on and adjacent to taxiways and runways after rain events when the ground becomes saturated. This ground saturation forces earthworms to the surface. Thousands of gulls are also observed loafing and flying locally at a waste transfer station located on Virginia Beach Boulevard. This transfer station is located within one mile of the departure end of Runway 32.

Management Recommendations

Although gulls were only the seventh most observed guild, gulls rank as the second most hazardous guild to aircraft safety at NASO for several reasons. From June 2010 through May 2011 WS personnel dispersed 6,565 gulls from the airfield (Table 4, Appendix G). Gulls are sporadically present on the airfield, but when present their numbers can be very high, and their habits during inclement weather (e.g., loafing/foraging on runways) make them very hazardous to aviation. Once dispersed, gulls tend to tower over the area they were dispersed from, or move to other parts of the airfield increasing the time, effort and geographical area required to alleviate this threat.

As with many species, removing sources of water is an important component of gull management. Since large flocks of gulls are mostly observed at NASO during (and immediately following) periods of rain, improving drainage can help reduce pooling of water in low lying areas. Using sweepers to remove earthworms from paved areas after rainfall may help to reduce the number of gulls foraging in the airfield. Care should be taken to ensure that dumpsters and other waste disposal areas are covered to prevent

attracting gulls and any feeding of gulls by airport tenants or customers should be stopped immediately.

Gulls may be harassed from the airfield by a variety of methods, including vehicles, sirens, pyrotechnics, and propane cannons. Lethal removal of gulls should be implemented when dispersal efforts are insufficient, and as such the airfield's migratory bird depredation permit should be kept current.

6.3 Raptors

Raptors (birds of prey) pose serious threats to aviation safety due to the larger size of many species and their flight behaviors. Some raptors may soar high over the airfield (eagles, vultures), others perch on structures in the airfield (Red-tailed Hawks and American Kestrels), while others may fly slowly close to the ground while hunting (harriers). From 1990 through 2009, raptors have been involved in 925 damaging wildlife strikes in the United States, resulting in almost $56 million in damages (Dolbeer et al. 2011). Since 1981, there have been 5 reported strikes involving raptors at NASO (Table 3).

General Abundance
Whereas raptors were the ninth most abundant guild observed at NASO from June 2010 through May 2011 with 744 observations (Appendix F), 2 species observed at NASO in the raptor guild pose an extremely high risk to aviation safety (Table 3), making raptors the third most hazardous guild to aviation safety (Table 3). As shown in Table 3, Red-tailed Hawks (*Buteo jamaicensis*) were the most commonly observed species in the raptor guild, followed by American Kestrels (*Falco sparverius*), Northern Harriers (*Circus cyaneus*), Turkey Vultures (*Cathartes aura*), Osprey (*Pandion haliaetus*), Cooper's Hawks (*Accipiter cooperii*), Bald Eagles (*Haliaeetus leucocephalus*), and Sharp-shinned Hawks (*Accipiter striatus*). Raptors were most often observed in or over short grass areas of the airfield (Figure 14).

Attractants
Raptors are attracted to the airfield at NASO by several features. Raptors find abundant prey (i.e., meadow voles, field mice, Eastern cottontails, etc.) in the grassland and woodland areas of the airfield. There are numerous perching sites such as navigation aids, lights, communication towers, trees, and radar facilities that may be utilized by raptors. Vultures are often observed towering on thermal updrafts high above the airfield. Mowing operations, road-killed animals, and deer shot but not retrieved provide abundant food sources for vultures in the area.

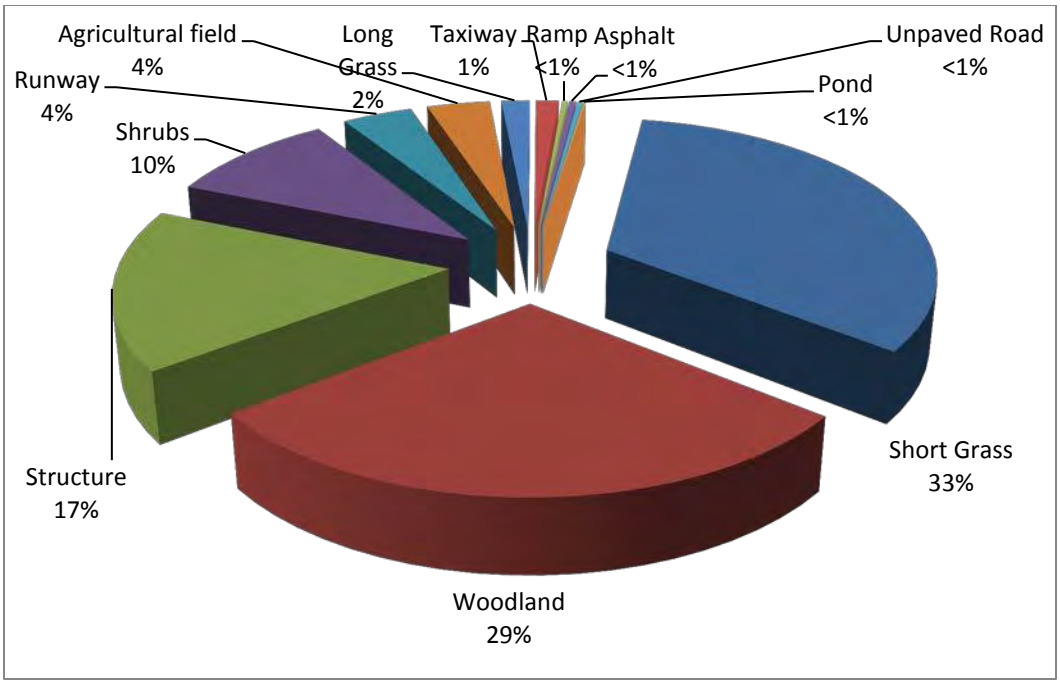

Figure 14: Raptor habitat use at NASO, June 2010 – May 2011.

Management Recommendations

To reduce the likelihood of strikes involving raptors, Blackwell and Wright (2006) suggest that management efforts in the airfield should be directed towards the availability of food and alteration of habitat used by raptors. The reduction of food sources such as rodents and carrion in the airfield is critical in controlling foraging by Red-tailed Hawks and vultures (Blackwell and Wright 2006). Reducing the number of small mammals in the airfield may be accomplished by a variety of methods, including trapping, shooting, or the use of rodenticides. Any animal carcasses found in or around the airfield should be removed and disposed of promptly to avoid attracting vultures. Turkey Vultures were noticeably more abundant following airfield mowing operations. During mowing, small mammals and snakes are often hit by the mower, leaving carcasses on the airfield.

Research has shown that small mammals use unmanaged areas of tall vegetation far more than disturbed areas (Barras and Seamans 2002, Blackwell and Wright 2006, Washburn and Seamans 2007), so frequent mowing can help to reduce small mammal abundance at airports (Barras and Seamans 2002), thereby reducing the availability of food for raptors. When possible, reducing the availability of locations where raptors may perch, roost, loaf, or nest is recommended. As such, NASO should consider the removal of trees and unused structures in the airfield (such as old utility poles). For structures that cannot be removed (i.e., signs, lights, towers, etc.), devices that exclude birds or make it difficult for their perching should be considered (such as spider wires, bird spikes, coil wire, etc.).

Raptor species must be harassed from the airfield whenever present using methods such as vehicles, horns, and pyrotechnics. Vultures commonly soar high above the airfield, making them difficult to disperse using 15mm pyrotechnics, given their limited range. Devices with much greater range (such as CAPA rounds or 12-gauge shellcrackers) may

be more useful for dispersing vultures. Lethal removal of some raptors may be necessary for persistent individuals, and as such NASO's depredation permit must be kept current to allow take of raptors. Lethal removal may include methods such as shooting or trapping. Though recently removed from the federal endangered species list, Bald Eagles are protected under the Bald and Golden Eagle Protection Act and are state threatened species, and a permit is required to simply harass eagles from the airfield. Eagles are becoming more abundant in the area around NASO and observations by base and WS personnel have increased in the past few years. NASO received a U.S. Fish and Wildlife Service Bald Eagle Depredation Permit in March of 2012 (Appendix C). The current permit is active for five years or until 2017, at this time it is recommended that the permit be renewed. All eagle dispersals conducted under this permit are required by the U.S. Fish and Wildlife Service to be documented and submitted at the end of each calendar year for the duration of the permit. Eagle activity is great in the areas immediately surrounding nests and any nesting attempts should be discouraged, and established nests should be removed promptly.

6.4 Waterfowl

Waterfowl can be particularly hazardous to aircraft safety due to their larger size and flocking behavior. In particular, Canada Geese have been responsible for some of the more serious wildlife strikes. In addition to the more recent "Miracle on the Hudson" event (see Section 1.1), 24 airmen were killed in 1995 when an Air Force AWACS aircraft crashed at Elmendorf Air Force Base in Alaska after striking a flock of Canada Geese (Wright 2011). From 1990 through 2009, waterfowl have been responsible for the greatest number of damaging strikes in the United States (1,503), resulting in over $144 million in losses (Dolbeer et al. 2011).

General Abundance

Waterfowl were the fourth most abundant guild observed at NASO from June 2010 through May 2011 (Appendix F). Waterfowl rank as the fourth most hazardous guild to aircraft safety at NASO (Table 3). Canada Geese (*Branta canadensis*) were the most commonly observed species in the waterfowl guild. Canada Geese are ranked as an extremely high hazard threat to aviation safety (Table 3). Canada Geese accounted for 95% of all observations in the waterfowl guild. Canada Geese were observed year-round at NASO and were most abundant during the winter months when migrating birds wintered in the area. The number of Canada Goose observations during summer months supports a substantial resident (non-migratory) population. Other waterfowl species observed at NASO included American Brant (*Branta bernicla*), Tundra Swan (*Cygnus* columbianus), Hooded Merganser (*Lophodytes cucullatus*) and a single Mallard (*Anas platyrhynchos*). Although only a single Mallard was observed during surveys, WS personnel observed numerous Mallards during routine field activities, removing 21, and dispersing 54 individuals from the airfield (Appendix G). All Mallards were removed or dispersed from standing water.

Attractants

Utilization of short grass areas adjacent to runways and taxiways by Canada Geese occurred predominantly during May through July, coinciding with populations of resident

geese. Tundra Swans were observed during migratory periods flying high over the airfield. Canada Geese were often observed by WS and NASO personnel feeding in grassy areas outside of the airfield on and off base. Resident Canada Geese were observed frequently utilizing ponds located on the Aero Pines Golf Course and the agricultural field located outside of the back gate.

Waterfowl are attracted to NASO and the surrounding area by several habitat features. There are many small bodies of water on and around the airport that provide a source of food and cover for waterfowl. Most of these bodies of water are small retention ponds and wetland mitigation sites that are the result of required Best Management Practices (BMP) for construction projects. These BMPs are found throughout the base and on the Aero Pines Golf Course. Three barrow pits are located along Oceana Boulevard just outside of the base. The barrow pits contain standing water, and are attractive to waterfowl. Agricultural fields on and off base outside of the active airfield are known to attract large numbers of foraging Canada Geese during the winter months.

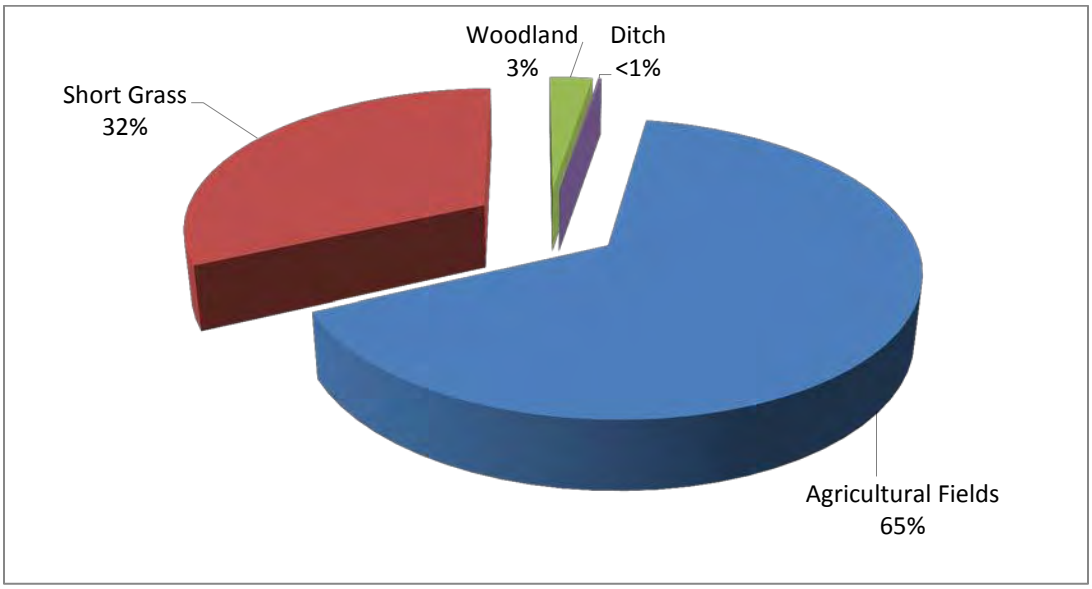

Figure 15: Waterfowl habitat use at NASO, June 2010 – May 2011.

Waterfowl were most often observed utilizing two habitat features at NASO: agricultural fields and short grass (Figure 15). Agricultural fields were utilized the most with winter wheat accounting for 85% of the sightings (Figure 16). Utilization of winter wheat occurred predominantly by Canada Geese and American Brant during December through March.

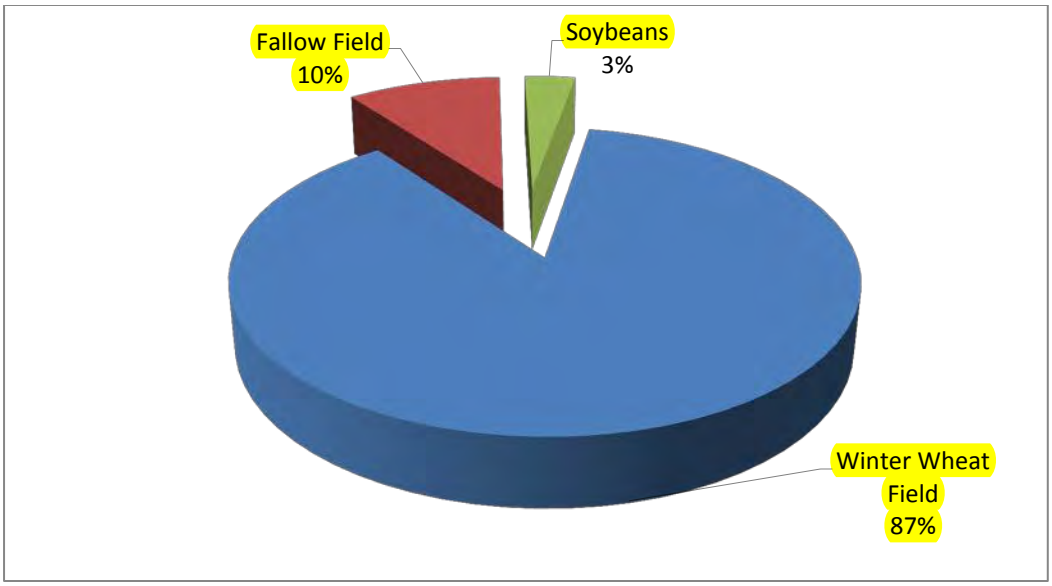

Figure 16: Waterfowl agricultural habitat use at NASO, June 2010 through May 2011.

Management Recommendations

Canada Geese should be considered the second greatest wildlife species threat to aviation safety at NASO. Nationally, Canada Geese are ranked as an extremely high hazard to civil aviation safety, as 51% of aircraft strikes with geese resulted in damage from 1990 through 2007 (Dolbeer and Wright 2009). By comparison, Mallards are ranked as a very high hazard to aviation safety, but the damaging strike rate for Mallards is about half that of Canada Geese (Dolbeer and Wright 2009). Resident Canada Geese find many areas of suitable habitat all around NASO and regularly fly through critical airspace when traveling from roosting/loafing areas to feeding areas. There are several control methods that should be considered to reduce hazards from Canada Geese (and waterfowl in general).

Winter wheat was the largest single attractant for geese during winter months on base property. Consideration should be given to eliminate the production of winter wheat on NASO agricultural fields. Whenever and wherever possible, areas of standing water in the airfield should be eliminated by improving drainage, grading, or filling in low areas. In the airfield, the wet areas of most concern are located at the approach and departure ends of runways 32R and 32L. Other areas of concern that contain standing water adjacent to the airfield include the barrow pits located along Oceana Boulevard, ponds located on the Aero Pines Golf Course, and Aero Pines wetland mitigation site. A permit may be required prior to disturbing/altering some wet areas, so coordination with the U.S. Army Corps of Engineers (ACOE) may be necessary. For areas that cannot be drained (such as BMPs), it may be useful to suspend a wire grid over ponds that may act as both a physical and visual barrier to prevent waterfowl from landing on the water. Installing stone rip-rap along the banks of BMPs or drainage ditches may help to reduce waterfowl use of these areas, as well. Drainage ditches should be properly maintained, allowing water to effectively drain from the airfield and the ditches. Ditches can be maintained by: removal of

vegetation slowing the flow, proper grading, removal of excess sediment, and use of herbicides to limit vegetation growth.

Vegetation management can be an important approach for managing Canada Geese. Generally, it is recommended that airfields maintain grass at an intermediate height in the airfield (between 6 and 10 inches). It has long been thought that tall vegetation management in the airfield would deter Canada Geese since they often prefer to forage in areas of short grass, though there is limited scientific data on how Canada Geese react to tall vegetation management and studies have often produced conflicting results (Seamans et al. 2007, Barras and Seamans 2002, Washburn et al. 2007). Though more research is needed, studies suggest that a promising method of reducing Canada Geese use of airfields is to use an endophyte-infected variety of tall fescue when re-seeding areas of an airport disturbed by tree removal, construction or renovation (Washburn et al. 2007). Research suggests that when consumed by wildlife, tall fescue produces a variety of adverse effects (taste aversion, physical distress) and is generally avoided (Washburn et al. 2007). When re-seeding areas of the airfield, NASO should consider planting tall fescue and avoid grass mixtures containing millet or ryegrass so as not to provide a preferred food source for geese and other hazardous bird species.

NASO should adopt and maintain a "zero tolerance" policy towards waterfowl in and adjacent to the airfield, especially Canada Geese. Waterfowl species should be aggressively harassed to disperse them from the area. Harassment methods may include the use of pyrotechnics, horns, sirens, paintballs, and chasing with vehicles. NASO should maintain its current migratory bird depredation permit from the USFWS to allow lethal take of waterfowl species that do not respond to harassment. Canada Geese may also be taken under the Control Order at Airports and Military Airfields (50 CFR §21.49), which allows take of Canada Geese on base property and other properties within a 3-mile radius of the airfield (with written permission of the landowner) from April 1 to September 15.

In order to further reduce threats from Canada Geese, NASO has expanded control efforts beyond the airfield to base properties that provide attractive sources of food and cover. This control should be expanded to off base locations within 3 miles of the base. A study conducted in New York by Seamans et al. (2009) indicated that resident Canada Geese remained within 3 miles (5 km) of their primary feeding and loafing areas around JFK International Airport, and this trend seems to be reflected in the areas around NASO. The WS program in NY reported that goose numbers at Rikers Island decreased yearly after removal efforts from 2004 through 2007, and subsequently goose strikes at nearby LaGuardia Airport decreased by 80% (Seamans et al. 2009).

6.5 Pigeons/Doves,

Pigeons/Doves were the fifth most hazardous guild identified at NASO from June 2010 through May 2011 (Table 3). Although Rock or feral Pigeons (*Columba livia*) rank as only a high hazard to aircraft, Pigeons are also a hazard to aircraft located in hangars due to fecal contamination. Fecal contamination of aircraft has been reported to cause corrosion of critical aircraft instruments. Rock Pigeons and Mourning Doves (*Zenaida macroura*) are the only two species observed at NASO in this guild.

From June 2010 through May 2011 Pigeons/Doves were the third most abundant guild observed at NASO (Appendix F). Pigeons were usually observed perched on hangars, while Morning Doves were usually observed perched on the perimeter fences to the blue ramp area and VACAPS. From 1981-2010 the only reported strike occurring at NASO involving this guild was one Morning Dove.

Attractants

Pigeons/Doves were observed most frequently utilizing structures followed by agricultural fields (Figure 17). Pigeons are attracted to the airfield to roost and nest on structures, while Mourning Doves prefer to feed in agricultural fields or perch/loaf on fences.

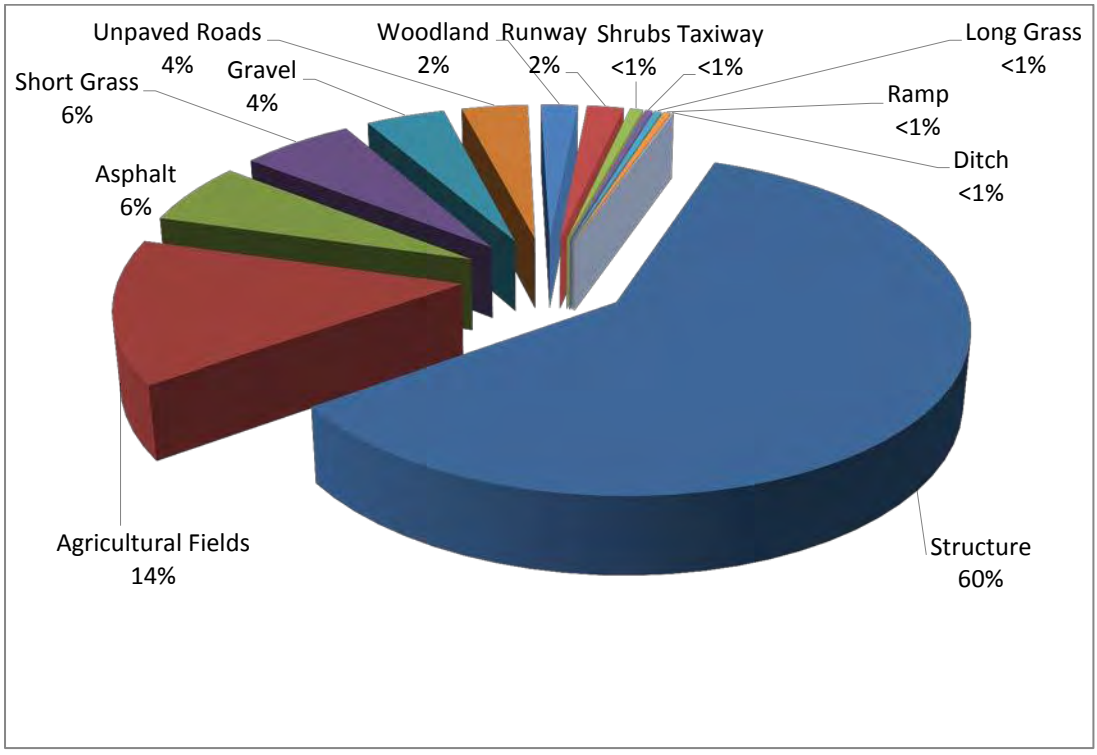

Figure 17: Pigeons/Doves habitat use at NASO, June 2010 – May 2011.

Management Recommendations

Flocks of birds in these guilds may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse should be removed lethally by shooting or trapping. The most effective means to remove pigeons from hangars is through trapping. Shooting should not be conducted in any hangars containing aircraft. Control of pigeons does not require a permit, though control of Mourning Doves does require a Federal Migratory Bird Depredation Permit. Mourning Doves are especially attracted to areas of bare ground and old pavement. These areas provide ideal areas for foraging and obtaining grit. Bare ground areas that have been graded or re-seeded should be monitored for Mourning Dove activity. WS noticed large numbers of doves utilizing the old ramp area north of runway 32L and 5R intersection. WS recommends that areas of old pavement no longer needed for airfield operations are removed and all areas of bare ground be reseeded. Activities at the stables should be evaluated for accidental feeding of pigeons and other wildlife. All feed should be maintained in closed containers and any spilled feed cleaned up. Even with all these measures in place the birds (pigeons and blackbirds) will always be attracted to this area due to the availability of undigested grains present in the horse manure. Other places of concern are any areas where the manure is spread mechanically.

6.6 Crows/Ravens, Starlings, and Blackbirds/Orioles

Crows/Ravens, starlings, and blackbirds/orioles were the sixth, seventh, and eighth most hazardous guilds identified at NASO from June 2010 through May 2011 (Table 3). One species within these guilds, the American Crow is ranked as high, while two other species the European Starling and Common Grackle were ranked as moderate, and a low ranking was given to the Red-winged Blackbird and Brown-headed Cowbird. While these guilds do not contain any species that rank as an extremely high or very high hazard, control efforts are often required, due to the large number of individuals observed on the airfield.

From June 2010 through May 2011, Blackbirds/Orioles were the most abundant guild observed at NASO, starlings were second, and Crows/Ravens were the fifth most abundant (Appendix F). These species were mostly observed flying locally over short grass and agricultural areas, though European Starlings (*Sturnis vulgaris*) were commonly observed perched on structures throughout the airfield. None of these guilds have been involved in reported damaging strikes at NASO since 1981 (Table 3). The greatest hazard these species pose to aviation is through their tendency to form large dense flocks that stay in almost continuous motion over short grass habitat near runways.

Attractants

Species in these guilds are attracted to the airfield to feed in the large areas of open grassland agricultural fields where they find abundant forage such as seeds, earthworms, and insects. There are many perching roosting locations utilized by these guilds such as hangars, buildings, communication equipment, fences, and radar facilities.

Management Recommendations

Flocks of birds in these guilds may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse should be removed

lethally by shooting and/or trapping. The control of crows, starlings, and blackbirds does not require a Federal permit. Grass management can be important for controlling these species. Grass that is tall enough to produce a seed head provides a food source and effective cover for species such as starlings and blackbirds, so grass in the airfield should be maintained at the recommended height of 6 to 10 inches (Dolbeer et al. 2011). Starlings using structures such as hangars for roosting locations can be excluded by keeping doors/windows closed and repairing any holes in the structure that allow birds to access the building. Nest traps, mist nets and toxicants may also be used to reduce the population of starlings utilizing these structures.

6.7 All Other Guilds

Appendix F. lists all guilds and species observed at NASO during wildlife surveys from June 2010 through May 2011. For all other guilds observed during wildlife surveys, many, if not all, of the management recommendations listed for waterfowl, raptors, artiodactyls, and gulls are applicable in reducing their threats to aviation safety. Many species utilize the same habitats, so management for one species will likely affect another. As discussed earlier in this section, habitat management and exclusion are the two most important components for reducing the threat of wildlife strikes at NASO. Vegetation and water management will likely have the greatest impact for most bird species, while maintaining the perimeter fence will be most effective in reducing the presence of larger mammal species (such as deer and coyotes).

6.8 Threatened and Endangered Species

Appendix E. lists species that are considered endangered, threatened, or of concern in the Commonwealth of Virginia. Of the species observed at NASO during the survey period, Bald Eagles and Upland Sandpiper are the only species appearing on the list, classified as State Threatened and a Federal Species of Concern. Strike records report one Upland Sandpiper has been struck at NASO. Six Upland Sandpipers were observed during wildlife surveys, and WS personnel have observed others during periods of migration.

7.0 CONTROL ACTIVITIES

In addition to conducting a wildlife hazard assessment, WS also provided direct control services to NASO from June 2010 through May 2011. Table 4 lists species within guilds that were removed or dispersed to protect aviation safety at NASO by WS.

Table 4: Species or Guilds removed or dispersed by WS at NASO, June 2010 – May 2011.

Guild/Group	Guild Hazard Ranking at NASO	# Removed[1]	# Dispersed[1]
Artiodactyls (i.e. White-tailed Deer)	1	138	0[2]
Gulls	2	11	7,643
Raptors	3	13	87
Waterfowl	4	51	5,399
Pigeons/Doves	5	310	276
Crows/Ravens	6	3	45
Starlings	7	99	382
Blackbirds/Orioles	8	61	5,450
All other Birds	N/A[3]	9	20
All other Mammals	N/A[3]	68	2
Totals	**-**	**763**	**19,304**

1. Total species removed and dispersed obtained by summing all activities conducted by WS personnel from June 2010-May 2011.
2. Deer were not considered dispersed from the airfield.
3. All other bird and mammal guilds were not ranked and are combined.

Artiodactyls

WS personnel removed 138 deer from NASO base property from June 2010 through May 2011 including 15 deer from Aeropines Golf Course. The other 123 deer were removed from the airfield. The initial two deer surveys conducted in June of 2010 surveyed 61 and 66 deer, while the two surveys in May 2011 surveyed 5 and 7 deer. Figure 18 below shows all deer survey numbers and cumulative deer removal.

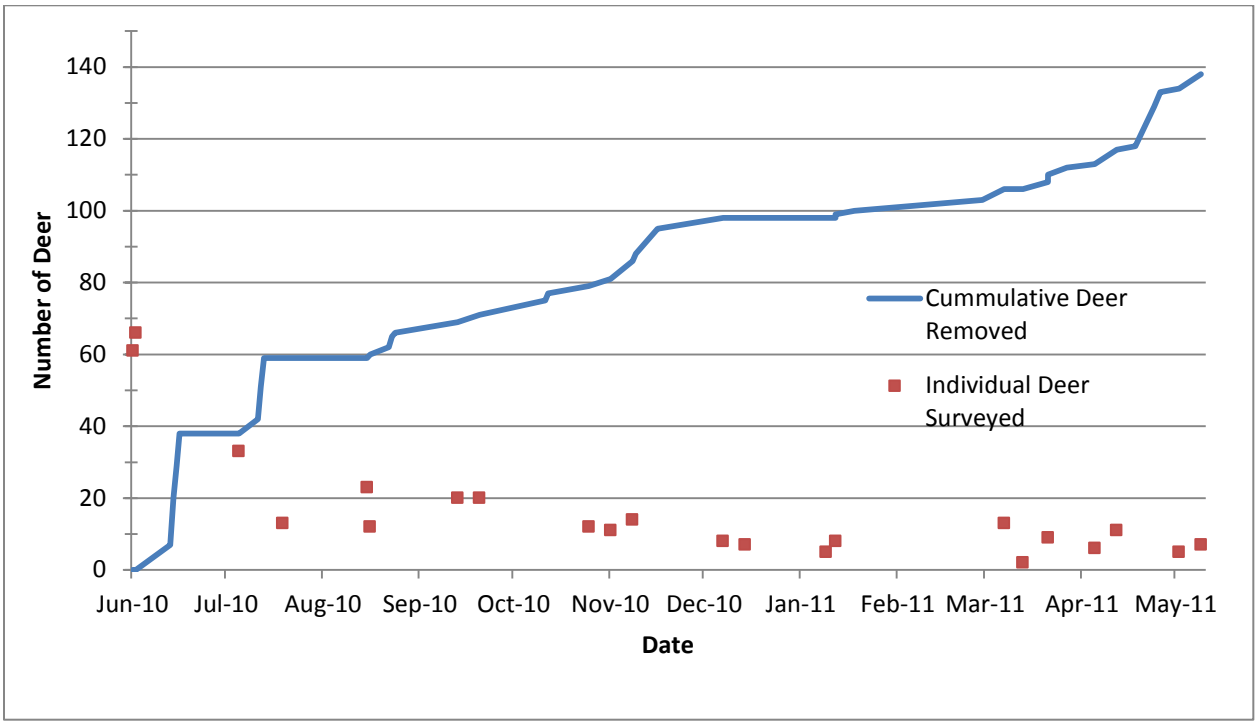

Figure 18: Deer surveyed and removed from NASO by WS personnel from June 2010 – May 2011.

Birds
WS dispersed 19,302 and removed 557 individual birds from the airfield (Table 4). The top 8 species dispersed from the airfield are listed below and Appendix G contains all species removed and dispersed from the airfield that fall in the eight most hazardous guilds/groups identified at NASO.

WS personnel responded to complaints of pigeons in hangars causing corrosion damage to aircraft by trapping and removing 276 pigeons from September 2010 through November 2011. Pigeons were not observed utilizing the hangars again after this trapping effort.

8.0 RECOMMENDATIONS

In addition to placing an emphasis on the management of the species discuss in Section 6, WS recommends that the following actions are implemented at NASO to improve wildlife hazard management at NASO and further reduce the threat of wildlife/aircraft strikes:

Install a security/wildlife fence around the perimeter of the entire airfield

The Federal Aviation Administration (FAA) recommends that civil airports in areas of high deer populations install a 10 to 12 foot chain link fence with outriggers supporting three strands of barbwire projecting away from the airfield. FAA also supports a 4 foot skirt of chain link fence attached at the bottom of the fence and buried at a 45 degree angle away from the airfield to exclude wildlife from digging of slipping under the fence. A properly installed wildlife fence will greatly improve safety and security of the airfield.

Update the NASO BASH Plan (WHMP) Based on the WHA

NASO's current BASH plan (NASOCEANAINST 3750.2B) was developed in 2008 by Geo-Marine, Inc. and was not based on a WHA. The plan provides the framework for the base to address wildlife hazards. The BASH plan lacks base specific details of wildlife hazards, and who, how and when the programs outlined in the plan will be conducted. It is recommended that the BASH plan be updated to reflect the information contained in this WHA.

Training of Airfield Personnel in Wildlife Hazard Management

FAA regulations require that civilian airport personnel who are responsible for implementing wildlife control measures are properly trained in wildlife hazard management by a qualified wildlife biologist [14 CFR Part 139.303 (c) and (e)]. NASO currently does not have a formalized training. Formalized training topics should include: USN regulations, policies, and procedures; wildlife strike reporting; wildlife attractants; habitat management; species identification; safety; and hands-on demonstrations of wildlife management tools and techniques. It is recommended that NASO develop formalized training for airfield personnel that may encounter wildlife on the airfield. The current BASH plan outlines this in the form of a Bird Detection and Dispersal Team (BDDT).

Establish a Formal BASH Working Group

The current NASO BASH Plan and the Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance (CNICINST 3700, 7 Jul 2011) both outline the functions and personnel to be involved with the BASH Working Group (BWG). WS recommends that NASO establish a BWG in accordance with CNICINST 3700. The formation of this group is important, as it will facilitate greater sharing of information and cooperation among those who have a stake in managing wildlife hazards at NASO.

Continue to Seek Cooperation from Adjacent Property Owners

As discussed in Section 6, wildlife on properties near the airport pose serious threats to aviation safety at NASO. WS recommends that NASO continues to identify areas within 3 miles of the airport that may provide roosting and/or foraging areas for birds that utilize the airspace at NASO, especially Canada Geese. NASO should approach these landowners to seek cooperation for the removal of these hazards.

Utilize the Wildlife Activity Log and Report Bird Strikes

Airfield Operations personnel currently use the airfield wildlife activity database to record occasional instances of wildlife activity on the airfield. It is recommended that operations personnel continue to increase the accuracy of the wildlife activity records. WS recommends that this log also be extended to other personnel including AFF, GEMD and Tower. WS recommends that the wildlife activity log be modified to include additional information that is currently not recorded, such as the number of birds involved, cover type, and location on the airfield. This information can be useful in determining trends and prioritizing management objectives.

Bird strikes should be reported online via WESS and a sample submitted to the Smithsonian Feather ID Lab for positive identification. Evaluation of the WESS data base has shown a lack in bird strike reporting. WS have seen an increase in strike reporting since June 2010. WS should continue training on proper strike reporting to airfield personnel and squadrons. Damage to aircraft following a strike or wildlife incidence is seldom recorded. WS recommends that NASO formalizes a process for recording damage. Damage should include aircraft structural damage, aircraft down time, repair, cleaning, and all other costs associated with a wildlife incidence. WS recommends that NASO work with the Naval Safety Center to ensure that the WESS data base is being updated with species identification and associated damages. This information is usually not available at the time a WESS report is initially submitted.

Maintain Necessary Permits to Control Wildlife

As stated previously, Federal and State permits are necessary for lethal take of migratory bird species and state-managed species such as deer and turkeys. In addition, a Federal permit is needed before Bald Eagles may be harassed from the airfield. NASO currently holds a migratory bird depredation permit, a State permit, and a Bald Eagle Harassment Permit. WS recommends that these permits be maintained to address wildlife species as necessary. If eagle nests are established, an amendment to the existing permit for base

property or a new permit for neighboring property will need to be obtained for immediate removal of the nest.

Have Wildlife Control Supplies on Hand

WS recommends that airfield personnel that are members of the BDDT who are responsible for wildlife hazard management be provided adequate equipment needed to disperse wildlife and adequate storage for this equipment, especially pyrotechnics. Such devices may include pyrotechnics and launchers, propane cannons, and vehicles equipped with sirens and lights. WS recommends that BDDT members are properly trained in the safe use and storage of these devices.

Evaluate Potential Wildlife Hazards When Planning New Construction or Land Use Changes

NASO is constantly undergoing expansion and improvement projects. It is critical to consider wildlife attractants during these planning phases. Several aspects to consider will be the planting of new vegetation, which may provide food to wildlife in the form of seeds and fruits and the creation of water bodies or drainage basins that provide fresh water. NASO's Airfield Manager currently reviews airfield maintenance projects with WS for possible BASH concerns. WS recommends that this continue and be expanded to all construction and maintenance projects on base property. In addition, adjacent off-site projects, industrial development, road construction, recreational development, etc. need to be considered as potential wildlife attractant hazards and dealt with accordingly.

Continue to Monitor Wildlife Populations and Habitat Use Patterns throughout the Airfield

The intent of this WHA has been to document general occurrence, land-use patterns, and population characteristics of wildlife at NASO. It must be realized that wildlife abundance and use patterns on airfields are affected by a host of variables that are rarely the same from year-to-year. Hence, conclusions based on wildlife populations and patterns during this study are only meant to be a guide and may or may not be consistent in subsequent years. Survey routes and methods were established in a manner that facilitates continued monitoring. Data from this study will provide a baseline for comparison in subsequent years and NASO should continue to monitor wildlife populations by conducting regular surveys using the same stations established in this assessment. While surveys conducted in subsequent years may not be conducted with the same frequency or intensity as this initial hazard assessment, they will still provide general insights into wildlife use patterns over time and enable NASO to gauge the effectiveness of its control efforts.

Habitat Modification and Exclusion

As discussed in Section 6, habitat modification and exclusion are two of the most important components of a wildlife hazard management plan. NASO airfield maintenance personnel have been diligent in maintaining grass in the airfield at the

recommended height (6 to 10 inches), and WS recommends that regular mowing is continued. Grass management is seasonal, and frequency of mowing may need to be increased during growing season as resources permit. Woody vegetation growing in drainage ditches should be removed and these areas should be maintained to prevent creating thick, shrub-like habitat that can provide cover for small mammals and perching sites for raptors. Most ditches within the airfield have become clogged with woody vegetation. This not only attracts wildlife but prevents water from effectively draining from the airfield compounding the problem with areas of standing water within the airfield. The resulting saturated soils increase the chance of field equipment rutting the airfield when driving across or avoiding the area completely during mowing operations.

Because all species are attracted to water, areas of standing water should be eliminated where possible. Low lying areas should be filled or graded to improve drainage. Underground drainage culverts in the airfield have failed in areas creating extended periods of standing water following heavy rains. WS recommends NASO continue with their plans to repair/replace all non-functioning drainage systems.

The entire perimeter fence should be inspected periodically for any areas that may allow larger mammals to enter the airfield. Any gaps discovered in or under the fence should be repaired immediately using bars, wire, or sections of fence to patch the area. Where wildlife are crawling under fences, it may be useful to install stone rip-rap along the bottom of the fence to prevent digging. If this is not sufficient, installing an "apron" of woven-wire or chain-link fence on the bottom of the perimeter fence that extends several feet out can help to prevent digging. Specific habitat features that require attention are detailed in appendix H. A list of habitat management sites should be maintained and progress toward resolving these hazards should be discussed in working group meetings and documented in annual monitoring reports.

Agricultural Practices

Agricultural crops can attract hazardous wildlife to the airfield. All approach/departure corridors on NASO contain agricultural fields. The WHA has shown that these fields attract wildlife (e.g., geese) to the airfield. Consideration should be given to the crops that are planted and the agricultural practices used for their production. Cereal grain products should be avoided. These crops attract large numbers of waterfowl for forage. Agriculture practices should minimize tilling. Tilling exposes large numbers of forage (i.e. insects, worms, etc.) that attract large numbers of gulls. Care should be taken during harvest to ensure excess amounts of grains are not spilled. If spills occur they should be cleaned up.

The FAA recommends a distance of 5 statute miles between the farthest edge of the airfield and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace.

Evaluation of Off Base Aviation Hazards

The FAA recommends a separation distance of 5 statute miles between the farthest edge of the airports AOA and hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace (FAA AC 150/5200-33B). WS has identified several potential areas that attract hazardous wildlife within the approach/departure and circling airspace of NAS Oceana. These areas include: several barrow pits located along Oceana Blvd, Owl's Creek Golf Course, and a waste transfer station located on Oceana Blvd. WS recommends that potential hazards surrounding the airfield be identified. Areas identified as potential hazards should be evaluated and BASH mitigation procedures implemented to reduce hazards.

9.0 SUMMARY

Based on data collected during the WHA, records from the WESS wildlife strike database, and control efforts by WS and NASO personnel, several species were identified that threaten aircraft safety at NASO. The guilds/groups that are of most concern to aircraft safety include Deer, gulls, raptors, waterfowl, pigeons/doves, crows, starlings, and blackbirds. Several management strategies may be implemented to reduce wildlife hazards at NASO, including habitat modification, exclusion, harassment, and lethal removal of hazardous wildlife species. WS recommends that NASO continues to take an active approach to wildlife hazard management, utilizing the information contained in this WHA to reduce wildlife hazards and provide a safe environment for aircraft operations.

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APPENDICES

APPENDIX A

CNICINST 3700; Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance

DEPARTMENT OF THE NAVY
COMMANDER, NAVY INSTALLATIONS COMMAND
716 SICARD STREET, SE, SUITE 1000
WASHINGTON NAVY YARD, DC 20374-5140

CNICINST 3700
N3
JUL 7 2011

CNIC INSTRUCTION 3700

From: COMMANDER, NAVY INSTALLATIONS COMMAND

Subj: NAVY BIRD/ANIMAL AIRCRAFT STRIKE HAZARD PROGRAM IMPLEMENTING GUIDANCE

Ref: (a) OPNAVINST 3750.6
(b) CNIC BASH Program Manual
(c) FAA Advisory Circular 150/5200-32 a of 22 Dec 04
(d) FAA Advisory Circular 150/5200-33 b of 28 Aug 07
(e) OPNAVINST 11010.20
(f) USDA/CNIC Work/Financial Plan

1. Purpose

a. To establish policy and procedures for implementing the Commander, Navy Installations Command (CNIC) Bird/Animal Aircraft Strike Hazard (BASH) Program.

b. To establish mandatory BASH event reporting and remains collection procedures in accordance with references (a), (b) and (c).

c. To establish BASH program procedures in accordance with reference (b) and consistent with reference (d).

2. Background

a. The Navy's first loss of life due to a bird strike occurred in 1914, coincidentally the same year it obtained its first aircraft. Since 1981, Naval Aviators have reported over 16,550 bird strikes, which resulted in over 440 aircraft mishaps, 250 foreign object damaged (FOD) engines and $372,000,000.00 in damage costs. Additionally, ten aircraft were destroyed along with one fatality. The Naval Safety Center's review of recent Navy BASH incidents found that the lack of an effective installation BASH program was a consistent contributing factor. The BASH program manages risk by addressing specific aviation safety hazards associated with

wildlife near airfields through coordination among all the entities supporting the aviation mission. The BASH program should also strive to effectively minimize secondary consequences of strikes, such as damage to aircraft, environmental cleanup due to aircraft crashes, and impairment of training. Success of the program, therefore, can be measured by the steady reduction and low recurrence rate of actual wildlife-to-aircraft strike events. Such success will be gained by the persistent application of dedicated resources, focused leadership support, execution of time-tested practices and procedures, effective monitoring programs, and institutionalized BASH training across aviation commands.

b. The goals of the guidance contained in this instruction are to increase the reporting and identification of strike events and to reduce BASH incidences at Navy airfields. These goals can be accomplished by reducing the quality and attractiveness of those airfields as habitats for identified problem wildlife, manage wildlife populations to minimize the potential for aircraft strikes, and through coordination with aircraft custodians and shore-based air operations personnel to improve the reporting and communications on both wildlife management and aircraft strikes.

3. Policy

a. CNIC is the Executive Agent, Budget Submitting Office, Program Manager, and Single Process Integrator for executing, monitoring and sustaining the BASH Program at all CNIC installations that conduct or support air operations.

b. This instruction is applicable to all CNIC commands that support fixed and rotary-wing air operations.

c. All Navy flying units that are tenants of CNIC commands shall report bird/wildlife strikes of known origin (e.g., bird remains found on an aircraft, bird remains found on the runway and correlated to a specific aircraft) in accordance with reference (a) and collect/forward remains in accordance with Appendix A-1 of reference (b).

d. All CNIC commands shall report all wildlife strikes in accordance with reference (a) and manage facilities in accordance with reference (b) and consistent with reference (d).

e. BASH manpower and equipment resourcing falls under the Chief Of Naval Operations (OPNAV) Shore Installation Readiness (N46) Base Operating Support (BOS) funding umbrella.

f. CNIC N3, as BASH Program Manager, is final authority for approval and submission to OPNAV N46 for BASH manpower and equipment resourcing requirements across the Navy shore enterprise.

g. Annual updates to those requirements beyond the basic equipment provided in appendix A-2 of reference (b) will be the province of Commanding Officers (CO) at air installations and air operations supporting facilities.

h. BASH incidents shall be reported, via the Web Enabled Safety System (WESS), in accordance with procedures contained in references (a) and (c).

4. Responsibilities

a. CNIC is responsible for execution and oversight of the BASH program.

b. Regional Commanders are responsible for execution and oversight of the BASH program in their regions.

c. COs are responsible for execution and oversight of the BASH program on installations that conduct or support air operations.

d. Air Operations Department Heads are responsible as the BASH program managers on installations that conduct or support air operations.

e. Public Works Officers (PWO) are responsible for ensuring BASH programs are supported by routine facility support services, maintenance, and management.

f. Environmental Program Directors (EPD) are responsible for ensuring BASH programs are compliant with all applicable state and federal environmental laws and regulations, and all applicable Department of Defense (DoD), Department of the Navy (DON) and U.S. Navy environmental policies, directives, and instructions.

g. Natural Resource Managers (NRM) are responsible for ensuring BASH programs are addressed in the installation Integrated Natural Resources Management Plan (INRMP) and compliant with all applicable state and federal natural resource laws and regulations as well as all applicable DoD, DON, and

U.S. Navy environmental policies, directives, and instructions related to natural resources.

5. Action

a. CNIC Headquarters shall:

(1) Assign N3 is the BASH program manager.

(2) Assign Air Operations Program Director (N32) as the executing agent for the CNIC BASH Program and will serve as principal point of contact to all agencies, internal or external, on matters involving the BASH Program. CNIC N32 shall:

(a) Resource CNIC air facilities to the recommended minimum equipment standards established in Appendix A-2 of reference (b).

(b) Centrally fund the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services (WS) for biologists assigned to air operations departments to perform Integrated Wildlife Damage Management (IWDM) and monitoring efforts in support of the installation BASH plan.

(c) Manage BASH resource execution.

(d) Chair an annual DON BASH Working Group among major aviation stakeholders typically attended by representatives from fleet type commanders, Naval Safety Center, OPNAV Shore Readiness (N46), OPNAV Energy and Environmental Readiness (N45), Naval Facilities Engineering Command (NAVFAC), regional and installation air operations and natural resources personnel.

(e) Compile regional inputs and additional requirements inputs from air operations stakeholders at the annual BASH Working Group prior to final Program Objective Memoranda (POM) requirements submissions.

(f) Review BASH procedures, and formulate and submit budgetary planning documents to OPNAV N46 per the annual POM schedule.

(g) Conduct a formal review of this instruction every year.

(3) CNIC N4 shall:

(a) Ensure adequately trained NRMs, professional biologists, and biological technicians are available to support preparation and implementation of installation BASH plans.

(b) Ensure BASH programs are addressed in and compliant with installation INRMPs.

b. CNIC Regions shall:

(1) Regional Commanders shall charge the Regional Operations Officer (N3) with responsibility for execution oversight of BASH at the installations. In Regions with an Air Operations Program, the Operations Officer will typically appoint the Air Operations Program Director with responsibility for BASH management oversight.

(2) Regional Air Operations Program Directors shall:

(a) Support COs in establishment and reporting of BASH budget requirements for the annual POM submission cycle.

(b) Manage BASH financial execution.

(c) Monitor installation BASH program viability and BASH incident reporting.

(d) Ensure training for BASH personnel at the installations is in place and standardized.

(3) Regional Engineer Environmental Program Directors (N4) shall ensure that adequately trained NRMs, professional biologists, and biological technicians are available to support Air Department staffs in preparation and implementation of installation BASH plans.

c. CNIC Installations shall:

(1) COs of installations that conduct or support air operations shall:

(a) Issue a BASH plan and maintain its currency based on normal command review guidelines and interim changes to this instruction. The BASH plan shall, at a minimum, address the following:

1. Establishment of a BASH Working Group (BWG) to coordinate BASH issues and requirements across departments and tenants.

2. Identify bird/animal hazards to aviation in the local geographic environment. Hazards shall be identified by regular monitoring of wildlife and if necessary a Wildlife Hazard Assessment (WHA).

3. Establish BASH mitigation procedures (active and passive) relative to the identified hazards in accordance with reference (b) and consistent with reference (d).

4. Develop methods to monitor the effectiveness of the installation IWDM and associated BASH program elements to ensure changes are made as necessary. Data shall be collected and compared from one year to the next in order to document program effectiveness over time.

5. Determine how real time BASH information is made available to aviators as well as potential changes to flying operations based on current operating conditions.

6. Establish procedures for a rapid response capability to deal with emergent BASH issues that threaten daily operations.

7. Ensure compliance with all applicable state and federal environmental and natural resources laws and and regulations, and all applicable DoD, DoN and U.S. Navy environmental policies, directives, and instructions.

8. Address submittal of regular updates to the BWG for review. These reports shall detail methodology and results of all work completed as well as appropriate BASH management recommendations.

9. Training requirements for installation personnel involved with air operations to promote knowledge of BASH issues and to institutionalize standardized procedures for reporting incidents and collecting/forwarding remains.

10. Establish requirements for an annual BASH program self-assessment process that, at a minimum, incorporates appendix A-3 of reference (b).

(b) Institutionalize these procedures by ensuring training on reporting procedures is provided to all divisions and offices directly exposed to the execution of air operations.

(c) Ensure installation personnel are responsible for reporting bird/wildlife strikes of unknown origin (e.g., bird remains found on a runway and not correlated to a specific aircraft) in accordance with references (b) and (c).

(d) Ensure installation personnel collect and forward remains in accordance with Appendix A-1 of reference (b).

(2) Installation Air Operations Officer shall:

(a) Be the BASH Program Manager responsible for execution oversight of installation BASH plan. Serve as central point of contact for BASH coordination and planning with other departments, installation tenants, and the local community.

(b) Establish a WESS account for the mandatory reporting of all BASH incidents.

(c) Coordinate with aircraft custodians on the proper reporting, via WESS, and remains collection procedures of all bird/animal strikes of known origin in accordance with references (a), (b) and (c).

(d) Ensure bird/animal strikes of unknown origin (wildlife found on or near the runway) are reported, via WESS, to the Naval Safety Center in accordance with reference (b) and that any remains are appropriately packaged and forwarded to the Smithsonian Institution for positive identification in accordance with references (b) and (c).

(e) Ensure all wildlife strike reporting and identification data is provided to the members of the BWG and analyzed by the installation for development of future BASH reduction management strategies.

(f) Ensure aircraft reporting custodians receive assistance in their efforts to report strikes of known origin and forward remains.

(g) Provide local oversight of the USDA Wildlife Biologist, if one is assigned, and ensure regular coordination of efforts and strike identification with the installation NRM occur.

(h) Chair the BWG which will typically be staffed, dependent on local billets, by the Air Field Manager (AFM), PWO, Aviation Safety Officer (ASO), tenant Wing or Squadron ASOs (SSO/WSO), a USDA Wildlife Biologist, and representatives from Air Traffic Control, environmental department, Natural Resources, Public Affairs Office (PAO), and Community Plans and Liaison Officer (CPLO). Ensure installation PWOs, EPDs, and NRMs participate as key members in the BASH Working Group.

(i) At overseas installations where host nation maintains responsibility for BASH, coordinate with host nation to ensure U. S. Navy representation on airfield BASH Working Group (BWG), or its equivalent. To the extent host nation agreements require, provide cost sharing or direct support of the installation BASH program.

(3) Installation PWOs shall:

(a) Participate in the local BWG and in on-site technical reviews of installation BASH programs during periodic Naval Safety Center surveys.

(b) Provide facilities support services and maintenance (such as mowing, vegetation and landscape management, trash removal, facilities and sign maintenance, etc.) that correspond to mitigation procedures appropriate for hazards, in accordance with reference (b) and consistent with reference (d), in the local installation operational environment.

(c) Ensure BASH projects that exceed local approval authority are submitted in compliance with reference (e).

(4) Installation EPDs shall:

(a) Ensure BASH programs are in compliance with all applicable state and federal environmental laws and regulations including but not limited to the National Environmental Policy Act and the Clean Water Act.

(b) Ensure BASH programs are in compliance with all applicable DoD, DoN and U.S. Navy environmental policies, directives, and instructions including but not limited to DoD Instruction 4715.03 Natural Resources Conservation dated March 2011 and Chief of Naval Operations Instruction 5090.

(c) Participate in local BWG and in on-site technical reviews of installation BASH programs during periodic Naval Safety Center surveys.

(5) Installation NRMs shall:

(a) Be the BASH program manager on installations that do not have an Air Operations Officer.

(b) In the absence of an air operations funded USDA wildlife biologist, and in addition to other duties assigned, assist the Air Operations Officer in managing the BASH program.

(c) Ensure BASH programs and plans are in compliance with the INRMP and all applicable state and federal natural resource laws and regulations including but not limited to the Endangered Species Act, Migratory Bird Treaty Act, and Sikes Act.

(d) Coordinate INRMP revisions and updates with air operations.

(e) Coordinate and manage all applicable natural resources consultations and permits necessary to support the BASH program including but not limited to Army Corps of Engineer Section 404 permits, U.S. Fish and Wildlife Service (USFWS) Migratory Bird Depredation Permits, and Endangered Species Act Section 7 consultations.

(f) Ensure BASH program elements consider sustainable land management practices, adaptive management and scientifically sound monitoring techniques.

(g) Support the WHA and ensure data collected is able to be reproduced for annual monitoring and reporting requirements.

(h) Participate in the local BWG and in on-site technical reviews of installation BASH programs during periodic Naval Safety Center surveys. If requested, participate as a co-chair of the BWG.

(i) Coordinate with the air operations funded USDA wildlife biologist, if one is assigned.

(j) Assist with strike identifications.

(6) USDA wildlife biologists, sponsored by Air Operations, shall:

(a) Abide by the roles and responsibilities defined in reference (f).

(b) Participate in the local BWG.

5. Forms and Reports. BASH incidents shall be reported, via WESS, in accordance with procedures contained in references (a) and (c). Tenant aviation units shall send a copy of the WESS BASH report to the installation BASH Program Manager.

M. C. Vitale

M. C. VITALE
Vice Admiral, U. S. Navy

Distribution:
Electronic only, via CNIC Gateway 2.0
https://g2.cnic.navy.mil.CNICHQ/Pages/Default.aspx

APPENDIX B

USDA, APHIS, Wildlife Services and CNIC Work/Financial Plan

United States Department Of Agriculture (USDA)
Animal and Plant Health Inspection Service (APHIS)
Wildlife Services (WS)
and
Commander Navy Installations Command (CNIC)

WORK/FINANCIAL PLAN

NAVY TECHNICAL REPRESENTATIVE:
CDR Fernando Argeles
CNIC, Air Operations
1325 10th Street SE
Washington, DC 20374
Phone (202) 685-0141
Cell (443) 684-4842

SERVICING AGENT REPRESENTATIVE:
Michael J. Begier, National Coordinator (AWHP)
USDA APHIS Wildlife Services
1400 Independence Ave., SW, Room 1621
Washington, DC 20250-3402
Phone (202) 720-4383
Fax (202) 690-0053

BEGINNING DATE: OCT 01, 2010
ENDING DATE: NTE 5 YEAR PERIOD

For CNIC

M. S. Remington Sept 23, 2010
M.S. Remington
CNIC, Air Operations Program Director
1325 10th Street SE
Washington, DC 20374

United States Department of Agriculture
APHIS Wildlife Services

William H Clay 9/24/10
William H. Clay
Deputy Administrator
USDA APHIS Wildlife Services
1400 Independence Ave., SW Room 1624
Washington, DC 20250-3402

27 § 1.1.3

NEED FOR ASSISTANCE The United States Navy, Commander Navy Installations Command (CNIC) has requested that the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Program (APHIS WS) provide assistance to mitigate potential and realized wildlife hazards at USN air stations in the continental United States.

Pursuant to this agreement between the (APHIS WS) and (CNIC), this Work/Financial Plan defines the basic objectives, plan of action, and budget for the APHIS Wildlife Services program to begin on 01 October 2010 for FY11 and continue for a period not to exceed 5 years. A new work and financial plan will be discussed between the parties prior to the initiation of the each subsequent FY for a period not to exceed 5 years.

The U.S. Department of Agriculture (USDA) is authorized to protect American agriculture and other resources from damage associated with wildlife. The primary authority for Wildlife Services (WS) is the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C.426-426b) as amended, and the Act of December 22, 1987 (101Stat. 1329-331, 7 U.S.C. 426c). Wildlife Services activities are conducted in cooperation with other Federal, State and local agencies; private organizations and individuals.

The Animal and Plant Health Inspection Service (APHIS) WS program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as IPM or "Integrated Pest Management") in which a series of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of the Animal Damage Control Program Final Environmental Impact Statement (USDA, 1994). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. However, controlling wildlife damage may require that the offending animal(s) are killed or that the populations of the offending species be reduced.

I. OBJECTIVES/GOALS

To establish and continue an Integrated Wildlife Damage Management program (IWDM) incorporating direct assistance and technical recommendations at installations subject to this agreement and associated outlying fields including any private property deemed necessary for the mitigation of damage to naval aircraft operations in order to alleviate wildlife hazards to aircraft as well as for the protection of human health and safety. The secondary objective will be to reduce damage to property and natural resources caused by wildlife at the installations subject to this agreement.

APHIS WS is recognized as the appropriate agency to conduct wildlife hazard management at military installations as well as civilian airports to reduce wildlife hazards. APHIS WS has the expertise in IWDM to provide these services.

Various wildlife species have caused problems at military airports. Wildlife, especially birds within aircraft operating environment, has caused damage to aircraft and continue to pose a safety threat to aircrews. Species directly or indirectly response for damage to aircraft include vultures, hawks, kestrels and a wide assortment of passerines. Mammals such as deer, feral hogs, coyotes and jack rabbits can get onto runways and pose a threat to aircraft and property as well as interrupt take-offs and landings at these facilities.

Additional objectives include:

a. Supplement and enhance the overall Natural Resource Program (NRP) for installations subject to this agreement.

b. To monitor wildlife activity while evaluating the effectiveness of IWDM program efforts.

c. To facilitate the acquisition and renewal of an annual migratory bird depredation/salvage permit

and state depredation permits, as needed.

d. To assist in wildlife-strike reporting and monthly briefings on the status of the BASH program.

e. To assist with the review and revision of the installation BASH Plan to ensure updated, effective techniques are in place to reduce the threat of wildlife strikes to aircraft.

f. To assist in the collection, preparation and shipment of wildlife strike remains to the Smithsonian Institution for positive identification.

g. As directed by installation points of contact, evaluate off-station airfields frequented by military aircraft, where repeated strikes have occurred.

h. Serve as a member of the installation Bird Hazard Working Group.

i. To train USN personnel that may be part of the installation Bird Detection and Dispersal Team (BDDT) in accordance with Weapons Division Qualification/Certification program.

j. To train BDDT on use of active scare techniques, as well as placement of static wildlife deterrent devices.

k. To provide training to local squadrons detailing bird and animal strike hazards.

II. PLAN OF ACTION

APHIS WS will assign one full-time Wildlife Biologist at each installation (and where needed an additional wildlife specialist) subject to this agreement and will provide a vehicle, field supplies and equipment, unless otherwise noted in this work plan. APHIS WS personnel will conduct Wildlife Hazard Assessments and mitigate wildlife hazards at all facilities. The timing and initiation of assessments will be coordinated locally so as to not impact on-going mitigation efforts (e.g., installations where an outlying training field exists but main efforts are focused on the air station). Information collected from this effort will be used to inform installation BASH plans.

IWDM techniques for controlling birds include all appropriate methods such as, but not limited to, cage traps, decoy traps, pole traps, capture nets, pyrotechnics, pellet guns, firearms, **Alpha Chloralose, Avitrol, DRC-1339**, hand capture and various exclusion and harassment techniques. APHIS WS will be responsible for application of bird toxicants and will adhere to all chemical label restrictions. All pesticides will be stored onsite as designated by the installation commanding officer or at offsite APHIS WS facilities.

IWDM techniques for controlling mammals will include all appropriate methods such as, but not limited to, foothold traps, snares, calling/ shooting, shooting, cage traps and hand capture. Only APHIS WS, military security, or other designated personnel will remove captured animals. APHIS WS will be responsible for the application and maintenance of WDM devices. All capture devices will be set to reduce the likelihood of non-target catches.

IWDM activities will be performed on or near runways and primarily confined to the facility boundaries outlined in the work plan with periodic activities conducted offsite where mammals and birds pose a hazard to aircraft operations. WDM will compliment NRP activities and coordinate activities with the Natural Resource Program Manager and Air Operations Officer, as well as with local, state and federal officials.

The installation will provide the APHIS WS employees assigned to this project with an area to dispose of carcasses, eggs and nesting material removed from the facilities outlined in this work. The Smithsonian

Institution shall be contacted about shipment of certain species, collected from the depredated carcasses, to enhance bird strike identification and education.

III. STIPULATIONS AND RESTRICTIONS

a. All operations shall have the joint concurrence of APHIS WS and the Installation Commanding Officer. APHIS WS personnel assigned to this project will remain under the direct supervision of APHIS WS.

b. APHIS WS will provide CNIC quarterly reports on program execution.

c. Control on Private Lands: An agreement for Control of Animal Damage on Private Property (WS Form 12A) will be executed between APHIS WS and the landowner, lessee, or administrator before any APHIS WS work is conducted.

d. Control on Public Lands: An Agreement for Control of Animal Damage on Non-Private Property (WS Form 12C) or an appropriate NEPA document will be executed between APHIS WS and the public land administrator(s)/manager(s) before any APHIS WS work is conducted.

e. APHIS WS will use only APHIS WS employees. All APHIS WS employees will adhere to installation and APHIS WS guidelines/policies while conducting IWDM activities, and have successfully met APHIS firearm safety and other training standards as necessary.

f. The installation will provide APHIS WS employees with the appropriate security identification badges/passes and safety training to allow free movement within the facilities as outlined in the work plan. APHIS WS vehicles operating within the project area will be properly marked and equipped with an amber strobe light or lights provided by the installation. Naval Air Station personnel will provide escort in restricted areas when needed.

g. The installation will provide furnished office space, office/communications equipment and secure storage as well as pyrotechnic magazine(s) from which the work to be conducted under the work plan can be organized and implemented efficiently and safely. Office/communications equipment shall include computers, printers, telephone equipment, associated data lines and two-way radios to facilitate communications between APHIS WS and installation personnel.

h. Local oversight for this program will be the responsibility of the Installation Air Operations Officer. Ordnance / firearms will be approved by the Operations Officer / Airfield Manager and shall be registered with installation security.

i. Any equipment and supplies purchased under the terms of this agreement will remain the property of APHIS WS.

IV. EFFECTIVE DATES

The agreement shall commence on October 01, 2010, and the work plan/ financial plan shall be renewed annually for a term not to exceed five years or until modified or terminated by mutual consent of all parties. Additional installations will be considered as modifications to this agreement during an annual review to be done concurrent with the renewal process. This agreement may be cancelled by either party upon giving at least 90 days written notice to the other party. Fiscal year funding will be provided via MIPR prior to the commencement of the succeeding fiscal year (subject to funds availability).

V. ISSUANCE OF ORDER and AVAILABILITY OF FUNDING

This agreement is subject to CNIC's issuance of an order through a Military Interdepartmental Purchase Request (MIPR), DD Form 448, to the USDA/APHIS-WS. No work may be initiated, or any expenses incurred, until such time as the MIPR is received by USDA/APHIS-WS.

Funding for the continuation of this agreement is issued in anticipation of the enactment of the FY11 DOD Appropriations Act or passage of an FY11 Continuing Resolution Authority (CRA), and is subject to the provisions of whichever act becomes applicable. In the event of a Continuing Resolution Act for Fiscal Year 2011, funds provided herein are releasable only for the amount of time covered by any additional Continuing Resolution passed by Congress.

CNIC's obligation under this agreement is contingent upon the availability of appropriated funds. No legal liability on the part of CNIC, the Navy, or the Department of Defense for any payment may arise until funds are made available to CNIC.

VI. PREVIOUS AGREEMENTS

This agreement supersedes all previous agreements between the following installations (NAS Whidbey Island, Naval Base Coronado, Naval Base Ventura County, NAS Corpus Christi, NAS Fort Worth, NAS Oceana, NAS Kingsville, NAS Meridian, NAS Pensacola, NAS Whiting Field) and the USDA.

VII. PERSONNEL PERFORMANCE REVIEW

In the event, performance deficiencies arise with APHIS WS personnel, a performance review will be conducted by the local APHIS WS state program office. A formal request by the installation commanding officer will be made to the local APHIS WS state program office for deficiency resolution.

VIII. INSTALLATION APHIS WILDLIFE SERVICES BASH BUDGET FY11

The overall budget for this work plan/financial plan is $1,946,420. These funds consist of $1,727,520 in FY11 appropriations directly from CNIC and $218,900 in FY10 appropriations for Naval Base Coronado - North Island and Naval Base Ventura County - Point Mugu. An estimated itemization of expenses is listed below. USDA/APHIS-WS may distribute costs between itemized categories at its discretion, subject to the standards, guidance, and limitations of DOD Financial Management Regulation (FMR), Volume 11A, Chapter 3, Section 306 and Volume 11A, Chapter 1.

Installations included in this agreement with one Biologist

a. NAS Whidbey Island
b. Naval Base Coronado – North Island
c. Naval Base Ventura County – Point Mugu
d. NAS Corpus Christi
e. NAS Fort Worth
f. NAS Kingsville
g. NAS New Orleans (new installation FY11)
h. NAS Meridian
i. NAS Patuxent River (new installation FY11)
j. NAS Key West (new installation FY11)
k. NAS Pensacola

Installations included in this agreement with one Biologist and a Specialist

l. NAS Oceana and NAS Chambers Field
m. NAS Jacksonville (new installation FY11)
n. NAS Whiting Field and NAS Mayport

Personnel (Salary - OPM rest of the U.S. base salary + average 20% locality adjustment + average 36% benefits)	
Wildlife Biologist (GS 9 at 14 installations)	$1,076,208
Wildlife Specialist (GS 7 at 3 installations)	$188,550
Supervisory and miscellaneous personnel (10%)	$126,473
Salaries	**$1,391,231**
Travel and miscellaneous training (e.g., Bird Strike Conference, etc.)	$35,000
Vehicle Usage (Lease, Mileage, Insurance)	$121,550
Equipment, and miscellaneous Supplies	$112,000
Equipment, and miscellaneous Supplies (extra start up costs for, 4 installations FY11)	$16,000
Logistics	**$284,550**
Sub-total	**$1,675,781**
Program Support (16.15%)	**$270,639**
Total FY11	**$1,946,420**
Existing SW Region FY10 funding	**$218,900**
CNIC FY11 Total	**$1,727,520**

The distribution of the budget for this project financial plan may be varied by APHIS WS as necessary to accomplish the purpose of this agreement but may not exceed the TOTAL COST of $1,946,420 for FY11.

Funding is based on 100 percent utilization of both labor and non labor. Disposition of funds available due to program under utilization (e.g., vacant positions or hiring delays) will be jointly discussed between USDA and CNIC with a goal of utilizing funds to maximize delivery of service. FY12 through FY15 budgets will be negotiated by the parties, include a cost increase pursuant with the federally approved inflation rate and POM guidance, and be subject to the limitations in section V above, "Issuance of Order and Availability of Funding."

APPENDIX C

Migratory Bird Depredation Permit and Bald Eagle Harassment Permit
Naval Air Station Oceana

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

3-201
(1/97)

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USD 703-712

REGULATIONS
50 CFR Part 13
50 CFR 21.41

1. PERMITTEE

U.S. NAVY, NAVFAC MIDLANT
ATTN: EMMETT CARAWAN
BLDG Z-144, 2ND FLR RM 218
VIRGINIA & TAUSSING AVE.
NORFOLK, VA 23511

COPY

3. NUMBER
MB734656-0

4. RENEWABLE	5. MAY COPY
☒ YES ☐ NO	☒ YES ☐ NO

6. EFFECTIVE	7. EXPIRES
06/01/2010	05/31/2011

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If #1 is a business)*
CHERRYL F. BARNETT
ENV. PROGRAM MANAGER

9. TYPE OF PERMIT
DEPREDATION AT AIRPORTS

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
(1) NAVAL AIR STATION OCEANA, VIRGINIA BEACH, VA; (2) NAVAL AUXILIARY LANDING FIELD FENTRESS, CHESAPEAKE, VA; (3) CHAMBERS FIELD, NORFOLK, VA; (4) NAVAL STATION NORFOLK, NORFOLK, VA; (5) NAVAL AMPHIBIOUS BASE LITTLE CREEK, VIRGINIA BEACH, VA; and (6) NAVAL MEDICAL CENTER PORTSMOUTH, PORTSMOUTH, NH **TEL: 757-462-8564 (X-392)**

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

THE CONDITIONS BELOW APPLY TO ACTIVIES AT ALL LOCATIONS COMBINED

D. You are authorized to take, temporarily possess, and transport the migratory birds specified below to relieve or prevent injurious situations impacting public safety. All take must be done as part of an integrated wildlife damage management program that emphasizes nonlethal management techniques. You may not use this authority for situations in which migratory birds are merely causing a nuisance.

(1) The following may be lethally taken:

(a) **50 of each: Herring gulls, Mallards and Brant,**
(b) **200 Ring-billed gulls,**
(c) **300 Laughing gulls,**
(d) **5 Great Black-backed gulls, and**
(e) **10 of each: Great Blue herons and Great Egrets**

(2) The following may be **taken within airport boundaries: up to 150 Canada Geese**, using:
(a) shotgun,
(b) legal live-traps or nets, and/or
(c) an immobilizing drug (Alpha Chloralose, FDA Investigational New Animal Drug Registration 6602).
Birds captured under (b) and (c) must be euthanized, and may be transported and donated to a local food bank for charity purposes.

(3) The following active nests (including eggs) may be destroyed: **50 Mallard nests**

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS

ANNUAL REPORT DUE WITH NEXT RENEWAL FORM

Forms can be found at: www.fws.gov/migratorybirds/mbpermits.html

ISSUED BY	TITLE	DATE
	CHIEF, MIGRATORY BIRD PERMIT OFFICE - REGION 5	06/01/2010

State restrictions: Peregrine Falcons and other bird species are listed as Endangered or Threatened by Virginia State law and therefore may not be taken, unless otherwise authorized by the Virginia Department of Game and Inland Fisheries.

E. You are authorized in emergency situations only to take, trap, or relocate any migratory birds, nests and eggs, including species that are not listed in Condition D (except bald eagles, golden eagles, or endangered or threatened species) when the migratory birds, nests, or eggs are posing a direct threat to human safety. A direct threat to human safety is one which involves a threat of serious bodily injury or a risk to human life.

You must report any emergency take activity to your migratory bird permit issuing office, Hadley, Ma, 413-253-8424 (fax), within 72 hours after the emergency take action. Your report must include the species and number of birds taken, method, and a complete description of the circumstances warranting the emergency action.

F. You are authorized to salvage and temporarily possess migratory birds found dead or taken under this permit for (1) disposal, (2) transfer to the U.S. Department of Agriculture, (3) diagnostic purposes, (4) purposes of training airport personnel, (5) donation to a public charity (those suitable for human consumption), or (6) donation to a public scientific or educational institution as defined in 50 CFR 10.12. Any dead bald eagles or golden eagles salvaged must be reported within 48 hours to the National Eagle Repository at (303) 287-2110 and to the migratory bird permit issuing office at 413-253-8643. The Repository will provide directions for shipment of these specimens.

G. You may not salvage and must immediately report to U.S. Fish and Wildlife Service Law Enforcement any migratory birds that appear to have been poisoned, shot, or otherwise injured as the result of criminal activity.

H. You may use the following methods of take: (1) firearms; (2) nets; (3) ONLY USDA Wildlife Services may use registered animal drugs (excluding nicarbazin), pesticides and repellents;
(4) falconry abatement; and (5) legal lethal and live traps (excluding pole traps). Birds caught live may be euthanized or transported and relocated to another site approved by the appropriate State wildlife agency, if required. When using firearms, you may use rifles or air rifles to shoot any bird when you determine that the use of a shotgun is inadequate to resolve the injurious situation. The use of any of the above techniques is at your discretion for each situation.

I. You may temporarily possess and stabilize sick and injured migratory birds and immediately transport them to a federally licensed rehabilitator for care.

J. The following subpermittees are authorized: **Employees of Regional Environmental Group Oceana; employees of the Natural Resources Program, Department of the Navy, Norfolk, VA; and employees of USDA/APHIS/Wildlife Services**

In addition, any other person who is (1) employed by or under contract to you for the activities specified in this permit, or (2) otherwise designated a subpermittee by you in writing, may exercise the authority of this permit.

K. You and any subpermittee(s) must comply with the attached Standard Conditions for Migratory Bird Depredation Permits

For suspected illegal activity, immediately contact USFWS Law Enforcement at: Richmond, VA 804-771-2883

For Canada Geese Egg Addling or Nest Destruction you MUST register each year between January 1 and June 30 at: https://epermits.fws.gov/eRCGR. You must return to website and report your take before October 31 each year.

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USC 668a

REGULATIONS
50 CFR Part 13
50 CFR 22.23

1 PERMITTEE

US NAVY
dba NAVAL AIR STATION OCEANA
NAVFAC MIDLANT NORTHEAST IPT ATTN: EMMETT CARAWAN
BLDG Z-144 VIRGINIA AVE, 2ND FLOOR, ROOM 214
NORFOLK, VA 23511
U.S.A.

3 NUMBER
MB65239A-0

4. RENEWABLE ☒ YES ☐ NO

5 MAY COPY ☒ YES ☐ NO

6. EFFECTIVE
03/21/2012

7 EXPIRES
12/30/2016

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If it is a business)*
EMMETT W. CARAWAN
NATURAL RESOURCES MANAGER

9. TYPE OF PERMIT
EAGLE DEPREDATION

10 LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
Naval Air Station Oceana Property, Virginia Beach, VA

11 CONDITIONS AND AUTHORIZATIONS

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

D. You are authorized to use non-lethal scare devices, scare tactics or frightening devices to move or disperse **Bald eagles** endangering human safety due to a high risk of a serious bird strike to landing and departing aircraft. You are authorized to use airhorns, pyrotechnics, and drive vehicles with horns as necessary to scare eagles. Pyrotechnics must not be shot directly at the eagles.

E. You must make a continuous effort to eliminate attractants and other physical properties that may draw eagles to airport property.

F. This permit does not authorize the killing, injury or capture of any eagle or the destruction of any young or nests.

G. This permit does not authorize the disturbance of eagles at active nest sites that contain eggs or young or nests.

H. You must notify the permit issuing office at telephone 413-253-8643 within 48 hours of any injury or death of any eagle during project activities.

I. The following subpermittees are authorized: Naval Air Station Oceana flight safety personnel or environmental staff and *employees of USDA/APHIS/Wildlife Services*. In addition, any other person who is (1) employed by or under contract to you for the activities specified in this permit, or (2) otherwise designated a subpermittee by you in writing, may exercise the authority of this permit.

J. You must submit a report of activities conducted under this permit to the USFWS, Migratory Bird Permit Office, P.O. Box 779, Hadley, MA, 01035, by the due date specified on the face of the permit. The report form, 3-202-11, is available at: http://www.fws.gov/forms/3-202-11.pdf.

K. You must comply with the attached Standard Conditions for Eagle Depredation Permits. **These standard conditions are a continuation of your permit conditions *and must remain with your permit*.**

For suspected illegal activity, immediately contact USFWS Law Enforcement at: Richmond, VA/DC 804-771-2883

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12 REPORTING REQUIREMENTS

ANNUAL REPORT DUE 1/31, PER STANDARD CONDITION (J) OF THIS PERMIT
USFWS Forms can be found at: <http://www.fws.gov/migratorybirds/mbpermits.html>

ISSUED BY

TITLE
CHIEF, MIGRATORY BIRD PERMIT OFFICE - REGION 5

DATE
03/21/2012

Standard Conditions
Eagle Depredation Permits
50 CFR 22.23

All of the provisions and conditions of the governing regulations at 50 CFR part 13 and 50 CFR part 22.23 are conditions of your permit. Failure to comply with the conditions of your permit could be cause for suspension of the permit. The standard conditions below are a continuation of your permit conditions and must remain with your permit. If you have questions regarding these conditions, refer to the regulations or, if necessary, contact your migratory bird permit issuing office. For copies of the regulations and forms, or to obtain contact information for your issuing office, visit: http://www.fws.gov/migratorybirds/mbpermits.html.

1. Unless otherwise specified on the face of this permit, you may not lethally take any bald eagle or golden eagle under this permit. Eagles may be taken only by the method(s) specified on the face of your permit. [*Note: Explosive Pest Control Devices (EPCDs) are regulated by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). If you plan to use EPCDs, you require a Federal explosives permit, unless you are exempt under 27 CFR 555.141. Information and contacts may be found at* www.atf.gov/explosives/how-to/become-an-fel.htm.]

2. If you encounter an eagle with a Federal band issued by the U.S. Geological Survey Bird Banding Laboratory, Laurel, MD, report the band number to 1-800-327-BAND (2263) or http://www.reportband.gov.

3. This permit does not authorize take or release of any bald eagle or golden eagle on Federal lands without additional prior written authorization from the applicable Federal agency, or on State lands or other public or private property without prior written permission or permits from the landowner or custodian.

4. Unless otherwise specified on the face of the permit, any bald eagle or golden eagle taken under this permit must be promptly turned over to a U.S. Fish and Wildlife Service (Service) agent or other wildlife law enforcement officer designated on the face of the permit.

5. Any person exercising the authorities of this permit must carry a legible copy of this permit, *including these Standard Conditions*, and display it upon request to any State or Federal officer when exercising its authority.

6. You must maintain records as required in 50 CFR 13.46. All records relating to the permitted activities must be kept at the location indicated in writing by you to the migratory bird permit issuing office.

7. Acceptance of this permit authorizes the Service to inspect any wildlife held, and to audit or copy any permits, books, or records required to be kept by the permit and governing regulations.

8. You may not conduct the activities authorized by this permit if doing so would violate the laws of the applicable State, county, municipal or tribal government or any other applicable law.

(EADP 12/3/2011)

APPENDIX D

Commonwealth of Virginia VDGIF Official Kill Permit for NAS Oceana

PWD

Gramps

COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

Department of Game and Inland Fisheries

Robert W. Duncan
Executive Director

July 8, 2009

Markham K. Rich
Captain, U. S. Navy
Commanding Officer
Naval Air Station Oceana
1750 Tomcat Boulevard
Virginia Beach, VA 23640-2191

Dear Captain Rich,

On behalf of the Department of Game and Inland Fisheries I would like to respond to your request for concurrence with NAS Oceana's proposed deer management plan we have recently received from you. We concur that this plan sufficiently identifies appropriate methodologies for herd reduction, which should meet the NAS Oceana deer management plan identified goals.

I have spoken to our local Conservation Police Officer for Virginia Beach and we have agreed that we can issue a kill permit for the entire 4,909-acre deer management focus area at Oceana. We will not go as far as to request individual names for participants on the kill permit; however, we will request that appropriate descriptions be placed on the permit for participants who will carry out the kill permit (e.g., "Seal team X" or "Natural Resource staff"). We will then leave it up to you to designate who will be allowed to participate, within the descriptions placed on the permit, and when you will conduct kill permit activities.

Regarding calibers of weapons used under the kill permit, I will say that popular rifle calibers commonly used on such deer reduction programs are .223, .22-250, .243, .270, and .308. Although the use of a caliber smaller than .23 is illegal for deer and bear hunting in Virginia, the Code of Virginia differentiates between "to kill" and "to hunt," so .22 caliber centerfire rifles would be allowed on your kill permit. In terms of muzzle energy and velocity, nothing weaker than a .223 and nothing more powerful than a .308 is recommended. Anything beyond these calibers is not necessary for white-tail deer removal given the flat landscape at Oceana and the population density in and around the base.

It is highly advisable that participants who will carry out the kill permit utilize suppressed weapons. Suppressed rifles are often used by USDA and VDGIF staff on deer collections, both for concealing muzzle blast from citizens as well as serving to dampen noise heard by other deer.

This fall, we will replace your base's DMAP (Deer Management Assistance Program) deer management program with a DPOP (Deer Population Reduction Program) permit to extend your

Shoot does Jan-Feb

4010 WEST BROAD STREET, P.O. BOX 11104, RICHMOND, VA 23230-1104
(804) 367-1000 (V/TDD) *Equal Opportunity Employment, Programs and Facilities* FAX (804) 367-0405

base's recreational hunting season through the month of February, effectively utilizing an extra 2 months of hunting season for antlerless deer only. This program will function much like the previous DMAP program we have used before at NAS Oceana.

We are currently coordinating with your Natural Resources Manager, Michael Wright, with regards to acquiring the aforementioned permits and providing appropriate training for those participants that will be caring out the kill permit.

These measures should go a long way in helping reduce the deer herd density at NAS Oceana.

Please contact me if you or your staff has further questions or concerns.

Sincerely,

Aaron Proctor
VDGIF District Wildlife Biologist
3909 Airline Blvd.
Chesapeake, VA 23321
(757) 592-6234

cc: Glen Askins, VDGIF Region1 Wildlife Biologist Manager
Marshall Crosby, VDGIF Conservation Police Officer Sergeant, District 13
Michael Wright, NAVFAC MIDLANT PWD- Oceana Natural Resources Manager

§ 29.1-529. Killing of deer or bear damaging fruit trees, crops, livestock, or personal property or creating a hazard to aircraft or motor vehicles.

A. Whenever deer or bear are damaging fruit trees, crops, livestock or personal property utilized for commercial agricultural production in the Commonwealth, the owner or lessee of the lands on which such damage is done shall immediately report the damage to the Director or his designee for investigation. If after investigation the Director or his designee finds that deer or bear are responsible for the damage, he shall authorize in writing the owner, lessee or any other person designated by the Director or his designee to kill such deer or bear when they are found upon the land upon which the damages occurred. However, the Director or his designee shall have the option of authorizing non-lethal control measures rather than authorizing the killing of the bear, provided that such measures occur within a reasonable period of time; and whenever deer cause damage on parcels of land of five acres or less, except when such acreage is used for commercial agricultural production. The Director or his designee shall have discretion as to whether to issue a written authorization to kill the deer. The Director or his designee issuing these authorizations shall specify in writing that only antlerless deer shall be killed, unless the Director or his Designee determines that there is clear and convincing evidence that the damage was done by deer with antlers. Deer or bear killed pursuant to such authorization shall be utilized or disposed of within 24 hours of being killed. Any owner or lessee of land who has been issued a written authorization shall not be issued an authorization in subsequent years unless he can demonstrate to the satisfaction of the Director or his designee that during the period following the prior authorization, the owner or his designee has hunted bear or deer on the land for which he received a previous authorization.

B. Subject to the provisions of subsection A. the Director or his designee may issue a written authorization to kill deer causing damages to residential plants, whether ornamental, noncommercial agricultural, or other types of residential plants. The Director may charge a fee not to exceed actual costs. The holder of this written authorization shall be subject to local ordinances, including those regulating the discharge of firearms.

C. Whenever wildlife is creating a hazard to the operation of any aircraft or to the facilities connected with the operation of aircraft, the person or persons responsible for the safe operation of the aircraft or facilities shall report such fact to the Director or his designee for investigation. If after investigation the Director or his Designee finds that wildlife is creating a hazard, he shall authorize such person or persons or their representative to kill wildlife when the wildlife is found to be creating such a hazard. As used in this subsection, the term "wildlife" shall not include any federally protected species.

D. Whenever deer are creating a hazard to the operation of motor vehicle traffic within the corporate limits of any city, the operator of a motor vehicle may report such fact to the Director or his designee for investigation. If after investigation the Director or his designee finds that deer are creating a hazard within such city, he may authorize responsible persons, or their representatives, to kill the deer when they are found to be creating such a hazard. The carcass of every deer or bear so killed may be awarded to the owner or lessee by the Director or his designee, who shall give such person a certificate to that affect on forms furnished by the Department. Any person awarded a deer or bear under this section may use the carcass as if he had killed the animal during the hunting season for deer or bear.

E. Whenever deer are damaging property in a locality in which deer herd population reduction has been recommended in the current Deer Management Plan adopted by the Board, the owner or lessee of the lands on which such damage is being done may report such damage to the Director or his designee for investigation. If after investigation the Director or his designee finds that deer are responsible for the damages, he may authorize in writing the owner, lessee or any other person designated by the Director or his designee to kill such deer when they are found upon the land upon which the damages occurred. The Director or his designee also may limit such authorization by specifying in writing the number of animals to be killed and the period of time for which the authorization is effective. The carcass of every deer so killed may be awarded to the owner or lessee by the Director or his designee, who shall give such person a certificate to that effect on forms furnished by the Department. Any person awarded a deer under this section may use the carcass as if he had killed the animal during the hunting season for deer. The requirement in subsection A of this section, that an owner or lessee of land demonstrate that during the period following the prior authorization deer or bear have been hunted on his land, shall not apply to any locality that conducts a deer population control program authorized by the Department.

F. The Director or his designee may revoke or refuse to reissue any authorization granted under this section when it has been shown by a preponderance of the evidence that an abuse of the authorization has occurred. Such evidence may include a complaint filed by any person with the Department alleging that an abuse of the written authorization has occurred. Any person aggrieved by the issuance, denial or revocation of a written authorization can appeal the decision to the Department of Game and Inland Fisheries. Any person convicted of violating any provision of the hunting and trapping laws and regulations shall be entitled to receive written authorization to kill deer or bear. However, such person shall not (i) be designated as a shooter nor (ii) carry out the authorized activity for a person who has received such written authorization for a period of at least two years and up to five years following his most recent conviction for violating any provisions of the hunting and trapping laws and regulations. In determining the appropriate length of the restriction, the Director shall take into account the nature and severity of the most recent violation and of any past violations of the hunting and trapping laws and regulations by the applicant. No person shall be designated as a shooter under this section during a period when such person's hunting license or privileges to hunt have been suspended or revoked.

G. The Director or his designee may authorize, subject to the provisions of this section, the killing of deer over bait within the political boundaries of any city or town, or any county with a special late antlerless season, in the Commonwealth when requested by a certified letter from the governing body of such locality.

H. It is unlawful to willfully and intentionally impede any person who is engaged in the lawful killing of a bear or deer pursuant to written authorization issued under this section. Any person convicted of a violation of this subsection is guilty of a Class 3 misdemeanor.

~~50102~~ 50102

OFFICIAL KILL PERMIT

To Whom It May Concern:
Permission is herewith granted NAS Oceana (Name (landowner or lessee)) 757-433-2151 (Telephone)

800 Oceana Blvd (Address) Va Beach (City) Va (State) 23460 (Zip) (E-Mail)

and those persons named below: (State law prohibits persons convicted of wildlife violations from being designated as a shooter or carrying out the authorized activity for the landowner/lessee).

Lawrence McGrogin, CO Authorized Kill Permit Team (Added 22 Dec09 MTW)
Michael Munley
~~NASO Natural Resources Staff~~; & USDA Wildlife Services Staff

To kill 0 (Quantity) {Bear, Beaver, (Deer), Muskrat, Rabbit, Raccoon, Squirrel} (Circle appropriate species) damaging the property of NAS Oceana (MTW 11 Jan 2010)
Red Fox, Grey Fox, Coyote, Opossum

in Va Beach (County or City) ~~Va~~ for the period from Jan 01, 2010 to Dec 31, 2010

Time Restrictions: N/A

Damage control limited to the location described below or on the attachment. No one except those listed on this permit may assist or be present during the damage control activities. Additionally, the landowner/lessee acknowledges that all damage control operations will comply with local firearm ordinances. This permit authorizes the killing of wild animals pursuant to Sections 29.1-516, 29.1-517, 29.1-518, and 29.1-529 Code of Virginia. ~~Unless otherwise authorized on this permit, deer killed on this permit must be antlerless. No animals may be killed between 12:00 midnight Saturday and 12:00 midnight Sunday.~~ Permit is not valid unless signed by the landowner/lessee and the authorizing Department representative. Permit must be carried and available for inspection during damage control activities.

Has the landowner/lessee been issued a kill permit previously on the requested parcel? Yes ☒ No ☐
Has the parcel been hunted in the previous hunting season for deer or bear? Yes ☒ No ☐ Indicate the number of days hunted: ___
How does the landowner/lessee plan to dispose of carcass(es) *(Required within 24 hours after killing a deer or bear)*:
Burial ☐ Personal Use ☐ Charitable Organization ☒ Other ___

The undersigned landowner/lessee agrees to the conditions of this permit and understands that failure to comply with these conditions may lead to its revocation or criminal prosecution.

Signature of Landowner or Lessee: Lawrence F McGrogin 12-18-09 (Date)

Signature of Department Representative: [signature] 12-18-09 (Date)

1. Describe the type of damage or hazard:	Description and/or map of control area:
Aircraft - Deer, Fox, Rabbit, Coyote, Raccoon & Opossum (Animal Aircraft Strike Hazard)	NAS Oceana Airfield ~~NALF Fentress Airfield~~ (MTW)
2. Area type: Commercial/Agricultural ☒ Urban ☐	
3. Type of crop/fruit trees/livestock/other: N/A	
4. Total acres in property/parcel: N/A	
5. Total acres of damage within property/parcel: N/A	
6. Total acres of crop/orchard: N/A	
7. Total animals killed under previous permit: 26	
8. Total number of animals killed under this permit:	
9. Complete if this permit was for deer:	
Antlered Bucks	
Button Bucks	
Does	
10. DCAP Yes ☐ No ☐	

Copies: Sergeant-Final Report, Green-Issuing Game Warden, Yellow-Lieutenant, Pink-Deer Program, Gold-Landowner/Permittee

WILD-4 (7/09)

- Antlered Deer is okay to take
- Sunday Depredation Work is Okay

Per VDGIF Approval obtained on 14 Jan 2010 via email (MTW)

54463

OFFICIAL KILL PERMIT

To Whom It May Concern:
Permission is herewith granted NAS OCEANA * 757 433-2151
Name (landowner or lessee) Telephone

800 OCEANA BLVD VA BEACH 23460 Michael.F.Wright6.mil
Address City State Zip E-Mail

and those persons named below: (State law prohibits persons convicted of wildlife violations from being designated as a shooter or carrying out the authorized activity for the landowner/lessee).

CO AUTHORIZED KILL PERMIT TEAM

NASO NATURAL RESOURCES STAFF

USDA WILDLIFE SERVICES STAFF

To kill UNLIMITED (Bear, Beaver, Deer, Muskrat, Rabbit, Raccoon, Squirrel) damaging the property of NAS OCEANA
(Quantity) (Circle appropriate species) RED FOX, GREY FOX, COYOTE, OPOSSUM, TURKEY

in VA BEACH for the period from JAN 01 2011 to DEC 31 2011
(County or City)

Time Restrictions: N/A MAY HUNT SUNDAY

Damage control limited to the location described below or on the attachment. No one except those listed on this permit may assist or be present during the damage control activities. Additionally, the landowner/lessee acknowledges that all damage control operations will comply with local firearm ordinances. This permit authorizes the killing of wild animals pursuant to Sections 29.1-516, 29.1-517*, 29-1-518, and 29.1-529 Code of Virginia. ~~Unless otherwise authorized on this permit, deer killed on this permit must be antlerless.~~ RTO ~~No animals may be killed between 12:00 midnight Saturday and 12:00 midnight Sunday.~~ Permit is not valid unless signed by the landowner/lessee and the authorizing Department representative. Permit must be carried and available for inspection during damage control activities.

Has the landowner/lessee been issued a kill permit previously on the requested parcel? Yes ☑ No ☐
Has the parcel been hunted in the previous hunting season for deer or bear? Yes ☑ No ☐ Indicate the number of days hunted: ___
How does the landowner/lessee plan to dispose of carcass(es) (*Required within 24 hours after killing a deer or bear*):
Burial ☐ Personal Use ☑ Charitable Organization ☑ Other CREMATION

The undersigned landowner/lessee agrees to the conditions of this permit and understands that failure to comply with these conditions may lead to its revocation or criminal prosecution.

Signature of Landowner or Lessee: [signature] (PRO CODE Holly Johnson) PUBLIC WORKS OFFICER 12/13/10
Date

Signature of Department Representative: Robert Drummond 133 12/13/10
Date

1. Describe the type of damage or hazard: AIRCRAFT STRIKE HAZARD SICK ANIMALS CALL ANIMAL CONTROL	Description and/or map of control area: NAS OCEANA AIRFIELD NALF FENTRESS NASO DAM NECK NSA NORFOLK NW ANNEX
2. Area type: Commercial/Agricultural ☑ Urban ☐	
3. Type of crop/fruit trees/livestock/other: CATTLE HORSES WHEAT	
4. Total acres in property/parcel: N/A	
5. Total acres of damage within property/parcel: N/A	
6. Total acres of crop/orchard: N/A	
7. Total animals killed under previous permit: ATTACHED	
8. Total number of animals killed under this permit: ATTACHED	
9. Complete if this permit was for deer: ATTACHED	
Antlered Bucks	
Button Bucks	
Does	
10. DCAP Yes ☑ No ☐	

Copies: Sergeant-Final Report, Green-Issuing Game Warden, Yellow-Lieutenant, Pink-Deer Program, Gold-Landowner/Permittee WILD-4 (7/09)

* ANTLERED DEER APPROVED
SUNDAY DEPREDATION APPROVED
TURKEY APPROVED
TRAPPING APPROVED

APPENDIX E

List of Threatened and Endangered Species in the Commonwealth Of Virginia

Virginia Department of Game and Inland Fisheries

Special Status Faunal Species in Virginia

Special Concern Faunal Species

Common Name	Scientific Name	Status[1] Federal	State
A millipede	*Buotus carolinus*	SOC	
A millipede	*Cleidogona lachesis*	SOC	
A millipede	*Dixioria pela coronata*	SOC	
A millipede	*Dixioria fowleri*	SOC	
A millipede	*Nannaria simplex*	SOC	
A millipede	*Pseudotremia alecto*	SOC	
A millipede	*Pseudotremia armesi*	SOC	
A millipede	*Pseudotremia momus*	SOC	
A millipede	*Pseudotremia sublevis*	SOC	
A millipede	*Pseudotremia tuberculata*	SOC	
A millipede	*Pseudotremia valga*	SOC	
A millipede	*Rhysodesmus restans*	SOC	
A millipede	*Rudiloria trimaculata tortua*	SOC	
A millipede	*Striaria causeyae*	SOC	
A millipede	*Striaria columbiana*	SOC	
A millipede	*Striaria granulosa*	SOC	
A millipede	*Striaria sp. 1*	SOC	
A millipede	*Trichopetalum dux*	SOC	
A millipede (Burkes garden)	*Conotyla sp. 1*	SOC	
Aeto millipede	*Conotyla aeto*	SOC	
Big Cedar Creek millipede	*Brachoria falcifera*	SOC	
Blowing Rock millipede	*Cleidogona medialis*	SOC	
Brooks millipede	*Dixioria brooksi*	SOC	
Cedar millipede	*Brachoria cedra*	SOC	
Celeno millipede	*Conotyla celeno*	SOC	
Collinwood millipede	*Brachoria mendota*	SOC	
Duke Forest xystodesmid millipede	*Nannaria conservata*	SOC	
Faithful millipede	*Cleidogona fidelitor*	SOC	
Hoffman's cleidogonid millipede	*Cleidogona hoffmani*	SOC	
Hoffman's xystodesmid millipede	*Brachoria hoffmani*	SOC	
Keeton's millipede	*Brachoria laminata*	SOC	
McGraw Gap xystodesmid millipede	*Nannaria ericacea*	SOC	
Melinda millipede	*Conotyla melinda*	SOC	
Powell Mountain millipede Sp. 2	*Brachoria sp. 2*	SOC	
Shenandoah Mountain xystodesmid millipede	*Nannaria shenandoah*	SOC	
Smith Creek xystodesmid millipede	*Nannaria laminata*	SOC	
South Branch Valley cave millipede	*Pseudotremia princeps*	SOC	
Turner's millipede	*Brachoria turneri*	SOC	
Venetia millipede	*Conotyla venetia*	SOC	

For further information or details regarding this list or any species listed herein, please contact:

Wildlife Diversity Division
Virginia Department of Game and Inland Fisheries
4010 W. Broad St.
Richmond, Virginia 23230
(804) 367-6913

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[1] FE=Federal Endangered; FT=Federal Threatened; S/A=Similarity of Appearance; FC=Federal Candidate; SOC=Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); SE=State Endangered; ST=State Threatened; SSC=State Special Concern (not a legal status).

Virginia Department of Game and Inland Fisheries

Special Status Faunal Species in Virginia

Threatened and Endangered Faunal Species

Common Name	Scientific Name	Status[1] Federal	State
FRESHWATER FISHES			
Blackbanded sunfish	*Enneacanthus chaetodon*		SE
Blackside dace	*Phoxinus cumberlandensis*	FT	ST
Carolina darter	*Etheostoma collis*		ST
Duskytail darter	*Etheostoma percnurum*	FE	SE
Emerald shiner	*Notropis atherinoides*		ST
Golden darter	*Etheostoma denoncourti*	SOC	ST
Greenfin darter	*Etheostoma chlorobranchium*		ST
Longhead darter	*Percina macrocephala*		ST
Orangefin madtom	*Noturus gilberti*	SOC	ST
Paddlefish	*Polyodon spathula*		ST
Roanoke logperch	*Percina rex*	FE	SE
Sharphead darter	*Etheostoma acuticeps*		SE
Shortnose sturgeon	*Acipenser brevirostrum*	FE	SE
Slender chub	*Erimystax cahni*	FT	ST
Spotfin chub	*Erimonax monachus*	FT	ST
Steelcolor shiner	*Cyprinella whipplei*		ST
Tennessee dace	*Phoxinus tennesseensis*		SE
Variegate darter	*Etheostoma variatum*		SE
Western sand darter	*Ammocrypta clara*		ST
Whitemouth shiner	*Notropis alborus*		ST
Yellowfin madtom	*Noturus flavipinnis*	FT	ST
AMPHIBIANS			
	Frogs		
Barking treefrog	*Hyla gratiosa*		ST
	Salamanders		
Eastern tiger salamander	*Ambystoma tigrinum tigrinum*		SE
Mabee's salamander	*Ambystoma mabeei*		ST
Shenandoah salamander	*Plethodon shenandoah*	FE	SE
REPTILES			
	Lizards		
Eastern glass lizard	*Ophisaurus ventralis*		ST
	Snakes		
Canebrake rattlesnake (Coastal Plain population of timber rattlesnake)	*Crotalus horridus*		SE
	Turtles		
Bog (= Muhlenberg) turtle	*Glyptemys (=Clemmys) muhlenbergii*	FT(S/A)	SE
Eastern chicken turtle	*Deirochelys reticularia reticularia*		SE
Green sea turtle	*Chelonia mydas*	FT	ST
Hawksbill sea turtle	*Eretmochelys imbricata*	FE	SE

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Common Name	Scientific Name	Status[1] Federal	State
Kemp's ridley sea turtle	*Lepidochelys kempii*	FE	SE
Leatherback sea turtle	*Dermochelys coriacea*	FE	SE
Loggerhead sea turtle	*Caretta caretta*	FT	ST
Wood turtle	*Glyptemys insculpta*		ST
BIRDS			
Bachman's sparrow	*Aimophila aestivalis*		ST
Bachman's warbler (=wood)	*Vermivora bachmanii*	FE	SE
Bald eagle	*Haliaeetus leucocephalus*	SOC	ST
Bewick's wren	*Thryomanes bewickii*		SE
Gull-billed tern	*Sterna nilotica*		ST
Henslow's sparrow	*Ammodramus henslowii*		ST
Kirtland's warbler (=wood)	*Dendroica kirtlandii*	FE	SE
Loggerhead shrike	*Lanius ludovicianus*		ST
Peregrine falcon	*Falco peregrinus*		ST
Piping plover	*Charadrius melodus*	FT	ST
Red-cockaded woodpecker	*Picoides borealis*	FE	SE
Roseate tern	*Sterna dougallii dougallii*	FE	SE
Upland sandpiper	*Bartramia longicauda*		ST
Wilson's plover	*Charadrius wilsonia*		SE
MAMMALS			
American water shrew	*Sorex palustris*		SE
Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	FE	SE
Delmarva Peninsula fox squirrel	*Sciurus niger cinereus*	FE	SE
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*		ST
Eastern puma (=cougar)	*Puma (=Felis) concolor cougar*	FE	SE
Gray bat	*Myotis grisescens*	FE	SE
Gray wolf	*Canis lupus*	FE	SE
Indiana bat	*Myotis sodalis*	FE	SE
Rafinesque's eastern big-eared bat	*Corynorhinus rafinesquii macrotis*		SE
Rock vole	*Microtus chrotorrhinus*		SE
Snowshoe hare	*Lepus americanus*		SE
Virginia big-eared bat	*Corynorhinus (= Plecotus) townsendii virginianus*	FE	SE
Virginia northern flying squirrel	*Glaucomys sabrinus fuscus*		SE
MOLLUSKS			
	Freshwater Mollusks		
Appalachian monkeyface (pearlymussel)	*Quadrula sparsa*	FE	SE
Atlantic pigtoe	*Fusconaia masoni*	SOC	ST
Birdwing pearlymussel	*Conradilla caelata (= Lemiox rimosus)*	FE	SE
Black sandshell	*Ligumia recta*		ST
Brook floater	*Alasmidonta varicosa*		SE
Cracking pearlymussel	*Hemistena lata*	FE	SE
Cumberland bean (pearlymussel)	*Villosa trabalis*	FE	SE
Cumberland monkeyface (pearlymussel)	*Quadrula intermedia*	FE	SE
Cumberlandian combshell	*Epioblasma brevidens*	FE	SE
Deertoe	*Truncilla truncata*		SE

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Common Name	Scientific Name	Status[1] Federal	State
Dromedary pearlymussel	*Dromus dromas*	FE	SE
Dwarf wedgemussel	*Alasmidonta heterodon*	FE	SE
Elephantear	*Elliptio crassidens*		SE
Fanshell	*Cyprogenia stegaria*	FE	SE
Fine-rayed pigtoe	*Fusconaia cuneolus*	FE	SE
Fluted kidneyshell	*Ptychobranchus subtentum*	FC	
Fragile papershell	*Leptodea fragilis*		ST
Green blossom (pearlymussel)	*Epioblasma torulosa gubernaculum*	FE	SE
Green floater	*Lasmigona subviridis*		ST
James spinymussel	*Pleurobema collina*	FE	SE
Little-wing pearlymussel	*Pegias fabula*	FE	SE
Ohio pigtoe	*Pleurobema cordatum*		SE
Oyster mussel	*Epioblasma capsaeformis*	FE	SE
Pimpleback	*Quadrula pustulosa pustulosa*		ST
Pink mucket (pearlymussel)	*Lampsilis abrupta*	FE	SE
Pistolgrip	*Tritogonia verrucosa*		ST
Purple bean	*Villosa perpurpurea*	FE	SE
Purple lilliput	*Toxolasma lividus*	SOC	SE
Pyramid pigtoe	*Pleurobema rubrum*	SOC	SE
Rayed bean	*Villosa fabalis*	SOC/FC	
Rough pigtoe	*Pleurobema plenum*	FE	SE
Rough rabbitsfoot	*Quadrula cylindrica strigillata*	FE	SE
Sheepnose	*Plethobasus cyphyus*		ST
Shiny pigtoe	*Fusconaia cor*	FE	SE
Slabside pearlymussel	*Lexingtonia dolabelloides*	FC	ST
Slippershell mussel	*Alasmidonta viridis*		SE
Snuffbox	*Epioblasma triquetra*		SE
Spectaclecase	*Cumberlandia monodonta*	SOC/FC	SE
Tan riffleshell	*Epioblasma florentina walkeri (= E. walkeri)*	FE	SE
Tennessee heelsplitter	*Lasmigona holstonia*		SE
	Freshwater & Land Snails		
Appalachian springsnail	*Fontigens bottimeri*	SOC	SE
Brown supercoil	*Paravitrea septadens*	SOC	ST
Rubble coil	*Helicodiscus lirellus*	SOC	SE
Shaggy coil	*Helicodiscus diadema*	SOC	SE
Spider elimia	*Elimia arachnoidea*		SE
Spiny riversnail	*Io fluvialis*	SOC	ST
Spirit supercoil	*Paravitrea hera*	SOC	SE
Springsnail (no common name)	*Fontigens morrisoni*	SOC	SE
Thankless ghostsnail	*Holsingeria unthanksensis*	SOC	SE
Virginia fringed mountain snail	*Polygriscus virginianus*	FE	SE
FRESHWATER CRUSTACEANS			
Big Sandy crayfish	*Cambarus veteranus*	SOC	SE
Lee County Cave isopod	*Lirceus usdagalun*	FE	SE
Madison Cave amphipod	*Stygobromus stegerorum*	SOC	ST
Madison Cave isopod	*Antrolana lira*	FT	ST

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Common Name	Scientific Name	Status[1] Federal	State
MILLIPEDES			
Ellett Valley pseudotremia	*Pseudotremia cavernarum*	SOC	ST
Laurel Creek xystodesmid	*Sigmoria whiteheadi*	SOC	ST
INSECTS[2]			
American burying beetle	*Nicrophorus americanus*	FE	
Appalachian grizzled skipper	*Pyrgus wyandot (=Pyrgus centaureae wyandot)*		ST
Buffalo Mountain mealybug	*Puto kosztarabi*		SE
Holsinger's cave beetle	*Pseudanophthalmus holsingeri*	FC	
Mitchell's satyr butterfly	*Neonympha mitchellii*		SE
Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	FT	ST
Virginia Piedmont water boatman	*Sigara depressa*		SE
MARINE MAMMALS			
Blue whale	*Balaenoptera musculus*	FE	SE
Finback whale	*Balaenoptera physalus*	FE	SE
Humpback whale	*Megaptera novaeangliae*	FE	SE
Right whale	*Balaena glacialis* (incl. *australis*)	FE	SE
Sei whale	*Balaenoptera borealis*	FE	SE
Sperm whale	*Physeter catodon (= macrocephalus)*	FE	SE
West Indian manatee	*Trichechus manatus*	FE	SE

[2] all insects listed as federal or state endangered or threatened are protected by regulations that fall under the Virginia Department of Agriculture and Consumer Services' jurisdiction

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FRESHWATER FISHES			
Appalachia darter	*Percina gymnocephala*	SOC	
Ashy darter	*Etheostoma cinereum*	SOC	
Atlantic sturgeon	*Acipenser oxyrhynchus*	SOC	SSC
Bigeye jumprock	*Moxostoma ariommum*	SOC	
Blotchside logperch	*Percina burtoni*	SOC	SSC
Bluebreast darter	*Etheostoma camurum*		SSC
Bluestone sculpin	*Cottus sp. 1*	SOC	
Bridle shiner	*Notropis bifrenatus*		SSC
Brook silverside	*Labidesthes sicculus*		SSC
Candy darter	*Etheostoma osburni*	SOC	SSC
Channel darter	*Percina copelandi*		SSC
Clinch sculpin	*Cottus sp. 4*	SOC	
Fatlips minnow	*Phenacobius crassilabrum*	SOC	SSC
Holston sculpin	*Cottus sp. 5*	SOC	
Kanawha darter	*Etheostoma kanawhae*	SOC	
Kanawha minnow	*Phenacobius teretulus*	SOC	
Mirror shiner	*Notropis spectrunculus*		SSC
Mountain brook lamprey	*Ichthyomyzon greeleyi*	SOC	
Popeye shiner	*Notropis ariommus*	SOC	SSC
River redhorse	*Moxostoma carinatum*		SSC
Riverweed darter	*Etheostoma podostemone*	SOC	
Roanoke bass	*Ambloplites cavifrons*	SOC	SSC
Roanoke hog sucker	*Hypentelium roanokense*	SOC	
Roughhead shiner	*Notropis semperasper*	SOC	SSC
Rustyside sucker	*Thoburnia hamiltoni*	SOC	SSC
Sauger	*Sander canadensis*		SSC
Speckled killifish	*Fundulus rathbuni*		SSC
Spotted-margin madtom	*Noturus insignis ssp. 1*	SOC	
Stonecat	*Noturus flavus*		SSC
Thicklip chub	*Cyprinella labrosa*	SOC	
Wounded darter	*Etheostoma vulneratum*	SOC	
AMPHIBIANS			
	Frogs		
Carpenter frog	*Rana virgatipes*		SSC
Oak toad	*Bufo quercicus*		SSC
	Salamanders		
Cow Knob salamander	*Plethodon punctatus*	SOC	SSC
Eastern hellbender	*Cryptobranchus alleganiensis alleganiensis*	SOC	SSC
Mole salamander	*Ambystoma talpoideum*		SSC
Peaks of Otter salamander	*Plethodon hubrichti*	SOC	SSC
Pigmy salamander	*Desmognathus wrighti*		SSC
Shovel-nosed salamander	*Desmognathus marmoratus*		SSC
Weller's salamander	*Plethodon welleri*	SOC	SSC

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REPTILES			
	Snakes		
Mountain earthsnake	*Virginia valeriae pulchra*		SSC
Northern pinesnake	*Pituophis melanoleucus melanoleucus*	SOC	
	Turtles		
Northern diamond-backed terrapin	*Malaclemys terrapin terrapin*	SOC	
BIRDS			
Alder flycatcher	*Empidonax alnorum*		SSC
Barn owl	*Tyto alba pratincola*		SSC
Black rail	*Laterallus jamaicensis*	SOC	
Brown creeper	*Certhia americana*		SSC
Brown pelican	*Pelecanus occidentalis carolinensis*		SSC
Caspian tern	*Sterna caspia*		SSC
Cerulean warbler	*Dendroica cerulea*	SOC	
Common moorhen	*Gallinula chloropus cachinnans*		SSC
Dickcissel	*Spiza americana*		SSC
Forster's tern	*Sterna forsteri*		SSC
Glossy ibis	*Plegadis falcinellus*		SSC
Golden-crowned kinglet	*Regulus satrapa*		SSC
Golden-winged warbler	*Vermivora chrysoptera*		SSC
Great egret	*Ardea alba egretta*		SSC
Hermit thrush	*Catharus guttatus*		SSC
Least tern	*Sterna antillarum*		SSC
Little blue heron	*Egretta caerulea caerulea*		SSC
Long-eared owl	*Asio otus*		SSC
Magnolia warbler	*Dendroica magnolia*		SSC
Migrant loggerhead shrike	*Lanius ludovicianus migrans*	SOC	
Mourning warbler	*Oporornis philadelphia*		SSC
Northern goshawk	*Accipiter gentilis*	SOC	
Northern harrier	*Circus cyaneus*		SSC
Northern saw-whet owl	*Aegolius acadicus*		SSC
Purple finch	*Carpodacus purpureus*		SSC
Red crossbill	*Loxia curvirostra*		SSC
Red-breasted nuthatch	*Sitta canadensis*		SSC
Saltmarsh sharp-tailed sparrow	*Ammodramus caudacutus*		SSC
Sandwich tern	*Sterna sandvicensis acuflavidus*		SSC
Sedge wren	*Cistothorus platensis*		SSC
Swainson's warbler	*Limnothlypis swainsonii*		SSC
Tricolored heron	*Egretta tricolor*		SSC
Winter wren	*Troglodytes troglodytes*		SSC
Yellow-bellied flycatcher	*Empidonax flaviventris*		SSC
Yellow-crowned night-heron	*Nyctanassa violacea violacea*		SSC

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MAMMALS			
Appalachian cottontail	*Sylvilagus obscurus*	SOC	
Allegheny woodrat	*Neotoma magister*	SOC	
Eastern small-footed myotis	*Myotis leibii*	SOC	
Marsh rabbit	*Sylvilagus palustris palustris*		SSC
Northern river otter	*Lontra canadensis lataxina*		SSC
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	SOC	
Smith's Island cottontail	*Sylvilagus floridanus hitchensi*	SOC	
Star-nosed mole	*Condylura cristata parva*		SSC
MOLLUSKS			
	Freshwater Mollusks		
Eastern lampmussel	*Lampsilis radiata radiata*		SSC
Elktoe	*Alasmidonta marginata*	SOC	SSC
Longsolid	*Fusconaia subrotunda*	SOC	
Roanoke slabshell	*Elliptio roanokensis*	SOC	SSC
Tennessee clubshell	*Pleurobema oviforme*	SOC	
Tennessee pigtoe	*Fusconaia barnesiana*	SOC	SSC
Virginia pigtoe	*Lexingtonia subplana*	SOC	
Yellow lampmussel	*Lampsilis cariosa*	SOC	SSC
Yellow lance	*Elliptio lanceolata*	SOC	SSC
	Freshwater Landsnails		
Balsam globe	*Mesodon andrewsae*	SOC	
Barred supercoil	*Paravitrea seradens*	SOC	
Bidentate dome	*Ventridens coelaxis*	SOC	
Black mantleslug	*Pallifera hemphilli*	SOC	
Blotchy mantleslug	*Megapallifera wetherbyi*	SOC	
Blue Ridge springsnail	*Fontigens orolibas*	SOC	
Brown globelet	*Inflectarius kalmianus*	SOC	
Buttressed threetooth	*Triodopsis rugosa*	SOC	
Comb supercoil	*Paravitrea dentilla*	SOC	
Cupped vertigo	*Vertigo clappi*	SOC	
Delicate vertigo	*Vertigo bollesiana*	SOC	
Depressed glyph	*Glyphyalinia virginica*	SOC	
Funnel supercoil	*Paravitrea mira*	SOC	
Glossy covert	*Fumonelix christyi*	SOC	
Glossy supercoil	*Paravitrea placentula*	SOC	
Hanging Rock threetooth	*Triodopsis pendula*	SOC	
Highland slitmouth	*Stenotrema altispira*	SOC	
Maryland glyph	*Glyphyalinia raderi*	SOC	SSC
Onyx rocksnail	*Leptoxis praerosa*	SOC	
Panhandle pebblesnail	*Somatogyrus virginicus*	SOC	
Round supercoil	*Paravitrea reesei*	SOC	
Rust glyph	*Glyphyalinia picea*	SOC	
Shrew supercoil	*Paravitrea blarina*	SOC	
Skyline Caverns snail	*Holsingeria sp. 1*	SOC	

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Slender supercoil	*Paravitrea subtilis*	SOC	
Smallmouth vertigo	*Vertigo parvula*	SOC	
Snowhill ambersnail	*Catinella hubrichti*	SOC	
Spruce knob threetooth	*Triodopsis picea*	SOC	
Talus coil	*Helicodiscus triodus*	SOC	
Twilight coil	*Helicodiscus multidens*	SOC	
Virginia mantleslug	*Philomycus virginicus*	SOC	
FRESHWATER CRUSTACEANS			
A cave amphipod (Botetourt County)	*Stygobromus sp. 10*	SOC	
A cave amphipod (Patrick County)	*Stygobromus sp. 13*	SOC	
A cave amphipod (Shenandoah County)	*Stygobromus sp. 9*	SOC	
A groundwater amphipod	*Stygobromus sp. 15*	SOC	
A cave amphipod (Nelson County)	*Stygobromus sp. 11*	SOC	
A cave amphipod (Rockbridge County)	*Stygobromus sp. 12*	SOC	
Alleghany County cave amphipod	*Stygobromus hoffmani*	SOC	
Appalachian Valley cave amphipod	*Crangonyx antennatus*		SSC
Bath County cave amphipod	*Stygobromus mundus*	SOC	SSC
Bigger's cave amphipod	*Stygobromus biggersi*	SOC	
Bland County amphipod	*Crangonyx sp. 3*	SOC	
Blue Ridge Mountain amphipod	*Stygobromus spinosus*	SOC	
Burnsville Cove cave amphipod	*Stygobromus conradi*	SOC	
Chowanoke crayfish	*Orconectes virginiensis*	SOC	
Clinch River crayfish	*Cambarus angularis*	SOC	
Craig County cave amphipod	*Stygobromus estesi*	SOC	
Cumberland cave amphipod	*Stygobromus cumberlandus*	SOC	
Cumberland Gap cave amphipod	*Bactrurus sp. 2*	SOC	
Cumberland isopod	*Caecidotea sp. 7*	SOC	
Dismal Swamp isopod	*Caecidotea attenuatus*	SOC	
Ephemeral cave amphipod	*Stygobromus ephemerus*	SOC	SSC
Finley's cave amphipod	*Stygobromus finleyi*	SOC	
Grayson crayfish ostracod	*Ascetocythere cosmeta*	SOC	
Helseley's cave amphipod	*Stygobromus sp. 16*	SOC	
Henrot's cave isopod	*Caecidotea henroti*	SOC	
Holsinger's cave isopod	*Caecidotea holsingeri*	SOC	
Incurved cave isopod	*Caecidotea incurva*	SOC	
James Cave amphipod	*Stygobromus abditus*	SOC	
Lee County cave amphipod	*Stygobromus leensis*	SOC	
Luray Caverns amphipod	*Stygobromus pseudospinosus*	SOC	
Montgomery County cave amphipod	*Stygobromus fergusoni*	SOC	
Morrison's cave amphipod	*Stygobromus morrisoni*	SOC	SSC
Mount Rogers groundwater amphipod	*Stygobromus sp. 8*	SOC	
Natural Bridge cave isopod	*Caecidotea bowmani*	SOC	
New Castle Murder Hole amphipod	*Stygobromus interitus*	SOC	
Northern Virginia well amphipod	*Stygobromus phreaticus*	SOC	
Phreatic isopod	*Caecidotea phreatica*	SOC	
Pittsylvania well amphipod	*Stygobromus obrutus*	SOC	
Pizzini's amphipod	*Stygobromus pizzinii*	SOC	SSC
Powell Valley terrestrial cave isopod	*Amerigoniscus henroti*	SOC	

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Price's cave isopod	*Caecidotea pricei*	SOC	
Racovitza's terrestrial cave isopod	*Miktoniscus racovitzai*	SOC	
Rock Creek groundwater amphipod	*Stygobromus kenki*	SOC	
Rockbridge County cave amphipod	*Stygobromus baroodyi*	SOC	
Rye Cove isopod	*Lirceus culveri*	SOC	SSC
Shenandoah Valley cave amphipod	*Stygobromus gracilipes*	SOC	SSC
Sherando spinosoid amphipod	*Stygobromus sp. 7*	SOC	
Southwestern Virginia cave amphipod	*Stygobromus mackini*		SSC
Southwestern Virginia cave isopod	*Caecidotea recurvata*	SOC	
Tidewater amphipod	*Stygobromus indentatus*	SOC	SSC
Tidewater interstitial amphipod	*Stygobromus araeus*	SOC	SSC
Vandel's cave isopod	*Caecidotea vandeli*	SOC	
INSECTS			
A beetle	*Nemadus horni*	SOC	
A cave beetle	*Pseudanophthalmus gracilis*	SOC	
A cave beetle	*Pseudanophthalmus pusio*	SOC	
A cave beetle	*Pseudanophthalmus seclusus*	SOC	
A cave beetle	*Pseudanophthalmus sp. 4*	SOC	
A cave beetle	*Pseudanophthalmus sp. 5*	SOC	
A cave beetle	*Pseudanophthalmus sp. 6*	SOC	
A cave beetle	*Pseudanophthalmus sp. 7*	SOC	
A cave beetle	*Pseudanophthalmus sp. 9*	SOC	
A cave beetle	*Pseudanophthalmus sp. 10*	SOC	
A cave beetle (Hubbardi group)	*Pseudanophthalmus sp. 8*	SOC	
A cave beetle (Pusio group)	*Pseudanophthalmus sp. 11*	SOC	
A cave dipluran	*Litocampa sp. 4*	SOC	
A cave dipluran	*Litocampa sp. 5*	SOC	
A cave dipluran (salamander cave)	*Litocampa sp. 1*	SOC	
A cave obligate springtail	*Pseudosinella hirsuta*	SOC	
A cave pselaphid beetle	*Arianops jeanneli*	SOC	
A cave springtail	*Oncopodura hubbardi*	SOC	
A cave springtail	*Arrhopalites caedus*	SOC	
A cave springtail	*Arrhopalites carolynae*	SOC	
A cave springtail	*Arrhopalites commorus*	SOC	
A cave springtail	*Arrhopalites lacuna*	SOC	
A cave springtail	*Arrhopalites marshalli*	SOC	
A cave springtail	*Arrhopalites pavo*	SOC	
A cave springtail	*Arrhopalites sacer*	SOC	
A cave springtail	*Arrhopalites silvus*	SOC	
A cave springtail	*Pseudosinella bona*	SOC	
A cave springtail	*Pseudosinella erewhon*	SOC	
A cave springtail	*Pseudosinella extra*	SOC	
A cave springtail	*Pseudosinella gisini*	SOC	
A cave springtail	*Pseudosinella granda*	SOC	
A cave springtail	*Pseudosinella orba*	SOC	
A cave springtail	*Pseudosinella sp. 2*	SOC	
A cave springtail	*Pseudosinella sp. 3*	SOC	
A cave springtail	*Pseudosinella sp. 4*	SOC	

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Virginia Department of Game and Inland Fisheries

Special Status Faunal Species in Virginia

Special Concern Faunal Species

Common Name	Scientific Name	Status[1] Federal	State
A cave springtail	*Schaefferia hubbardi*	SOC	
A cave springtail	*Typhlogastrura valentini*	SOC	
A geometrid moth	*Euchlaena milnei*	SOC	
A ghost moth	*Hepialus sciophanes*	SOC	
A ground beetle	*Cyclotrachelus incisus*	SOC	
A leaf beetle	*Calligrapha pnirsa*	SOC	
A mayfly	*Isonychia tusculanensis*	SOC	
A mirid bug	*Bothynotus johnstoni*	SOC	
A rove beetle	*Atheta troglophila*	SOC	
A shield bug	*Galgupha denudata*	SOC	
A springtail	*Arrhopalites benitus*	SOC	
A tiger beetle	*Cicindela ancocisconensis*	SOC	
A turtle bug	*Oncozygia clavicornis*	SOC	
An assassin bug	*Pnirontis brimleyi*	SOC	
Appalachian snaketail	*Ophiogomphus incurvatus*	SOC	
Appalachian grizzled skipper	*Pyrgus centaureae wyandot*	SOC	
Arogos skipper	*Atrytone arogos arogos*	SOC	
Avernus cave beetle	*Pseudanophthalmus avernus*	SOC	
Barrens itame	*Itame sp. 1 (cf I. Inextricata)*	SOC	
Barrens tiger beetle	*Cicindela patruela*	SOC	
Beartown perlodid stonefly	*Isoperla major*	SOC	
Benfield's bearded small minnow mayfly	*Barbaetis benfieldi*	SOC	
Black lordithon rove beetle	*Lordithon niger*	SOC	
Buchholz's dart moth	*Agrotis buchholz*	SOC	
Buffalo Mountain mealybug	*Puto kosztarabi*	SOC	
Burke's Garden cave beetle	*Pseudanophthalmus hortulanus*	SOC	
Catawba cave beetle	*Pseudanophthalmus sp. 12*	SOC	
Cherokee clubtail	*Gomphus (= Stenogomphurus) consanguis*	SOC	
Chestnut leaf miner moth	*Tischeria perplexa*	SOC	
Cobblestone tiger beetle	*Cicindela marginipennis*	SOC	
Combneck assassin bug	*Ctenotrachelus shermani*	SOC	
Crossroads cave beetle	*Pseudanophthalmus intersectus*	SOC	
Deceptive cave beetle	*Pseudanophthalmus deceptivus*	SOC	
Delicate cave beetle	*Pseudanophthalmus delicatus*	SOC	
Diana fritillary	*Speyeria diana*	SOC	
Dismal Swamp green stink bug	*Chlorochroa dismalia*	SOC	
Doll's merolonch	*Merolonche dolli*	SOC	
Dotted skipper	*Hesperia attalus slossonae*	SOC	
Elusive clubtail	*Stylurus notatus*	SOC	
Fraser fir geometrid moth	*Semiothisa fraserata*	SOC	
Gammon's stenelmis riffle beetle	*Stenelmis gammoni*	SOC	
Green-faced clubtail	*Gomphus viridifrons*	SOC	
Hanson's Appalachian stonefly	*Hansonoperla appalachia*	SOC	
Hebard's noctuid moth	*Erythroecia hebardi*	SOC	
Herodias underwing	*Catocala herodias*	SOC	
Hoffman's cave beetle	*Pseudanophthalmus hoffmani*	SOC	
Hubbard's cave beetle	*Pseudanophthalmus hubbardi*	SOC	
Hubricht's cave beetle	*Pseudanophthalmus hubrichti*	SOC	
Jefferson's short-nosed scorpionfly	*Brachypanorpa jeffersoni*	SOC	
Kanawhole springfly	*Diploperla kanawholensis*	SOC	

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Virginia Department of Game and Inland Fisheries

Special Status Faunal Species in Virginia

Special Concern Faunal Species

Common Name	Scientific Name	Status[1] Federal	State
Karl's Pit cave beetle	*Pseudanophthalmus sp. 14*	SOC	
Kosztarab's common stonefly	*Acroneuria kosztarabi*	SOC	
Lee County cave beetle	*Pseudanophthalmus hirsutus*	SOC	
Little Kennedy cave beetle	*Pseudanophthalmus cordicollis*	SOC	
Lobed roach-like stonefly	*Tallaperla lobata*	SOC	
Long-headed cave beetle	*Pseudanophthalmus longiceps*	SOC	
Maiden Spring cave beetle	*Pseudanophthalmus virginicus*	SOC	
Maureen's Hydraenan minute moss beetle	*Hydraena maureenae*	SOC	
McMullan Cave beetle	*Pseudanophthalmus sp. 13*	SOC	
Mountain river cruiser	*Macromia margarita*	SOC	
Mud-dwelling cave beetle	*Pseudanophthalmus limicola*	SOC	
Natural Bridge cave beetle	*Pseudanophthalmus pontis*	SOC	
Nelson's cave beetle	*Pseudanophthalmus nelsoni*	SOC	
Nelson's early black stonefly	*Taeniopteryx nelsoni*	SOC	
New River Valley cave beetle	*Pseudanophthalmus egberti*	SOC	
Overlooked cave beetle	*Pseudanophthalmus praetermissus*	SOC	
Persius duskywing	*Erynnis persius persius*	SOC	
Petrunkevitch's cave beetle	*Pseudanophthalmus petrunkevitchi*	SOC	
Precious underwing	*Catocala pretiosa pretiosa*	SOC	
Pygmy snaketail	*Ophiogomphus howei*	SOC	
Rare skipper	*Problema bulenta*	SOC	
Regal fritillary	*Speyeria idalia*	SOC	
Rotund cave beetle	*Pseudanophthalmus rotundatus*	SOC	
Saint Paul cave beetle	*Pseudanophthalmus sanctipauli*	SOC	
Scarce swamp skipper (or Duke's skipper)	*Euphyes dukesi*	SOC	
Schaum's ground beetle	*Sphaeroderus schaumi*	SOC	
Septima's clubtail	*Gomphus septima*	SOC	
Shenandoah rhyacophilid caddisfly	*Rhyacophila shenandoahensis*	SOC	
Silken cave beetle	*Pseudanophthalmus sericus*	SOC	
Six-banded longhorn beetle	*Dryobius sexnotatus*	SOC	
Skillet clubtail	*Gomphus ventricosus*	SOC	
Smyth's apamea moth	*Apamea smythi*	SOC	
South Branch Valley cave beetle	*Pseudanophthalmus potomaca potomaca*	SOC	
Southeastern myotis bat fly	*Basilia boardmani*	SOC	
Spatulate snowfly	*Allocapnia simmonsi*	SOC	
Spieth's great speckled olive mayfly	*Siphloplecton costalense*	SOC	
Spotted cave beetle	*Pseudanophthalmus punctatus*	SOC	
Straley's cave beetle	*Pseudanophthalmus quadratus*	SOC	
Sweet underwing (or quiet underwing)	*Catocala dulciola*	SOC	
Tawny crescent	*Phyciodes batesii*	SOC	
Thin-neck cave beetle	*Pseudanophthalmus parvicollis*	SOC	
Thomas' cave beetle	*Pseudanophthalmus thomasi*	SOC	
Vicariant cave beetle	*Pseudanophthalmus vicarius*	SOC	
Virginia Piedmont water boatman	*Sigara depressa*	SOC	
Williams' rare winter stonefly	*Megaleuctra williamsae*	SOC	
PLANARIANS			
A groundwater planarian	*Procotyla typhlops*	SOC	
Chandler's planarian	*Sphalloplana chandleri*	SOC	

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Virginia Department of Game and Inland Fisheries

Special Status Faunal Species in Virginia

Special Concern Faunal Species

Common Name	Scientific Name	Status[1] Federal	State
Powell Valley planarian	*Sphalloplana consimilis*	SOC	
Rockbridge County cave planarian	*Sphalloplana virginiana*	SOC	
ANNELIDS			
A branchiobdelid worm	*Ankyrodrilus legacus*	SOC	
A cave lumbriculid worm	*Stylodrilus beattiei*	SOC	
A cave obligate worm	*Cambarincola fallax*	SOC	
CENTIPEDES			
Montane centipede	*Escaryus cryptorobius*	SOC	
Whitetop Mountain centipede	*Escaryus orestes*	SOC	
ARACHNIDS			
A cave mite	*Foveacheles paralleloseta*	SOC	
A cave pseudoscorpion	*Apochthonius coecus*	SOC	
A cave pseudoscorpion	*Apochthonius holsingeri*	SOC	
A cave pseudoscorpion	*Chitrella sp. 1*	SOC	
A cave pseudoscorpion	*Chitrella superba*	SOC	
A cave pseudoscorpion	*Kleptochthonius anophthalmus*	SOC	
A cave pseudoscorpion	*Kleptochthonius binoculatus*	SOC	
A cave pseudoscorpion	*Kleptochthonius proximosetus*	SOC	
A cave pseudoscorpion	*Kleptochthonius regulus*	SOC	
A cave pseudoscorpion	*Kleptochthonius similus*	SOC	
A cave pseudoscorpion	*Kleptochthonius sp. 1*	SOC	
A cave pseudoscorpion	*Microcreagris valentinei*	SOC	
A cave pseudoscorpion	*Mundochthonius holsingeri*	SOC	
A cave spider	*Islandiana muma*	SOC	
A cave spider	*Nesticus mimus*	SOC	
A cave spider	*Nesticus paynei*	SOC	
A cave spider	*Nesticus tennesseensis*	SOC	
A funnel-web spider	*Barronopsis jeffersi*	SOC	
A pseudoscorpion	*Chitrella cavicola*	SOC	
Coyle's purse-web spider	*Sphodros coylei*	SOC	
Gertsch's cave pseudoscorpion	*Kleptochthonius gertschi*	SOC	
Holsinger's cave spider	*Nesticus holsingeri*	SOC	
Lutz's cave pseudoscorpion	*Kleptochthonius lutzi*	SOC	
Robust trapdoor spider	*Antrodiaetus robustus*	SOC	
MILLIPEDES			
A cave millipede	*Pseudotremia sp. 3*	SOC	
A millipede	*Aniulus orientalis*	SOC	
A millipede	*Brachoria dentata*	SOC	
A millipede	*Brachoria insolita*	SOC	
A millipede	*Brachoria separanda calcaria*	SOC	
A millipede	*Brachoria separanda hamata*	SOC	
A millipede	*Brachoria separanda versicolor*	SOC	

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APPENDIX F

Species Guilds Observed at NASO Airfield, June 2010 through May 2011

GUILD AND SPECIES	TOTAL OBSERVATIONS
Blackbirds/Orioles	**15454**
Mixed Blackbirds	14925
Red-winged Blackbirds	441
Common Grackle	84
Brown-headed Blackbird	4
Starlings	**6046**
European Starling	6046
Waterfowl	**1701**
Canada Goose	1618
American Brant	67
Tundra Swan	12
Hooded Merganser	3
Mallard	1
Pigeons/Doves	**1571**
Mourning Dove	952
Rock Pigeon	619
Crows/Ravens	**1472**
American Crow	1472
Meadowlarks	**1244**
Eastern Meadowlark	1244
Gulls	**1139**
Laughing Gull	766
Ring-billed Gull	346
Herring Gull	23
Unknown Gull	4
Swallows	**839**
Tree Swallow	510
Barn Swallow	328
Purple Martin	1
Raptors	**744**
Red-tailed Hawk	279
American Kestrel	171
Northern Harrier	171
Turkey Vulture	99
Osprey	11
Cooper’s Hawk	8
Bald Eagle	4
Sharp-shinned Hawk	1
Shorebirds	**441**
Killdeer	432
Upland Sandpiper	6
Wilson’s Snipe	3
Thrushes	**420**
American Robin	373
Eastern Bluebird	47
Artiodactyls	**365**

	White-tailed Deer	365
Warblers		**273**
	Yellow-rumped Warbler	270
	Yellow-breasted Chat	2
	Common Yellowthroat	1
Swifts		**131**
	Chimney Swift	131
Sparrows		**119**
	Unknown Sparrow	45
	Vesper Sparrow	22
	Savannah Sparrow	20
	Song Sparrow	18
	White-throated Sparrow	6
	Chipping Sparrow	5
	Field Sparrow	2
	Grasshopper Sparrow	1
Jays/Magpies		**84**
	Blue Jay	84
Finches/Bunting		**76**
	Northern Cardinal	40
	Indigo Bunting	27
	Blue Grosbeak	9
	American Goldfinch	4
Waxwings		**65**
	Cedar Waxwing	65
Chickadees/Titmice/Wrens		**47**
	Carolina Chickadee	21
	Tufted Titmouse	13
	Carolina Wren	13
Mimics		**44**
	Northern Mockingbird	41
	Brown Thrasher	3
	Gray Catbird	1
Egrets		**34**
	Cattle Egret	34
Woodpeckers		**27**
	Northern Flicker	21
	Pileated Woodpecker	6
Flycatchers		**25**
	Eastern Kingbird	23
	Great Crested Flycatcher	1
	Eastern Phoebe	1

Carnivores		**14**
	Coyote	5
	Red fox	3
	Bobcat	3
	Gray fox	2
Herons/Bitterns		**11**
	Great Blue Heron	11
Cormorants		**6**
	Double-crested Cormorant	6
Towhees		**4**
	Eastern Towhee	4
Gallinaceous Birds		**3**
	Northern Bobwhite	1
	Eastern Wild Turkey	2
Gnatcatchers		**2**
	Blue-gray Gnatcatcher	2
Vireos		**1**
	White-eyed Vireo	1
Owls		**1**
	Barred Owl	1
Lagomorphs		**1**
	Eastern cottontail rabbit	1
Unknown (birds)		**13**
	Unknown	13
Mammals (other)		**1**
	Feral cat	1
	Total	**32418**

APPENDIX G

Total Species Observed, Removed and Dispersed by WS Personnel from June 2010 through May 2011 in the 8 Most Hazardous Guilds on NASO.

Guild/Group	Species	Total Observed at NASO[1]	# Removed[2]	# Dispersed[2]
Artiodactyls	White-tailed Deer	365	138	0[3]
Gulls	Laughing Gull	766	0	210
	Ring-billed Gull	346	11	5,950
	Herring Gull	23	0	398
	Unknown Gull	4	0	0
	Lesser Black-backed Gull	0	0	7
	Totals	**1139**	**11**	**6565**
Raptors	Red-tailed Hawk	279	4	1
	American Kestrel	171	0	0
	Northern Harrier	171	1	3
	Turkey Vulture	99	8	81
	Osprey	11	0	0
	Cooper's Hawk	8	0	0
	Bald Eagle	4	0	0
	Sharp-shinned Hawk	1	0	0
	Broad-winged Hawk	0	0	0
	Totals	**744**	**13**	**85**
Waterfowl	Canada Geese	1618	30	3554
	American Brant	67	0	1742
	Tundra Swan	12	0	0
	Hooded Merganser	3	0	0
	Mallard	1	21	54
	Wood Duck	0	0	2
	Totals	**1701**	**51**	**5352**
Pigeons/Doves	Mourning Dove	925	20	4
	Rock Pigeon	619	290	270
	Totals	**1571**	**310**	**274**
Crows/Ravens	American Crow	1472	3	45
Starlings	European Starling	6046	99	342
Blackbirds/Orioles	Mixed Flock	14925	0	5450
	Red-winged Blackbird	441	2	0
	Common Grackle	84	57	0
	Brown-headed Cowbird	4	2	0
	Totals	**15454**	**61**	**5450**
Grand Totals for the 8 Most Hazardous Guilds at NASO		**28492**	**686**	**18113**

1. Total observations obtained by summing all observations during surveys (day and night) from June 2010-May 2011. Total may include individuals that were present day after day and were recorded on multiple occasions.
2. Total species removed and dispersed obtained by summing all activities conducted by WS personnel from June 2010-May 2011.
3. Deer were not considered to be dispersed from the airfield.

APPENDIX H

Specific Habitat Features Requiring Attention.

NAS Oceana Specific Airfield Habitat Recommendations

1. Airfield Drainage

1.1 – Repair malfunctioning underground drainage structures.

Specific areas on the airfield with poor or improper drainage allowing for extended periods of standing water (Figure 20):

1.2 – Runway 5R approach adjacent to the pavement.

1.3 – Runway 32L inboard of the 9 gear.

1.4 – Between 23L/R approach under run.

1.5 – 32L approach agricultural field.

1.6 – Inboard Bravo and outboard Foxtrot taxiways.

1.7 – Outboard runway 23R under run.

1.8 – Decrease vegetation height of airfield ditches to improve water flow.

2. Vegetation Management

2.1 – Removal of secondary growth adjacent to runways and taxiways. All areas identified by the NR Burn Plan.

2.2 - Increase separation of woody vegetation from runways and taxiways.

Figure 20: Specific areas on the airfield with poor or improper drainage allowing for extended periods of standing water.

Enclosure 2. Wildlife Hazard Assessment for Naval Auxiliary Landing Field Fentress (2012)

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WILDLIFE HAZARD ASSESSMENT

For

NAVAL AUXILARY LANDING FIELD FENTRESS

October 1, 2011 through September 30, 2012

Prepared by

United States Department of Agriculture

Animal and Plant Health Inspection Service

Wildlife Services

Taylor S. Austin, Wildlife Specialist

February 19, 2013

Project was monitored by Tim Linder, Wildlife Biologist, Virginia Wildlife Services.

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EXECUTIVE SUMMARY

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program (WS) conducted a 12-month wildlife hazard assessment (WHA) to identify wildlife hazards to aviation safety at Naval Auxiliary Landing Field Fentress (NALFF), an outlying airfield associated with Naval Air Station Oceana (NASO), from October 2011 to September 2012. Airfield bird surveys were conducted twice per month. Twenty-four night-time surveys of the airfield were also conducted to observe deer and other mammals' use of this area. Data collected included species abundance, behavior, and habitat use. Small mammal surveys were conducted in the fall of 2011 and spring of 2012 to determine species abundance in four different habitat types. In addition, WS identified and monitored areas outside of the airfield that may attract hazardous wildlife species to NALFF. Bird species observed were grouped into guilds (species that display similar behavioral characteristics) for analysis. Data collected during surveys were analyzed and compared with records from the Navy Safety Center Web Enabled Safety System (WESS) BASH database, control efforts by NALFF and WS personnel, and a wildlife hazard ranking list (Dolbeer and Wright 2009) to identify the species that are most hazardous to aviation safety at NALFF.

Based on information collected during the WHA, 1 mammal group and 7 bird guilds identified at NALFF from October 2011 through September 2012 presented the greatest threats to aviation safety. These group/guilds included deer, raptors (hawks, vultures, eagles), waterfowl (ducks and geese), pigeons/doves, blackbirds/orioles, starlings and swallows. Though blackbirds/orioles were the most abundant guild, deer were the most hazardous due to their large size, strike record, availability of habitat at or near NALFF, and general abundance in the area. There were 6 species within these group/guilds that were observed during the WHA that ranked as an extremely high hazard to aviation safety, and one species that ranked very high.

WS recommends a variety of methods to reduce or eliminate the threat of wildlife strikes from the group and guilds observed during the WHA. Habitat management can include: eliminating or excluding wildlife from areas of standing water; vegetation management in the airfield; reducing or excluding birds from perching/loafing areas; reducing abundance of prey species (such as small rodents) in the airfield; and installation and maintenance of a perimeter fence to prevent mammals such as deer from entering the airfield. WS also recommends harassment methods such as pyrotechnics, sirens, paintballs, and propane cannons to disperse birds from the airfield. Lethal control of hazardous species should be exercised when necessary utilizing firearms or traps. Permits for lethal control of species protected under federal and state laws should be maintained from the U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries as appropriate.

Additional recommendations include updating the NASO's/NALFF's Bird/Animal Aircraft Strike Hazard (BASH) Plan, establishment of a formal BASH Working Group (BWG), establish a Bird Detection and Dispersal Team (BDDT), establish formal BASH training and evaluating potential wildlife hazards when planning new construction or land use changes. It is recommended that NALFF continue to monitor wildlife abundance and habitat use in order to provide insight into wildlife use of the airfield and to gauge the effectiveness of control efforts.

1.0 INTRODUCTION

1.1 Purpose and Need for Action

Birds and other wildlife in the vicinity of airports are an increasing threat to aviation safety (Dolbeer et al. 2011). Since 1980, the Navy's national wildlife/aircraft strike database accounted for 440 A (> $1,000,000 in damages), B ($200,000 to < $1,000,000), C ($10,000 to < $200,000) and D (<$10,000) Class-rated incidents that included two fatalities to Naval pilots and over $372 million dollars in damages (Naval Safety Center). Based on the Naval Safety Center analysis and statistics, the average damage cost over the last 31 years is one million dollars per month. It is estimated that wildlife/aircraft strikes cost the U.S. civil aviation industry more than $614 million annually, while worldwide the total cost is over $1.2 billion per year (Keirn et al. 2010). In addition to costly aircraft repairs and down time, wildlife strikes sometimes result in serious injury or death. In January 2009, the wildlife/aircraft strike issue was dramatically illustrated when U.S. Airways Flight 1549 crash landed in New York's Hudson River after ingesting Canada Geese into both engines shortly after takeoff from LaGuardia Airport (Dolbeer 2009). This incident has been referred to in the media as "The Miracle on the Hudson" since all 155 passengers and crew survived despite the aircraft being a total loss. Less than two weeks prior to this incident, eight people were killed and one was seriously injured when a helicopter transporting workers to an offshore site in Louisiana struck a Red-tailed Hawk and crashed into a marsh (Wright 2011).

The Commander, Naval Installations Command (CNIC) established the Navy Bird/Animal Strike Hazard Program Implementing Guidance (CNICINST 3700, Appendix A). This instruction establishes the guidance for all installations that conduct or support air operations to conduct a Wildlife Hazard Assessment (WHA). Although the U.S. Navy is not required to follow the regulations set down by the FAA, the Navy does implement the FAA's guidance and expertise whenever practical.

The Federal Aviation Administration (FAA) is responsible for setting and enforcing the Federal Aviation Regulations (FAR) and policies to enhance public safety at civil airports. To ensure compliance with Code of Federal Regulations (CFR) 14 Part 139.337, the FAA requires certificated airports to conduct a wildlife hazard assessment (WHA), and if necessary, establish a wildlife hazard management plan (WHMP) when any of the following triggering events occur on or near an airport:

(1) An air carrier aircraft experiences multiple wildlife strikes;

(2) An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph, substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component;

(3) An air carrier aircraft experiences an engine ingestion of wildlife; or

(4) Wildlife of a size, or in numbers, capable of causing an event described above are observed to have access to any airport flight pattern or aircraft movement area.

The WHA must be conducted by a qualified wildlife biologist (see FAA Advisory Circular 150/5200-33B) and should include the following information:

(1) An analysis of the events or circumstances that prompted the assessment;

(2) Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences;

(3) Identification and location of features on and near the airport that attract wildlife;

(4) A description of wildlife hazards to air carrier operations; and

(5) Recommended actions for reducing identified wildlife hazards to air carrier operations.

Naval Auxiliary Landing Field Fentress

In June 2010, Natural Resources MidAtlantic entered into a cooperative service agreement with the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Program (hereafter referred to as WS) to initiate bird and deer surveys, evaluate the current Wildlife Damage Management (WDM) program, and provide direct control of hazardous wildlife using the airfield. In August 2010, CNIC entered into a cooperative service agreement with WS to conduct a WHA and to establish and continue an Integrated Wildlife Damage Management program (IWDM) at NALFF. Oversight and direction of the IWDM will fall under direct supervision of the NAS Oceana Air Operations Department. In March of 1999, Geo-Marine, Inc. provided NASO/NALFF with a BASH Plan. This BASH Plan did not include a formal evaluation of airfield specific hazards.

Starting in December of 2011, NALFF underwent complete renovation, remaining closed through October 2012. The taxiway and runway were completely reconstructed, lighting and signs were replaced, and buildings were reconstructed.

1.2 Legal Authority of Wildlife Services

The U.S. Navy, Commander Navy Installations Command (CNIC) and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program (WS) have entered into a Work/ Financial Plan where WS will provide assistance to mitigate potential and realized wildlife hazards at USN air stations in the continental United States (Appendix B). The Plan establishes WS as the appropriate agency to conduct wildlife hazard management at Navy installations.

The primary statutory authority by which WS operates is the Animal Damage Control Act of March 2, 1931, as amended (7 U.S.C. 426-426c; 46 Stat. 1468). WS has the authority to manage migratory bird damage as specified in the CFR. In addition, the Rural Development, Agriculture and Related Agencies Appropriations Act of 1988 authorizes and directs the Secretary of Agriculture to cooperate with States, individuals, public and private agencies, organizations and institutions in the control of nuisance mammals and birds deemed injurious to the public.

The Plan and legislation authorize WS to conduct initial on-site investigations, biological assessments (short-term studies), WHA, and wildlife management techniques to assist USN air stations.

1.3 Legal Status of Wildlife Species

Most species of wildlife are protected by one or more Federal, State, and/or local laws and regulations. As such, several agencies may be responsible for implementation of these regulations and issuance of specific permits may be required prior to taking action to reduce wildlife threats to aviation safety.

Federal laws passed by Congress to protect wildlife include (but are not limited to) the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and the Endangered Species Act (ESA). Federal wildlife laws are generally administered by the U.S. Fish and Wildlife Service (USFWS), which is the lead agency responsible for migratory birds protected under the MBTA, BGEPA, and ESA. The USFWS may issue depredation permits to take or harass migratory birds when those species are causing damage to various resources or threaten human health and safety (Appendix C).

The Commonwealth of Virginia defers to the Federal depredation permit for take of non-game migratory bird species, though a separate permit is required to take mammals and game bird species managed by the Virginia Department of Game and Inland Fisheries (VDGIF). As detailed in § 29.1-529 of the Code of Virginia, airport operators may obtain authorization from VDGIF to take wildlife (that are not federally protected) as necessary to protect aviation safety (Appendix D).

The Commonwealth of Virginia hosts a number of threatened and endangered (T&E) species that are granted protection under Federal and State regulations (Appendix E). Prior to conducting operational control work such as harassment, shooting, trapping, or habitat manipulation, the list of species of concern should be reviewed to ensure compliance with Federal and State regulations.

2.0 OBJECTIVES

The objectives of this WHA were to:

1. Identify wildlife species, numbers, locations, behavior and habitat use in and around the airfield, with particular emphasis on species most hazardous to aviation safety;
2. Identify and locate features on and in the vicinity of the airfield that attract wildlife;

3. Describe wildlife hazards to aviation safety at NALFF;
4. Provide NALFF with management recommendations to reduce or eliminate wildlife hazards to aviation safety and serve as a basis for updating the current BASH Plan.

3.0 DESCRIPTION OF STUDY AREA

Figure 1: Aerial view of NALFF (photo from GoogleEarth, 2010).

NALFF is located within Chesapeake, VA. NALFF has one operational runway (5/23), supporting day and night Field Carrier Landing Practice (FCLP) operations by US Navy and US Marine Corps F/A 18 Hornet, F/A 18 Super Hornet and E-2/C-2 Hawkeye, supporting 42,688 day and 50,132 night aircraft operations in calendar year 2010. The runway was closed in December 2011 for complete reconstruction and became fully operational in October 2012. The airfield also includes 8 Landing Zones (LZ's), primarily supporting H-60 and H-53 helicopters. For calendar year 2010, 496 LZ operations were conducted. The NALFF property incorporates approximately 3,000 acres, comprised of open, mowed grassland (296 acres), agricultural leases (~860 acres), woodlots and areas of secondary growth (~1850 acres). The woodlots are primarily comprised of mixed hardwoods, forested swamps and evergreens. A 7-foot fence with a three strand barbed-wire outrigger surrounds the buildings on base, though there is no perimeter or aircraft operating area (AOA) fence present. NALFF is surrounded by agricultural and residential property. To the North and East of the airfield lies the Intracoastal Waterway, connecting the Atlantic Ocean and James River.

4.0 METHODS

Data collection for the WHA began October 1, 2011 and continued through September 30, 2012.

Bird Surveys

Bird survey procedures were based on the North American Breeding Bird Survey methodology. Surveys were conducted twice per month for 12 months at 11 observation points on the airfield (Figure 2). The beginning observation point for each survey was randomly selected, with 2 repetitions of the survey route per day (1/2 hour after sunrise and 2-3 hours prior to dusk).

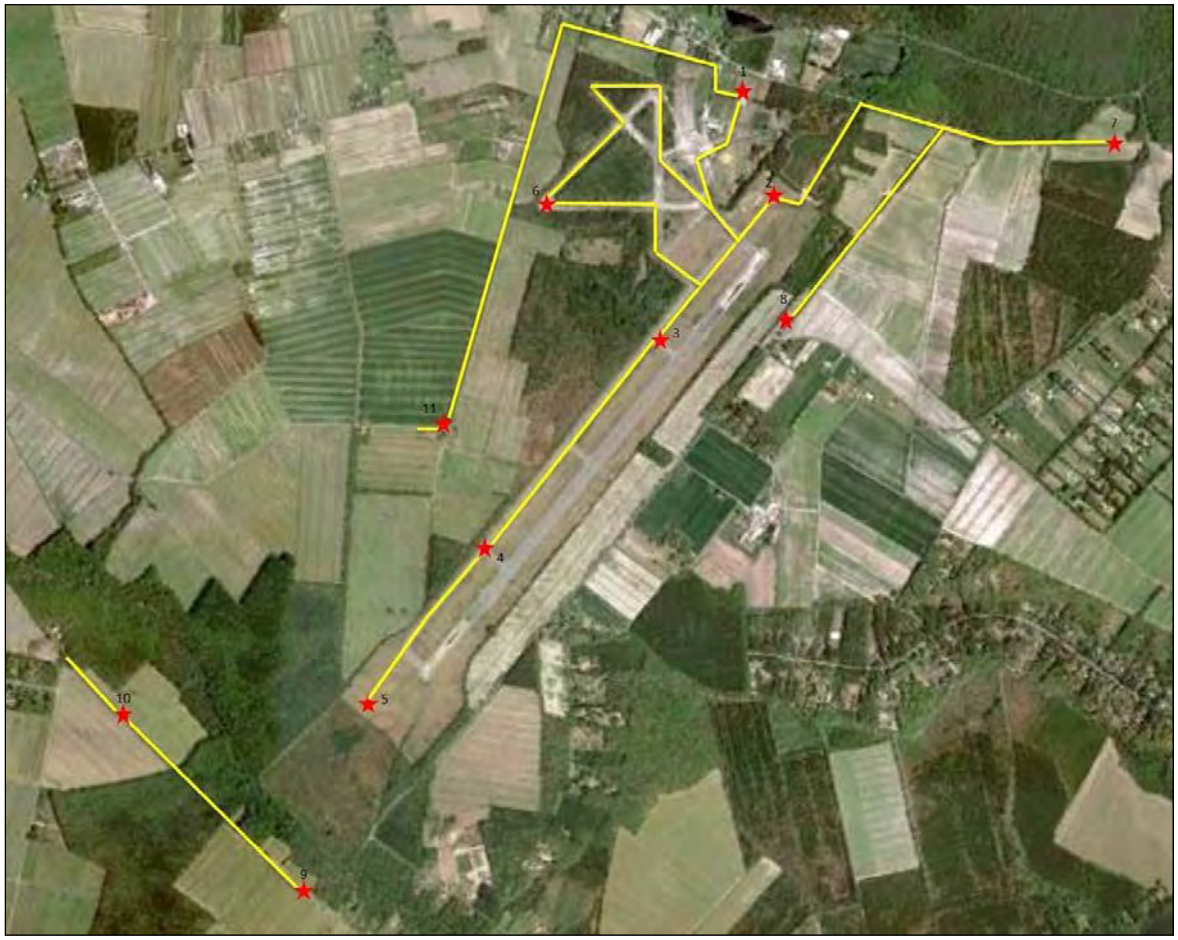

Figure 2: NALFF Bird Observation Points and Survey Route.

Birds were observed from a vehicle for 3 minutes at each point, with approximately ¼ mile distance between points. Between each observation point and at each point, the following data were recorded: weather, temperature, time, location, species, number observed, activity (behavior), habitat type, direction of flight, and comments on any other significant information (e.g., freshly mowed grass, approaching weather, change in flight activity, agricultural crop on fields, etc.). A map overlain with a 1,000-foot grid system was used to record location. Bird species were located without the aid of binoculars, though binoculars were used to identify species that could not be readily identified with the naked eye or in low light conditions. Alpha

species codes from the North American Bird Banding Manual were used to record birds observed during surveys.

Spotlight Surveys

In addition to bird surveys, 24 night-time spotlight surveys were conducted on the airfield over the course of the study period. Beginning 1 hour after sunset, night surveys were conducted by driving an established route approximately 8 miles long around the airfield (Figure 3). Observations were made using spotlights and forward looking infra-red (FLIR) equipment to determine primarily deer and other mammal use of the airfield. Information recorded included: weather, temperature, time, location, species, number observed, activity, and habitat type.

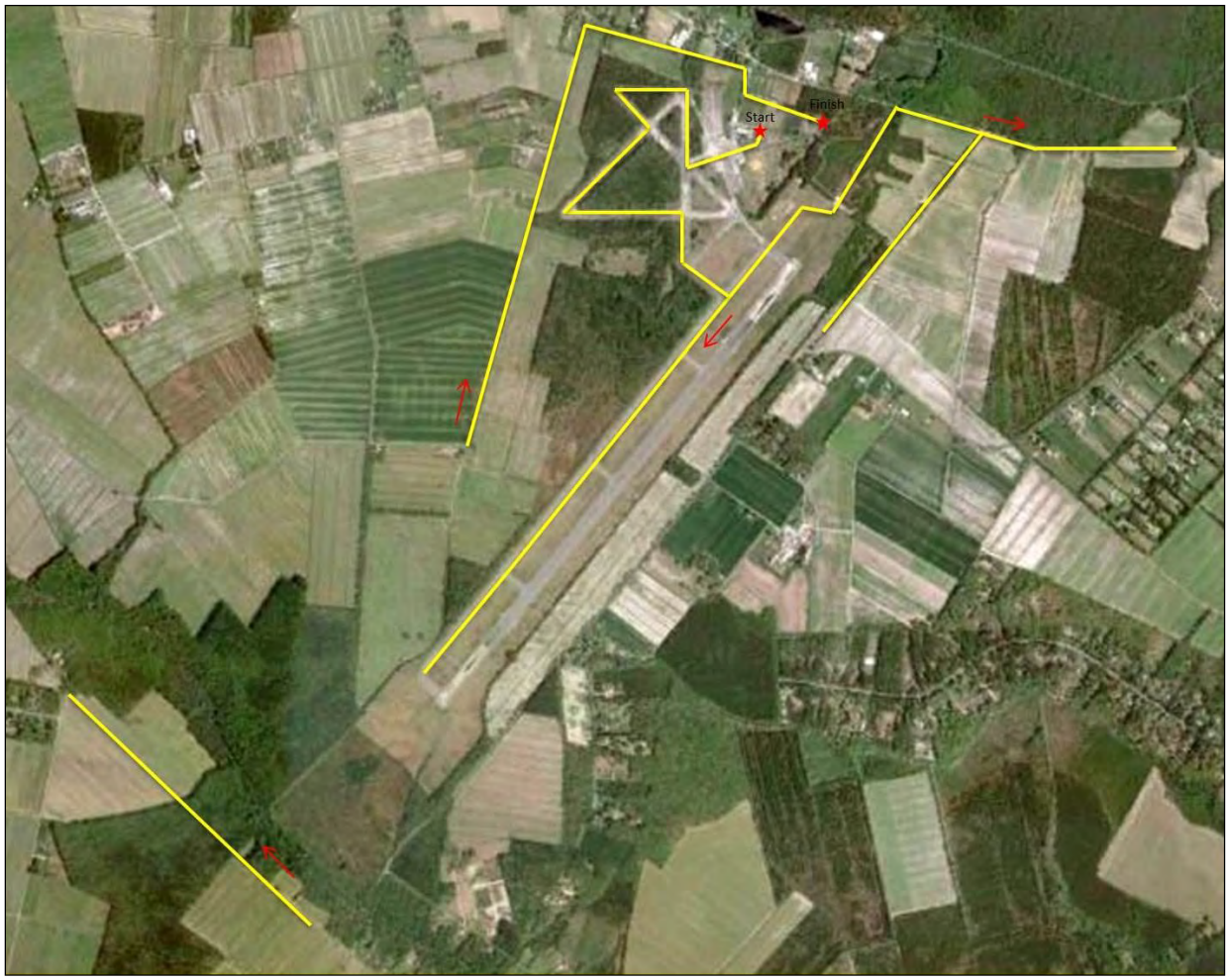

Figure 3: NALFF Spotlight Survey Route.

Small Mammal Surveys

Small mammal surveys were conducted in the fall of 2011 and spring of 2012 to determine abundance and habitat associations for species such as voles and mice inhabiting the airfield. Trapping sessions occurred in the spring and fall seasons over a three night period. Eight plot areas were randomly selected within airfield study areas. Plots consisted of 25 snap-traps in a 5x5 grid spaced ten yards apart within each sample area. Sample areas consisted of 4 different

habitat types; short grass, woodland, secondary growth/shrub, and agricultural field. Each trap was checked for three consecutive days and traps were re-baited, if necessary. Data recorded included: date, weather, study plot, number of species captured, number of sprung traps without capture, number of unsprung traps, and the number of missing traps. Capture-per-unit-effort was calculated for each trap session.

Data Analysis

Data were analyzed with descriptive statistics and frequency distributions per month using the Wildlife Hazard Management Information System (WHMIS) software developed by WS to determine trends in species abundance, habitat use, and behavior. For analysis purposes, common species were categorized into groups or guilds. Species were placed into their respective guilds based on similar behavioral characteristics, not taxonomic relationships (although guilds often parallel taxonomic lines). This approach was selected because behavioral attributes play a significant role in predisposing some species of wildlife to collisions with aircraft. In addition, wildlife control strategies are often selected based on their ability to exploit an animal's specific behavior(s), therefore species that exhibit similar behaviors and life history attributes generally require similar control methods.

5.0 RESULTS

5.1 Wildlife/Aircraft Strikes

According to criteria outlined in FAA Advisory Circular 150/5200-33A, a wildlife strike has occurred when:

1. A pilot reports striking 1 or more birds or other wildlife;
2. Aircraft maintenance personnel report aircraft damage as having been caused by a wildlife strike;
3. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;
4. Bird or other wildlife remains, whether in whole or in part, are found within 250 feet of a runway centerline, unless another reason for the animal's death is identified; and
5. An animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high speed emergency stop, aircraft left pavement area to avoid collision with an animal, etc.).

Wildlife strike data provide valuable information about wildlife hazards on or near airfields, including the species that are struck, seasonal trends, and time of day when strikes occur. Nationwide, the number of reported wildlife strikes has shown a five-fold increase from 1990 through 2009 (Dolbeer et al. 2011). Despite the increase in reported strikes, the number of strikes resulting in damage during this same time period has declined by 21% (Dolbeer et al. 2011). This important fact is attributed to successful wildlife hazard management programs at many FAA certificated airports (Dolbeer et al. 2011).

Data obtained from the Navy Safety Center WESS and Smithsonian Feather ID Lab revealed that there have been 170 reported wildlife strikes at NALFF from 1981 through

2011 (Figure 4). Wildlife strikes peaked in 2010 with 26 reported strikes (Figure 4). The upward trend in wildlife strikes at NALFF may be attributed to factors such as increases in wildlife populations, changing land uses on and adjacent to the airbase, an increase in reporting, as well as more strikes being attributed to NALFF as opposed to NASO in accordance with the number of operations and flight time at that specific airfield. The Navy Safety Center estimates that only 25% of all strikes are reported. Much of the increase may be attributed to better reporting of wildlife strikes due to greater awareness of the wildlife strike issue and greater cooperation within the aviation industry to report strikes (Dolbeer et al. 2011).

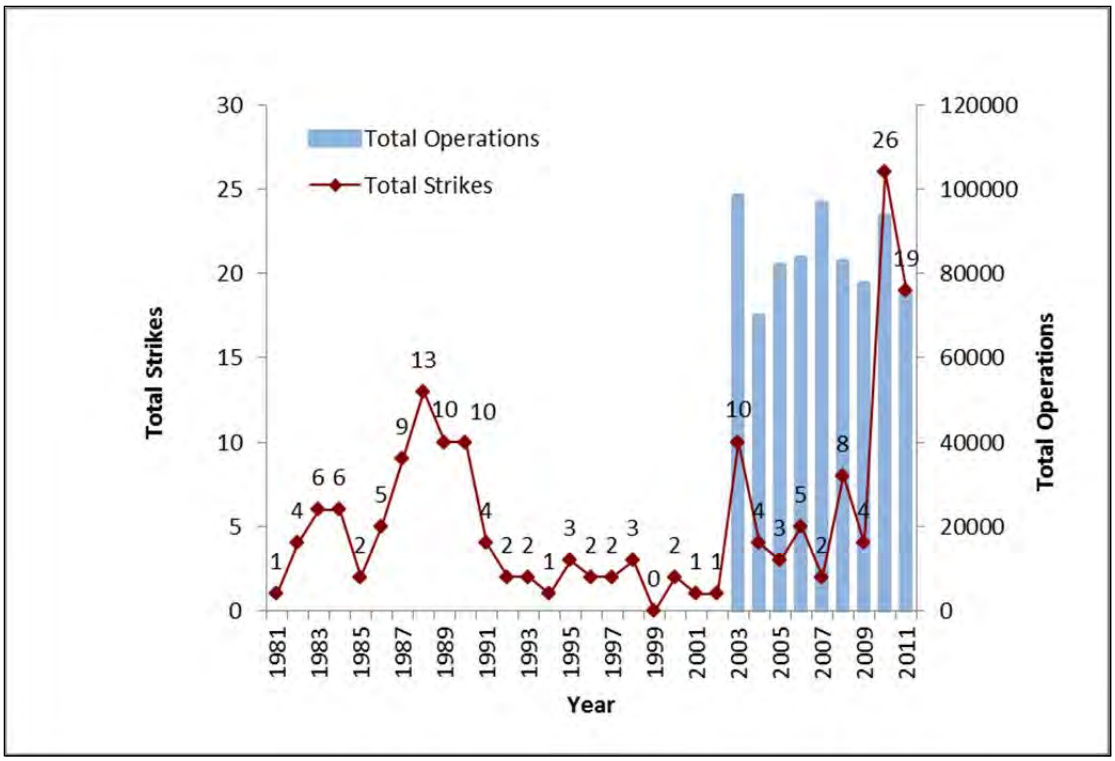

Figure 4: Reported wildlife strikes (1981-2011) and aircraft operations (2003-2011) at NALFF.

Of the 170 reported strikes at NALFF from 1981 through 2011, over 86% were unknown (146), 10% involved birds (17), 2% were white-tailed deer (3), and 2% involved bats (3). Most of the unknown strike reports were bird species (146, or 86%). Of the strikes where the species was identified, Yellow-rumped Warbler (5), Vesper Bats (3) and white-tailed deer (3) were the most frequently reported species. Consistent with national trends (Dolbeer et al. 2011), most strikes at NALFF occur in the late summer through early fall (Figure 5). Strikes during these periods coincide with the dispersal of naïve juveniles and fall migration.

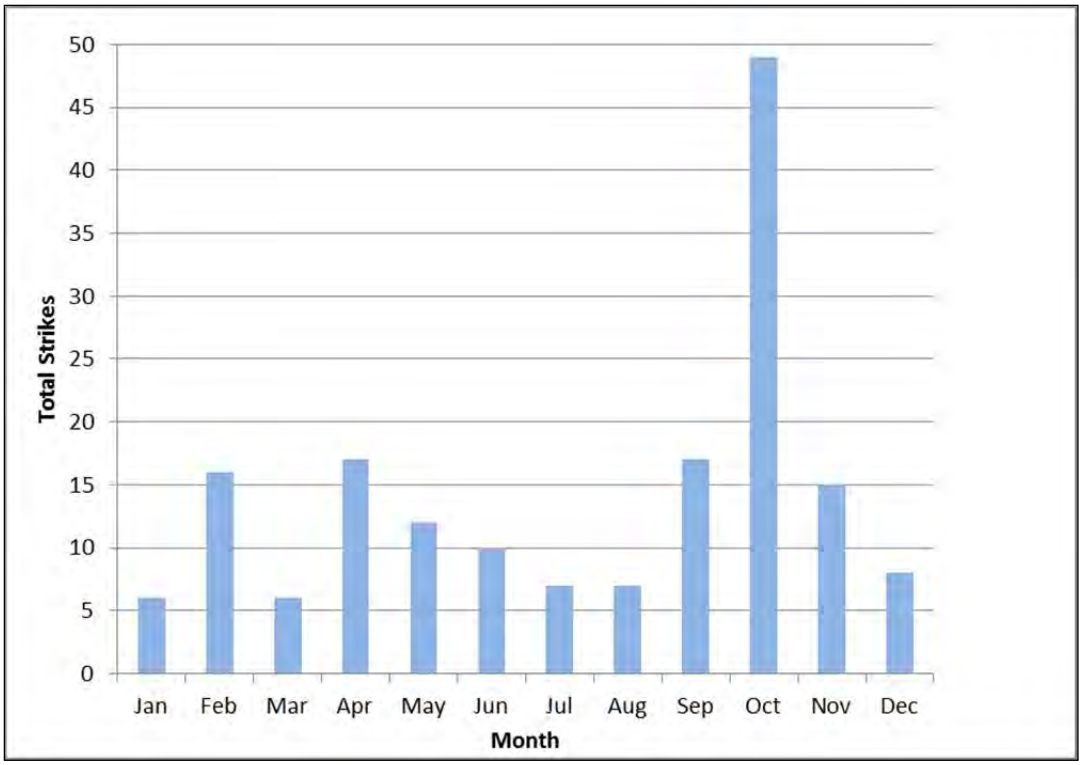

Figure 5: Number of strikes reported by month at NALFF, 1981-2011.

For all strikes reported at NALFF only 3.5% (6 of 170) reported damage >$10,000 (Table 1). All 6 strikes were * Class C Mishaps (1 deer $179,484, 1 Lesser Scaup $125,039 and 4 unknowns which individually totaled $47,842, $34,131, $15,000 and $13,500, respectively).

Table 1: Strikes with reported damage at NALFF, 1981-2011.

Species	N	A	B	C	Total
Unknown	142			4	146
Yellow-rumped Warbler (*Dendroica coronate)*	5				5
White-tailed Deer (*Odocoileus virginianus*)	2			1	3
Vesper Bat (*Vespertilionidae*)	3				
American Redstart (*Setophaga ruticilla*)	1				
American Robin (*Turdus migratorious*)	1				
Blackpoll Warbler (*Dendroica striata)*	1				
Cedar Waxwing (*Bombycilla cedrorum*)	1				
Chimney Swift (*Chaetura pelagica)*	1				
Common Yellowthroat (*Geothlypis trichas*)	1				
Eastern Meadowlark (*Strunella magna*)	1				
Least Sandpiper (*Calidris minutilla*)	1				
Lesser Scaup (*Aythya affinis*)				1	

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Table 1 continued: Strikes with reported damage at NALFF, 1981-2011.

Species	N	A	B	C	Total
Mourning Dove (*Zenaida macroura*)	1				
Ovenbird (*Seiurus aurocapillus*)	1				
Ruby-crowned Kinglet (*Regulus calendula*)	1				
Virginia Opossum (*Didelphis virginiana*)	1				
Total	**164**	**0**	**0**	**6**	**170**

Damage Classes: N = No damage Reported or <$10,000
A = >$1,000,000
B = $200,000 to <$1,000,000
C = $10,000 to <$200,000

5.2 Wildlife Surveys

Bird Surveys

From October 2011 through September 2012, WS recorded 44,448 bird observations at NALFF during bird surveys. Sixty-seven bird species representing 26 different bird guilds were observed throughout the study year (a complete table listing each guild and species observed throughout the study year may be found in Appendix F). The 6 most abundant guilds were Blackbirds/Orioles (27,252), Swallows (8,325), Starlings (3,801), Thrushes (1,075), Pigeons/Doves (880), Waterfowl (715), and Warblers (595). The 10 most abundant species observed are listed below[1]:

1.) Mixed Blackbirds = 25,918
2.) Tree Swallows (*Tachycineta bicolor*) = 7,703
3.) European Starling (*Sturnus vulgaris*) = 3,801
4.) Red-winged Blackbird (*Agelaius phoeniceus*) = 1,074
5.) American Robin (*Turdus migratorious*) = 1,064
6.) Yellow-rumped Warbler (*Dendroica coronata*) = 578
7.) Rock Pigeon (*Columba liva*) = 551
8.) Snow Goose (*Chen caerulescens*) = 530
9.) Eastern Meadowlark (*Strunella magna*) = 474
10.) Purple Martin (*Progne subis*) = 464

Birds were observed in 13 different habitat types during surveys at NALFF. Birds were most commonly observed utilizing the large, agricultural fields (76%) that makeup the dominant habitat feature around the airfield. Short grass areas were the next most commonly used habitat (8%), followed by structure (6%) such as power lines, towers, fences, buildings and old aircraft where birds were often observed perching (Figure 6). Bird activity was classified into 11 categories: flying passing (flying in a continuous path beyond the survey area); flying locally (short, random flights); feeding (actively

[1] Total abundance is derived by summing all bird observations throughout the study year. Therefore, the total number of bird observations includes individuals that may have been present on the airfield day after day and were recorded on multiple occasions.

consuming food); perched (loafing on a structure); vocalizing; standing; towering (flying in a circular pattern, often while utilizing thermal currents); walking; loafing (staying in one area, not on a structure for a length of time without engaging in another activity); hawking insects (flying erratically while attempting to catch insects) and running. Ninety percent of all observations fell into three activities: flying passing (54%), flying locally (24%) and feeding (12%) for all species during the study year (Figure 7).

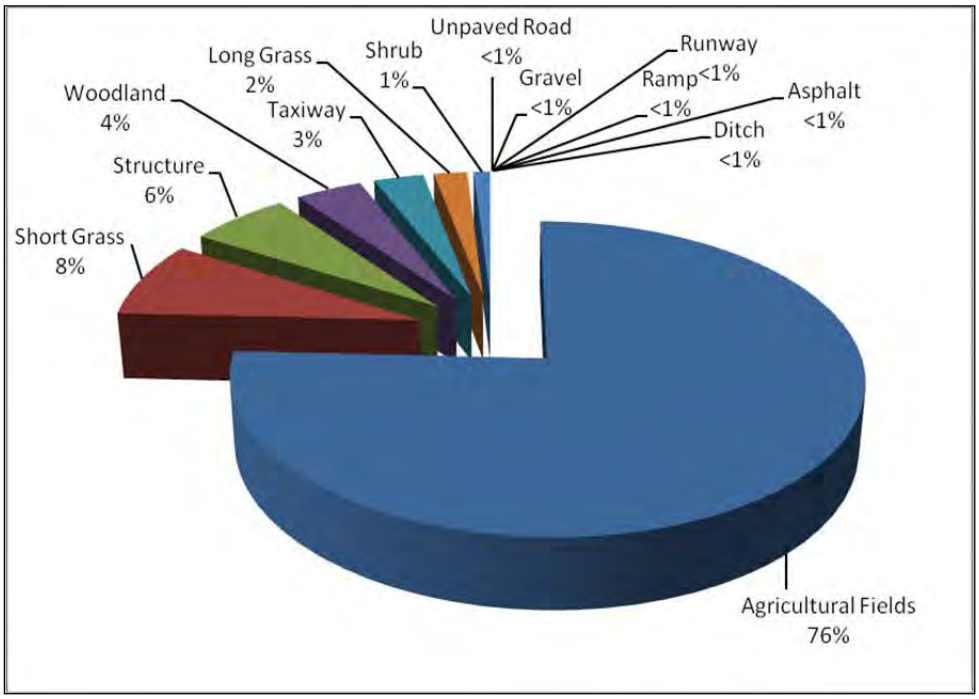

Figure 6: Habitat use by birds at NALFF, October 2011 through September 2012.

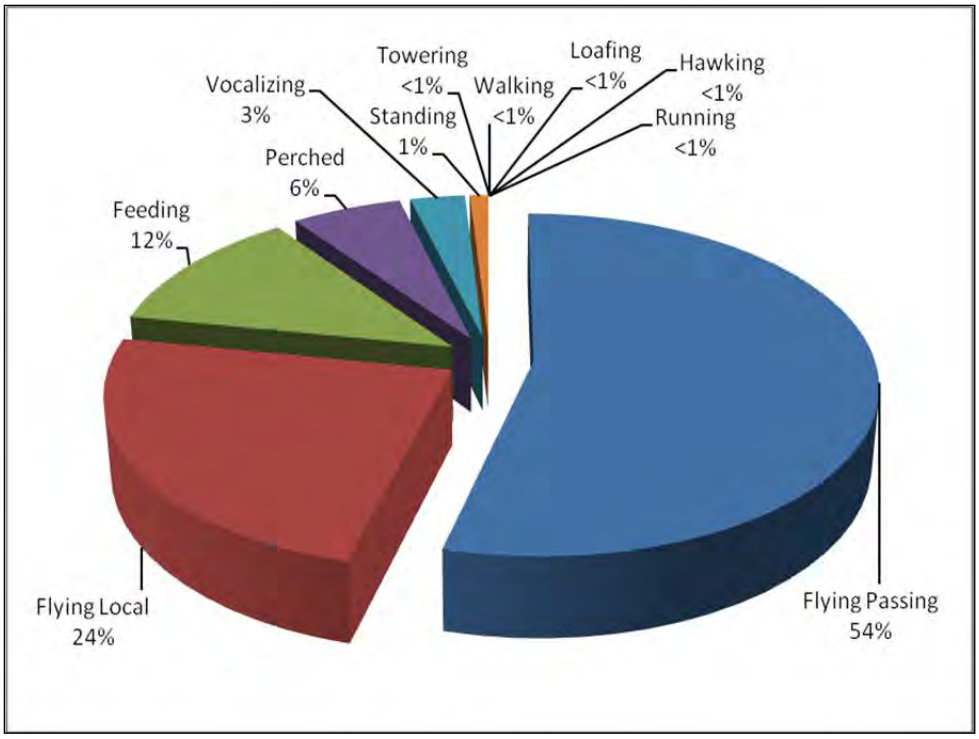

Figure 7: Bird activity at NALFF, October 2011 through September 2012.

Spotlight Surveys

WS completed 24 night spotlight surveys of the NALFF airfield during the study year. Three hundred-forty medium to large-sized mammals were observed during night surveys, with white-tailed deer (*Odocoileus virginianus*) being the most frequently observed species (Table 2). Observations recorded during night surveys may have been multiple observations of the same individuals throughout the survey year. Most mammal species were observed in the agricultural fields or in short grass (Table 2).

Table 2: Mammal species and cover type observed during night surveys at NALFF.

Species	Ag. Fields	Grass, Short	Woodland	Unpaved Road	Grass, Long	Shrub	Ramp/ Ditch	Total
White-tailed Deer	216	51	15	4	6	3	0	**295**
Coyote	3	0	0	0	0	0	0	**3**
Red Fox	1	0	2	0	0	0	1	**4**
Gray Fox	1	3	0	0	0	0	0	**4**
Raccoon	10	0	5	0	0	1	2	**18**
Rabbit	1	0	0	4	0	0	0	**5**
Opossum	7	1	1	2	0	0	0	**11**
Total	**239**	**55**	**23**	**10**	**6**	**4**	**3**	**340**

Small Mammal Surveys

Airfield small mammal surveys were conducted in November 2011 (fall trapping session) and May 2012 (spring trapping session). Species captured during the trapping sessions included: northern short-tailed shrew (*Blarina brevicauda,* 33%), peromyscus species (32%), least shrew (*Cryptotis parva,* 21%), meadow vole (*Microtus pensylvaticus,* 13%) and hispid cotton rat (*Sigmodon hispidus,* 1%). Capture rates were greater during the spring when compared to the fall trapping sessions (Figure 8). Small mammals were most often captured in secondary growth/shrub (49%) and woodland (37%) habitats.

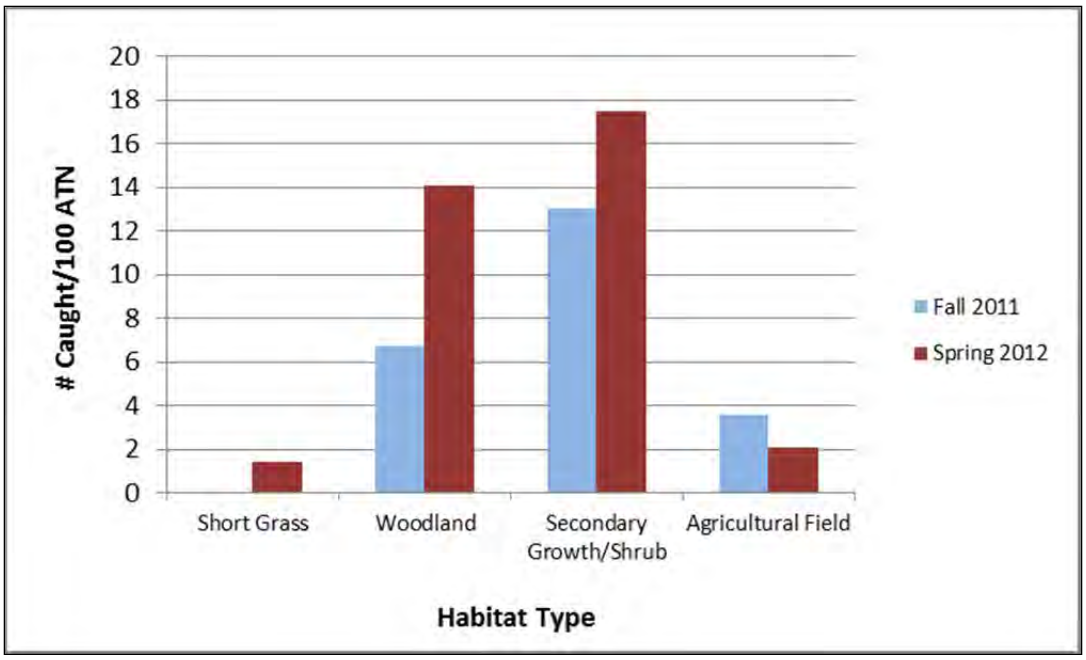

Figure 8: Catch-per-unit-effort of rodents captured for each habitat type at NALFF, fall 2011 and spring 2012.

6.0 DISCUSSION

Although almost all wildlife species commonly found at airports can pose some hazard to aviation safety, not all species are equally hazardous to aviation (Dolbeer and Wright 2009). For example, bird species such as Canada Geese (*Branta canadensis*) are more likely to cause damage if struck by aircraft than species the size of a sparrow. Utilizing the FAA wildlife strike database, Dolbeer and Wright (2009) developed a ranking of 89 wildlife species that pose the greatest threats to aviation safety. The ranking was based on the percentage of strikes causing damage from aircraft from 1990 to 2007, and species were classified into 6 hazard severity levels ranging from extremely high (>40% of strikes causing damage) to very low (<1% of strikes causing damage). Combined with wildlife surveys conducted locally at an airbase, this hazard ranking list can be used to prioritize management actions to species posing the greatest risk to aviation safety (Dolbeer and Wright 2009). As of 2011, DeVault et. al developed a new process for identifying the hazard level ranking of wildlife if struck as opposed to species that caused the most damage. The effects of avian body mass, body density, and group size on relative hazard

scores was assessed, and a ranking was developed (DeVault et al 2011). Even though the process has been updated, the species that pose the greatest risk remained the same.

Though 67 species were observed from 26 different guilds and 7 mammal groups through the study year (Appendix F), for this discussion emphasis will be placed on those guilds/groups that pose the greatest threats to aviation safety at NALFF. For this analysis the following criteria were used:

Primary Consideration:

1. Number of individuals observed during surveys.
2. The individuals' associated hazard ranking according to Dolbeer and Wright.
3. Evaluation of NALF Fentress' strike record.

Additional consideration was given for the following conditions:

- Location and behavior of individuals within each guild/group.
- Amount of control effort required to remove the specific hazard from the airfield (i.e. did the species easily disperse or not).

Using this information, guilds/groups were ranked in order of the threat level that they pose to aviation safety at NALFF from the most severe to the least. This comparison helps to show that the most abundant species on an airfield (Blackbirds/Orioles, in this case) are not necessarily the most hazardous to aviation safety due to abundance alone. The 7 guilds/groups identified as most hazardous to aviation safety at NALFF from October 2011 through September 2012 were deer, Raptors, Waterfowl, Pigeons/Doves, Blackbird/Orioles, Starlings, and Swallows (Table 3). There were six species observed at NALFF that rank as an extremely high hazard to aviation safety, one as very high, and two as a high hazard (Table 3). The following discussion and management recommendations will focus on the 7 most hazardous guilds/groups listed in Table 3. However, most if not all of the management recommendations (habitat modification, dispersal methods, etc.) will be effective for managing the majority of species observed at NALFF.

Table 3: Guild hazard ranking and total observations at NALFF, October 2011 - September 2012.

Guild/Group	Species	Hazard Level and percentage of strikes causing damage in the U.S.[1]	Total Observed at NALFF[2]	Reported Strikes at NALFF, 1981-2010	Strikes at NALFF with reported damage, 1981-2010[3]
Artiodactyls	White-tailed Deer	Extremely High (82%)	295	3	1
Raptors	Turkey Vulture	Extremely High (52%)	126	0	0
	Red-tailed Hawk	High (17%)	49	0	0
	American Kestrel	Very Low (1%)	11	0	0
	Black Vulture	Extremely High (51%)	9	0	0
	Northern Harrier	Low (2%)	7	0	0
	Cooper's Hawk	n/a	7	0	0
	Bald Eagle	Extremely High (42%)	2	0	0
	Sharp-shinned Hawk	n/a	1	0	0
	Totals		**212**	**0**	**0**
Waterfowl	Snow Goose	Extremely High (51%)	530	0	0
	Canada Geese	Extremely High (51%)	141	0	0
	Tundra Swan	n/a	43	0	0
	Mallard	Very High (26%)	1	0	0
	Totals		**715**	**0**	**0**
Pigeons/Doves	Rock Pigeon	High (12%)	551	0	0
	Mourning Dove	Moderate (4%)	329	1	0
	Totals		**880**	**1**	**0**
Blackbird/Orioles	Mixed Blackbirds	n/a	25,918	0	0
	Red-winged Blackbird	Low (3%)	1,074	0	0
	Common Grackle	Moderate (9%)	251	0	0
	Brown-headed Cowbird	Low (2%)	9	0	0
	Totals		**27,252**	**0**	**0**

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Table 3 continued: Guild hazard ranking and total observations at NALFF, October 2011 - September 2012.

Guild/Group	Species	Hazard Level and percentage of strikes causing damage in the U.S.[1]	Total Observed at NALFF[2]	Reported Strikes at NALFF, 1981-2010	Strikes at NALFF with reported damage, 1981-2010[3]
Starlings	European Starlings	Moderate (4%)	3,801	0	0
Swallows	Tree Swallow	Very Low (0%)	7,703	0	0
	Purple Martin	Low (3%)	464	0	0
	Barn Swallow	Very Low (1%)	158	0	0
	Totals		**8,325**	**0**	**0**

1. Ranking based on strike reports from 1990-2007 (Dolbeer and Wright 2009); "n/a" indicates that species was not individually ranked.
2. Total observations obtained by summing all observations during surveys (day and night) from October 2011-September 2012. Total may include individuals that were present day after day and were recorded on multiple occasions.
3. Reported damage >$10,000.

6.1 Artiodactyls

Artiodactyls (i.e., deer) rank as the most hazardous mammal species to aviation safety in the United States, with 93% of strikes resulting in damage from 1990 through 2009 (Dolbeer et al. 2011). The large size of species such as white-tailed deer and the percentage of strikes involving multiple animals make them especially hazardous to aircraft during the takeoff and landing phases of flight. From 1990 through 2009, Artiodactyls, primarily white-tailed deer, have been involved in 847 damaging strikes in the U.S., resulting in over $36 million in reported costs (Dolbeer et al. 2011).

General Abundance

Deer were the ninth most abundant group observed at NALFF from October 2011 through September 2012 (Appendix F). White-tailed deer (*Odocoileus virginianus*), the only species observed in this group, rank as an extremely high hazard to aviation safety, with 82% of strikes causing damage from 1990 through 2007 on civil airfields (Table 3, Dolbeer and Wright 2009). From 1981 through 2011, three deer were struck by aircraft at NALFF, and account for one out of 6 reported Class C mishaps (WESS Database) on base. A total of 295 deer were observed during 24 night surveys. Night surveys were conducted by driving a predetermined 8 mile route around the airfield, using spotlights and/or FLIR to locate deer. Deer observations ranged from 3 to 25 animals, with an average of 12 seen per survey. A major contributing factor to the variation in deer surveyed was due to the agricultural practices present on NALFF property. Corn fields throughout the summer drastically decreased visibility of deer present in the agricultural fields. Also, a lack of perimeter fence allows white-tailed deer to move in and out of the airfield and surrounding agricultural areas of NALFF at will.

Attractants

The NALFF airfield and surrounding habitats are ideal for deer, including agricultural fields (corn, soybeans), mature timber (especially white oak, a preferred food source), edge/shrub areas, wetlands, and open grassland.

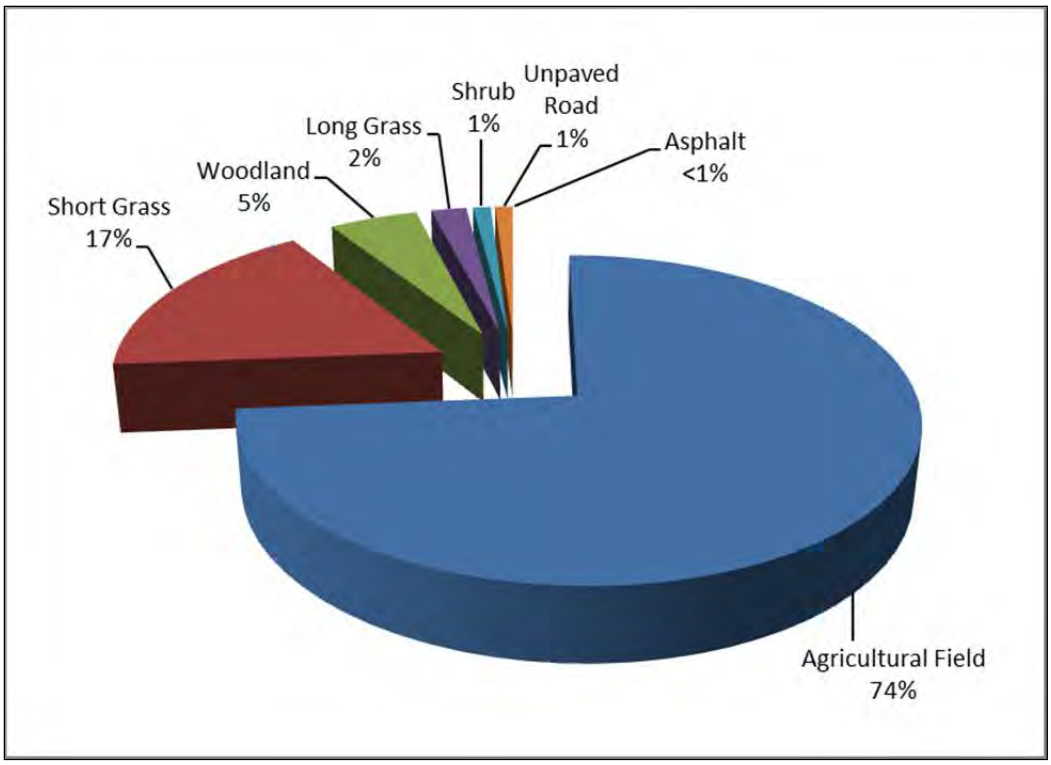

Figure 9: Deer habitat use at NALFF, October 2011 through September 2012.

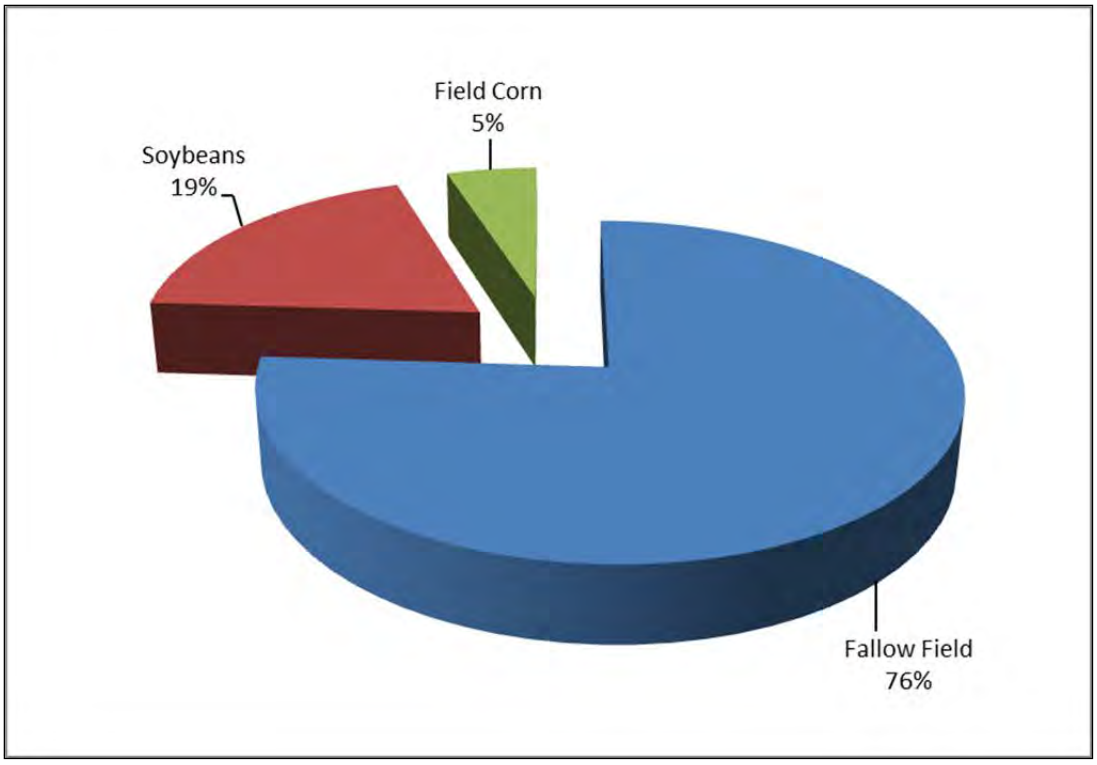

Figure 10: Deer agricultural field use at NALFF, October 2011 - September 2012.

Deer were most often observed utilizing agricultural fields (74%) at NALFF (Figure 9). Fallow fields accounted for 76% of all deer surveyed in agricultural fields (Figure 10). Visibility of fallow fields is much greater in comparison to a field with crops, most likely resulting in a higher percentage of deer observed. Fallow fields are identified as an agricultural field that is not planted with any crops. Agricultural fields were planted in soybeans and corn, both of which were harvested throughout the study period.

NALFF contains areas outside of the airfield on base property that contain ideal habitat for deer including: agricultural fields, mature timber, edge/shrub areas, wetland areas and open grassland. Deer were often seen utilizing these habitat features by WS and base personnel. With no perimeter fence installed, deer are free to roam across the airfield with no restrictions.

Figure 11: White-tailed deer removal focus area at NALFF.

Management Recommendations

The best recommendation for NALFF to decrease and limit deer activity on the airfield involves the installation of a 10-12 foot perimeter fence with three strands of barbed wire attached to outriggers. This is the most effective method for reducing the threat of deer strikes at NALFF. Once installed, it is necessary that the entire fence be inspected frequently for damage and gaps. Habitat management and removal of deer on the airfield and nearby navy property are also major components to reducing the threat. Airfield management is currently converting areas of optimal deer habitat (i.e., secondary growth and security cover) adjacent to the runways to maintained open grassland or agricultural fields. Airfield Operations is currently pursuing a Clear Zone Management Plan that will target travel corridors and continue to reduce optimal deer habitat adjacent to runways and taxiways.

NALFF should continue to actively remove deer from the base. This is currently being accomplished through WS personnel and a base hunting program utilizing VDGIF Deer Population Reduction Program (DPOP). Removal activities should be focused on the area denoted in Figure 11.

WS recommends that any deer present in the airfield be removed immediately via shooting or trapping. While not an immediate threat to aviation safety, deer present on base property can and do gain access to the airfield. Deer on base, off of the airfield also

serve as a source population for deer to annually disperse to the airfield. Lethal removal of deer requires a permit from the VDGIF, and it is recommended that NALFF maintain its permit current.

6.2 Raptors

Raptors (birds of prey) pose serious threats to aviation safety due to the larger size of many species and their flight behaviors. Some raptors may soar high over the airfield (eagles, vultures), others perch on structures in the airfield (Red-tailed Hawks and American Kestrels), while others may fly slowly close to the ground while hunting (harriers). From 1990 through 2009, raptors have been involved in 925 damaging wildlife strikes in the United States, resulting in almost $56 million in damages (Dolbeer et al. 2011).

General Abundance

Although raptors were the ninth most abundant guild observed at NALFF from October 2011 through September 2012 with 212 observations (Appendix F), 3 species observed at NALFF in the raptor guild pose an extremely high risk to aviation safety, making raptors the second most hazardous guild to aviation safety at NALFF (Table 3). As shown in Table 3, Turkey Vultures (*Cathartes aura*) were the most commonly observed species in the raptor guild, followed by Red-tailed Hawk (*Buteo jamaicensis*), American Kestrel, (*Falco sparverius*), Black Vulture (*Coragyps atratus*), Cooper's Hawk (*Accipiter cooperii*), Northern Harrier (*Circus cyaneus*), Bald Eagle (*Haliaeetus leucocephalus*), and Sharp-shinned Hawk (*Accipiter striatus*). Raptors were most often observed flying locally 46% of the time in or over woodland areas and agricultural fields at NALFF (Figure 12).

Attractants

Raptors are attracted to the airfield at NALFF by several features. Raptors find abundant prey (e.g., meadow voles, field mice, Eastern cottontails, etc.) in the grassland, agricultural field and woodland areas of the airfield. There are numerous perching sites such as navigation aids, lights, communication towers, trees, and radar facilities that may be utilized by raptors. Vultures are often observed towering on thermal updrafts high above the airfield. Mowing operations and road-killed animals provide abundant food sources for vultures in the area.

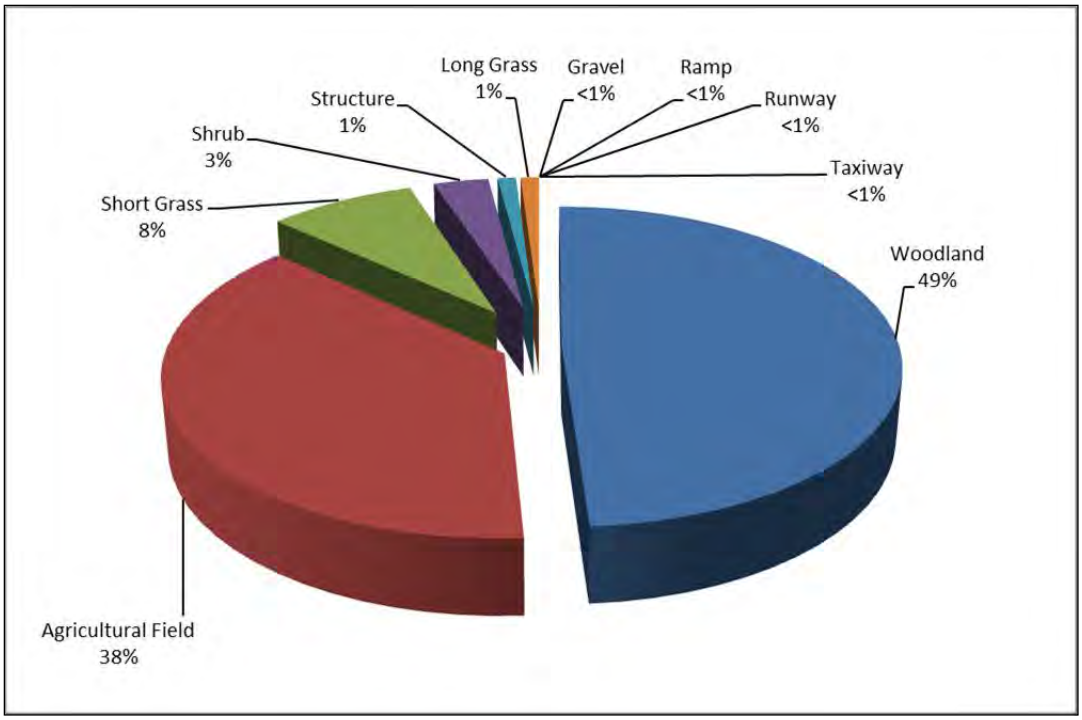

Figure 12: Raptor habitat use at NALFF, October 2011 through September 2012.

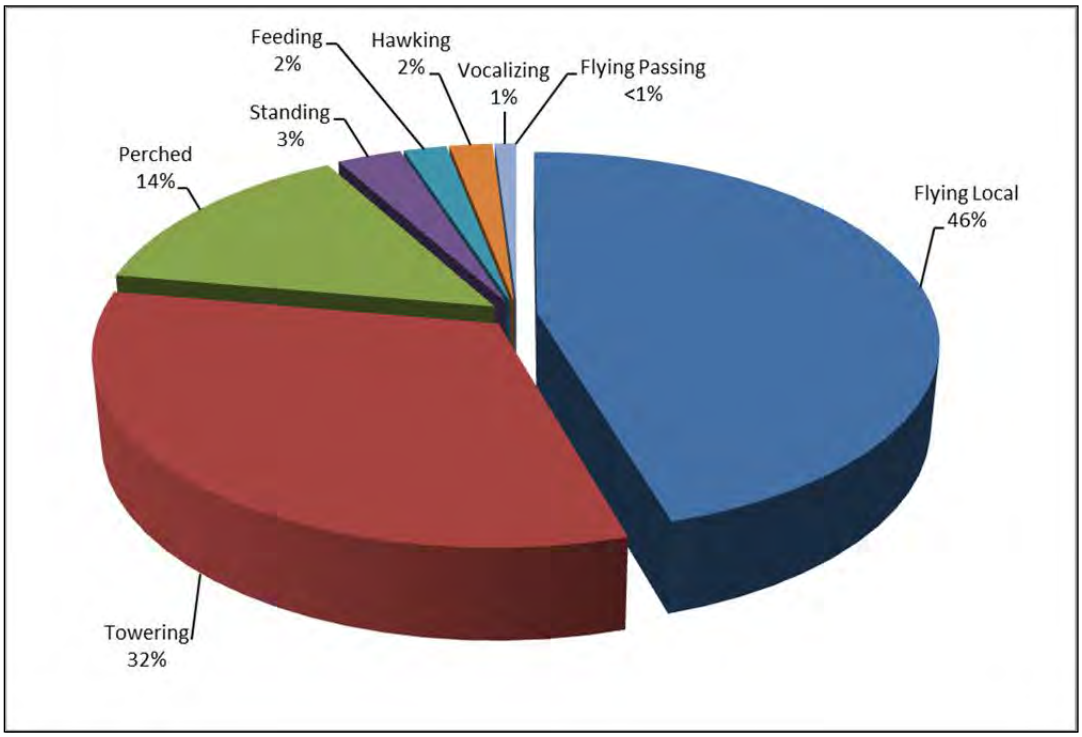

Figure 13: Raptor activity on NALFF, October 2011 through September 2012.

Management Recommendations

To reduce the likelihood of aircraft strikes involving raptors, Blackwell and Wright (2006) suggested that management efforts in the airfield should be directed towards the

availability of food and alteration of habitat used by raptors. The reduction of food sources such as rodents and carrion in the airfield is critical in controlling foraging by Red-tailed Hawks and vultures (Blackwell and Wright 2006). Reducing the number of small mammals in the airfield may be accomplished by a variety of methods, including frequent mowing and/or the use of rodenticides. Any animal carcasses found in or around the airfield should be removed and disposed of promptly to avoid attracting vultures. Mowing practices should remain consistent throughout the summer to prevent vegetation from reaching heights attractive to small rodents, decreasing the amount of scavenging by Turkey Vultures and other birds of prey.

Research has shown that small mammals use unmanaged areas of tall vegetation far more than disturbed areas (Barras and Seamans 2002, Blackwell and Wright 2006, Washburn and Seamans 2007), so frequent mowing can help to reduce small mammal abundance at airports (Barras and Seamans 2002), reducing the availability of food for raptors. When possible, reducing the availability of locations where raptors may perch, roost, loaf, or nest is recommended. As such, NALFF should consider the removal of trees and unused structures in the airfield. For structures that cannot be removed (i.e., signs, lights, towers, etc.), devices that exclude birds or make it difficult for their perching should be considered (such as spider wires, bird spikes, coil wire, etc.).

Raptor species must be harassed from the airfield whenever present using methods such as vehicles, horns, and pyrotechnics. Vultures commonly soar high above the airfield, making them difficult to disperse using 15mm pyrotechnics, given their limited range. Devices with much greater range (such as CAPA rounds or 12-gauge shellcrackers) may be more useful for dispersing vultures. Lethal removal of some raptors may be necessary for persistent individuals, and as such NALFF's depredation permit must be kept current to allow take of raptors. Lethal removal may include methods such as shooting or trapping. Though recently removed from the endangered species list, Bald Eagles are protected under the Bald and Golden Eagle Protection Act and a permit is required to simply harass eagles from the airfield. Eagles are periodically observed around the airfield environment. The intracoastal waterway to the North and East of the airfield is a major attractant for eagles, and falls within the 5 mile radius of the airfield. NALFF has submitted an application for this dispersal permit and it is recommended that the permit be kept current once obtained.

6.3 Waterfowl

Waterfowl can be particularly hazardous to aviation safety due to their larger size and flocking behavior. In particular, Canada Geese have been responsible for some of the more serious wildlife strikes. In addition to the more recent "Miracle on the Hudson" event (see Section 1.1), 24 airmen were killed in 1995 when an Air Force AWACS aircraft crashed at Elmendorf Air Force Base in Alaska after striking a flock of Canada Geese (Wright 2011). From 1990 through 2009, waterfowl have been responsible for the greatest number of damaging strikes in the United States (1,503), resulting in over $144 million in losses (Dolbeer et al. 2011).

General Abundance

Waterfowl were the sixth most abundant guild observed at NALFF from October 2011 through September 2012 (Appendix F). Waterfowl rank as the third most hazardous guild to aviation safety at NALFF (Table 3). Snow Geese (*Chen caerulescens*) are ranked as an extremely high hazard threat to aviation safety (Table 3) and accounted for the majority of waterfowl observed, but only occurred one time in February 2012. Other waterfowl observed at NALFF included Canada Geese (six observations), Tundra Swans (*Cygnus columbianus*) (one observation) and a single Mallard (*Anas platyrhynchos)* making up the rest of the waterfowl guild. Waterfowl observations were not common in terms of number of observations on NALFF property, most likely due to a lack of water, and were seen flying passing above or in the vicinity of the airfield during bird surveys 85% of the time (Figure 14).

Attractants

The Chesapeake/Virginia Beach area is within the Atlantic Flyway and home to a major stopover area for migrating waterfowl in Back Bay National Wildlife Refuge (9,250 acres) to the Southeast of NALFF. Snow Geese and other waterfowl are regularly observed loafing at both of these locations during peak migration. Surveys at NALFF included approximately 530 Snow Geese observed flying in numerous flocks during the migratory period high above the airfield. Canada Geese were observed on several occasions throughout the survey period flying across the airfield or feeding in nearby agricultural fields. There are three golf courses within five miles of NALFF and one (Battlefield Golf Course) within 10,000 feet to the West of NALFF and appears to provide plentiful food and a place for resident geese to molt from May to July (Appendix G and H).

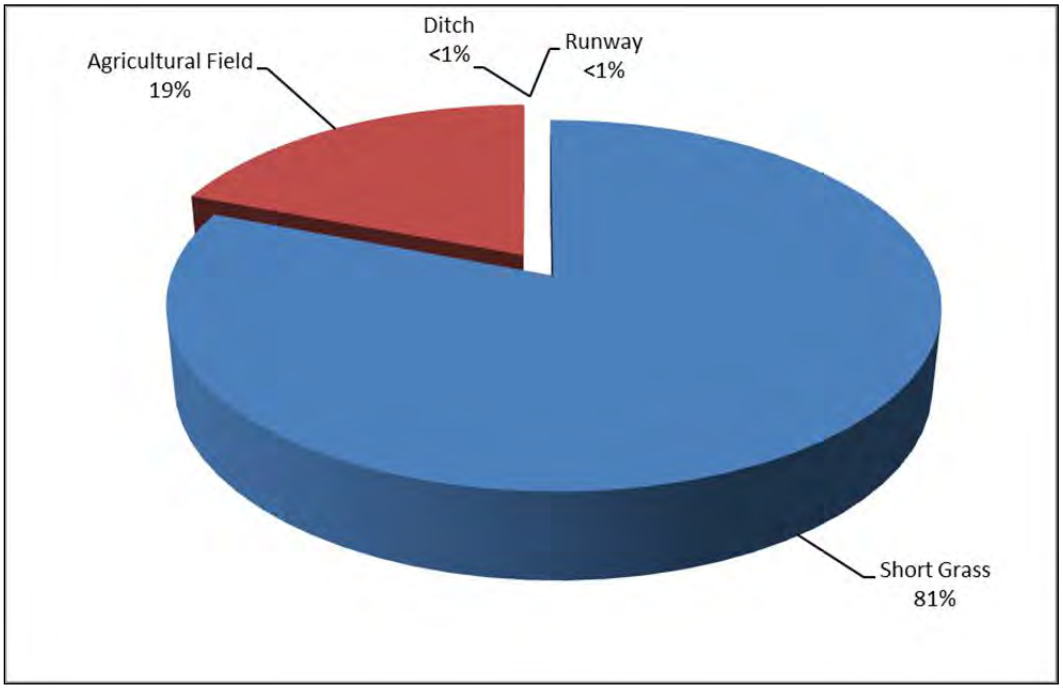

Figure 14: Waterfowl habitat use at NALFF, October 2011 through September 2012.

Management Recommendations

Canada Geese and Snow Geese should be considered the third greatest wildlife species threats to aviation safety at NALFF. Nationally, Canada Geese are ranked as an extremely high hazard to civil aviation safety, as 51% of aircraft strikes with geese resulted in damage from 1990 through 2007 (Dolbeer and Wright 2009). By comparison, Mallards are a very high hazard to aviation safety, but the damaging strike rate for Mallards is about half that of Canada Geese (Dolbeer and Wright 2009). Resident Canada Geese find many areas of suitable habitat around NALFF and have the potential to fly through critical airspace when traveling from roosting/loafing areas to feeding areas, considering the habitat in the area. There are several control methods that should be considered to reduce hazards from Canada Geese (and waterfowl in general).

Agricultural practices within five miles and on NALFF property include the harvest of soybeans, winter wheat, and corn. Winter wheat is a major attractant for waterfowl, in particular Canada Geese, and considerations should be given to eliminate the production of winter wheat on NALFF agricultural fields. Whenever and wherever possible, areas of standing water in the airfield should be eliminated by improving drainage, grading, or filling in low areas.

Recently, a linear ditch was constructed to divert water away from a nearby neighborhood (Appendix G, 3.1). One recommendation would be to suspend a wire grid over any area of water. Wire grids act as both a physical and visual barrier to prevent waterfowl from landing on the water. Installing stone rip-rap along the banks of drainage ditches may help to reduce waterfowl use of these areas, as well. Drainage ditches should be properly maintained, allowing water to effectively drain from the airfield and the ditches. Ditches can be maintained by: removal of vegetation slowing the flow, proper grading, removal of excess sediment, and use of herbicides to limit vegetation growth.

Vegetation management can be an important component for managing Canada Geese. Generally, it is recommended that airfields maintain grass at an intermediate height in the airfield (between 6 and 10 inches). It has long been thought that tall vegetation management in the airfield would deter Canada Geese since they often prefer to forage in areas of short grass, though there is limited scientific data on how Canada Geese react to tall vegetation management and studies have often produced conflicting results (Seamans et al. 2007, Barras and Seamans 2002, Washburn et al. 2007). Though more research is needed, studies suggests that a promising method of reducing Canada Goose usage of airfields is to use an endophyte-infected variety of tall fescue when re-seeding areas of an airport disturbed by tree removal, construction or renovation (Washburn et al. 2007). Research suggests that when consumed by wildlife, tall fescue produces a variety of adverse effects (taste aversion, physical distress) and is generally avoided (Washburn et al. 2007). When re-seeding disturbed areas of the airfield, NALFF should consider planting tall fescue and avoid grass mixtures containing millet so as not to provide a preferred food source for geese and other threatening bird species.

NALFF should adopt and maintain a "zero tolerance" policy towards waterfowl in and adjacent to the airfield, especially Canada Geese. Waterfowl species should be aggressively harassed to disperse them from the area. Harassment methods may include the use of pyrotechnics, horns, sirens, paintballs, and chasing with vehicles. NALFF should maintain its current migratory bird depredation permit from the USFWS to allow lethal take of waterfowl species that do not respond to harassment. Canada Geese may also be taken under the Control Order at Airports and Military Airfields (50 CFR §21.49), which allows take of Canada Geese on base property and other properties within a 3-mile radius of the airfield (with written permission of the landowner) from April 1 to September 15.

In order to further reduce threats from Canada Geese, NALFF should utilize control efforts beyond the airfield to base properties that provide attractive sources of food and cover. This control should be expanded to off base locations within 5 miles of the base (appendices G and H identify locations of wildlife attractants at 10,000 ft and 5 miles). A study conducted in New York by Seamans et al. (2009) indicated that resident Canada Geese remained within 3 miles (5 km) of their primary feeding and loafing areas around JFK International Airport. The WS program in NY reported that goose numbers at Rikers Island decreased annually after removal efforts from 2004 through 2007, and subsequently goose strikes at nearby LaGuardia Airport decreased by 80% (Seamans et al. 2009).

6.4 Pigeons/Doves

Pigeons/Doves were the fourth most hazardous guild identified at NALFF from October 2011 through September 2012 (Table 3). Rock Pigeons and Mourning Doves (*Zenaida macroura*) are the only two species observed at NALFF in this guild.

From October 2011 through September 2012, Pigeons/Doves were the fifth most abundant guild observed at NALFF (Appendix F). Pigeons were usually observed flying locally and passing, whereas Mourning Doves were usually observed feeding or flying locally around agricultural fields and areas of exposed soil. From 1981-2011, the only reported strike occurring at NALFF involving this guild was one Mourning Dove.

Attractants

Pigeons/Doves were observed most frequently in agricultural fields (Figure 15). Pigeons are attracted to the airfield to roost and nest on structures, while Mourning Doves prefer to feed in agricultural fields and bare ground or perch/loaf on fences. Pigeons and Doves were primarily seen flying locally 64% of the time across agricultural fields and around unpaved roads, looking for seeds and grit. Agricultural fields that were recently cultivated, especially corn fields, attracted greater numbers of both pigeons and doves.

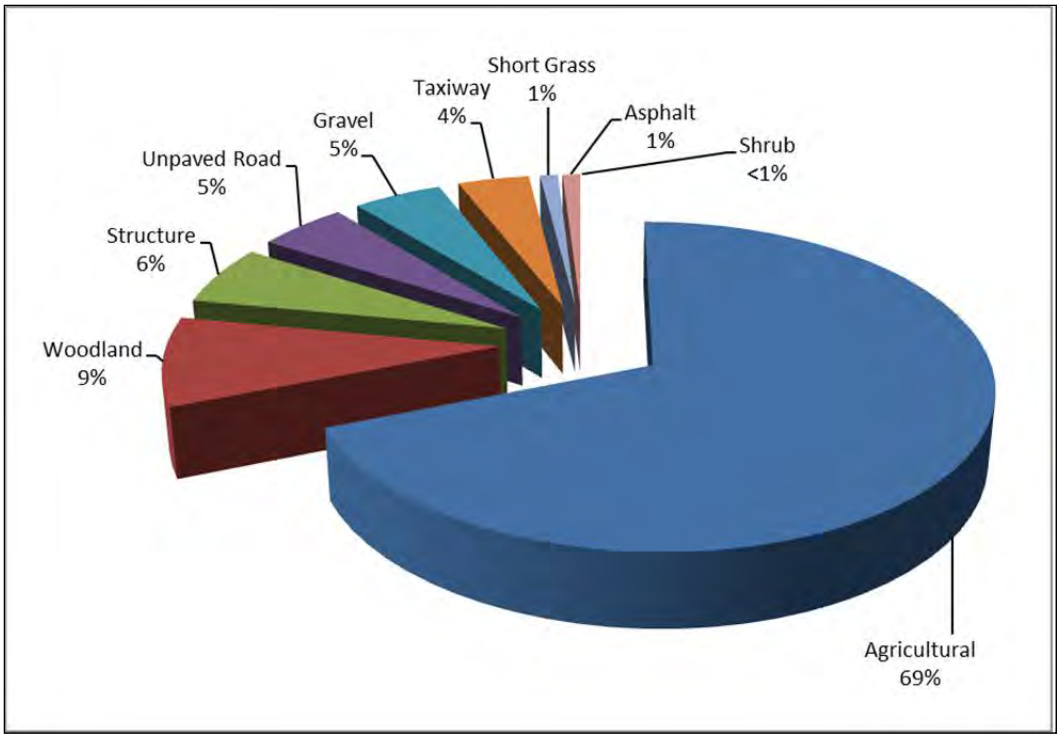

Figure 15: Pigeons/Doves habitat use at NALFF, October 2011 through September 2012.

Management Recommendations

Flocks of birds in this guild may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse should be removed lethally by shooting or trapping. Areas of bare ground that have been graded or re-seeded should be monitored for Mourning Dove activity. Control of pigeons does not require a permit, though control of Mourning Doves does require a Federal Migratory Bird Depredation Permit.

6.5 Blackbirds/Orioles and Starlings

Blackbirds/Orioles and Starlings were the fifth and sixth most hazardous guilds identified at NALFF from October 2011 through September 2012 (Table 3). European Starling and Common Grackle were ranked as moderate whereas Red-winged Blackbird and Brown-headed Cowbirds were assigned a low ranking. While these guilds do not contain any species that rank as an extremely high or very high hazard and control efforts are not often required, discussion is still warranted due to the number of observations during the study year.

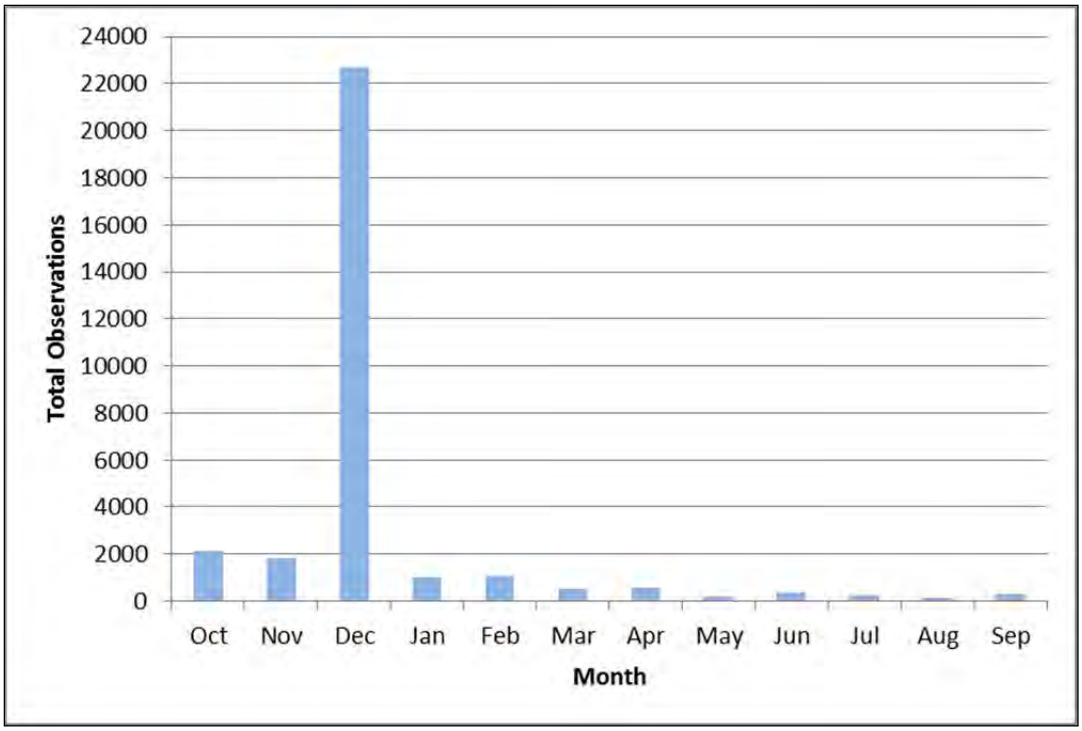

Figure 16: Blackbirds/Orioles and Starling Observations at NALFF, October 2011 through September 2012.

From October 2011 through September 2012, Blackbirds/Orioles were the most abundant guild observed at NALFF and starlings were second among all species (Appendix F). These species were mostly observed flying over short grass and agricultural areas, though European Starlings (*Sturnis vulgaris*) were commonly observed perched on structures throughout the airfield, particularly on the old aircraft and around quarterdeck area. None of these guilds have been involved in reported damaging strikes at NALFF since 1981 (Table 1). The greatest hazard these species pose to aviation is through their tendency to form large dense flocks that stay in almost continuous motion over short grass habitat near active runways. Figure 16 shows the increase in numbers during the winter months when dense flocks are most often observed as compared to the rest of the year. In June of 1996, a Belgian Hercules C-130 flying into Eindhoven Air Force Base in S. Netherlands struck a flock of European starlings, killing 34 people (Kitowski 2011).

Attractants

Species in these guilds are attracted to the airfield to feed in the large areas of open grassland and agricultural fields where they find abundant forage such as seeds, earthworms, and insects (Figure 17,18). There are many perching roosting locations utilized by these guilds such as buildings, static aircraft, communication equipment, fences, and radar facilities.

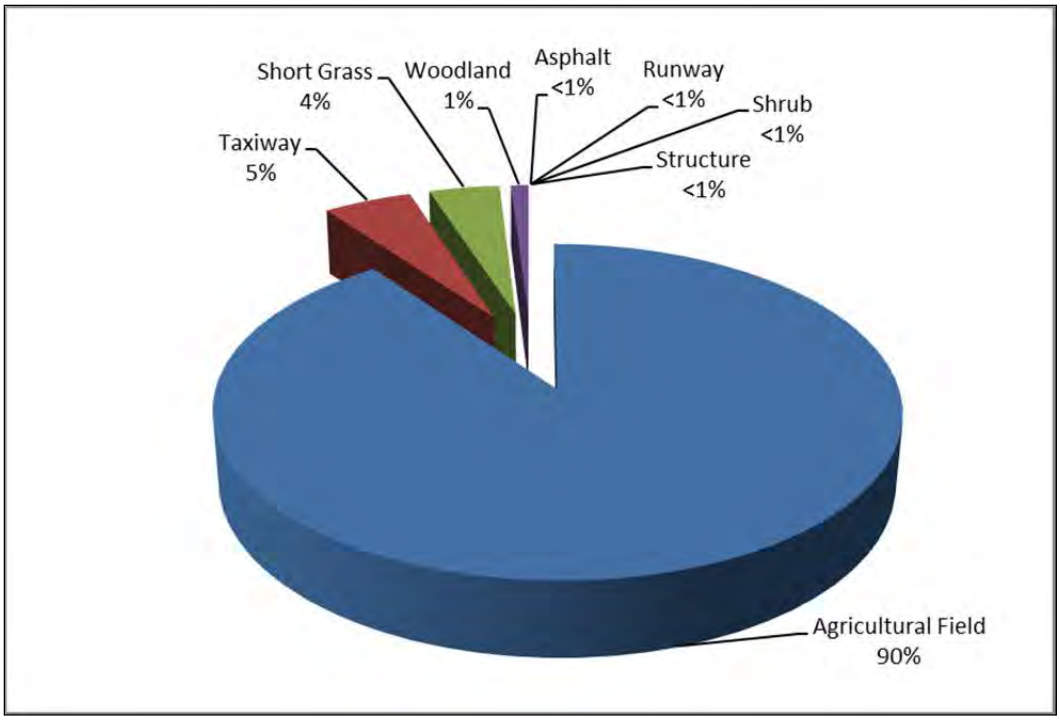

Figure 17: Blackbirds/Orioles habitat use at NALFF, October 2011 through September 2012.

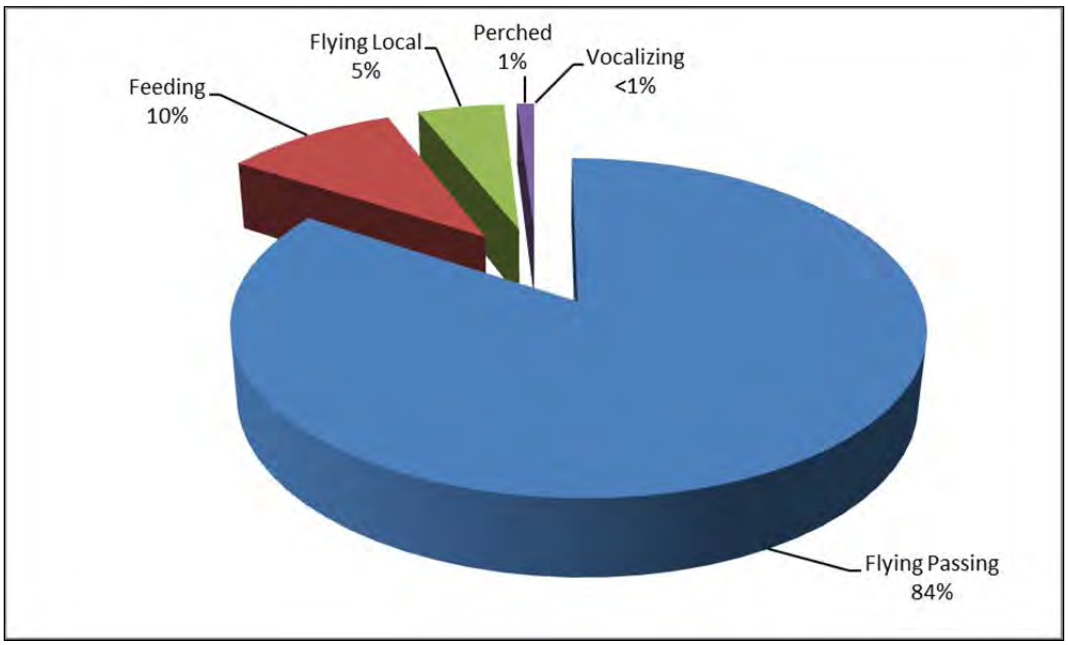

Figure 18: Blackbirds/Orioles activity on NALFF, October 2011 through September 2012.

Management Recommendations

Flocks of birds in these guilds may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse should be removed lethally by shooting and/or trapping under the FWS blackbird depredation order (50 CFR

21.43). Under this order, a permit is not necessary for the removal of blackbirds and crows causing damage or threats to human health and safety; however, it is required that all take and dispersal be reported. European starlings are not included in this order since they are an invasive/nuisance species and therefore do not require a permit. Grass management can be important for controlling these species. Grass that is tall enough to produce a seed head provides a food source and effective cover for species such as starlings and blackbirds, so grass in the airfield should be maintained at the recommended height of 6 to 10 inches (Dolbeer et al. 2011). Nest box traps can be used to manage populations of starlings in and around these areas.

6.6 Swallows

Swallows are listed as the seventh most hazardous guild identified at NALFF from October 2011 through September 2012 (Table 3). Surveys of swallows at NALFF are comprised of Tree Swallows, Barn Swallows and Purple Martins. Although these three species do not rank as high hazards to aviation safety from a perspective of reported damage, discussion is still warranted due to the number of observations during the study period.

From October 2011 through September 2012, swallows were the second most abundant guild observed at NALFF (Appendix F). Tree Swallows comprised over 93% (7,703 individuals) of this guild. This guild poses a high hazard to aviation in their feeding pattern and tendency to fly in large numbers across the airfield in search of food. From 1990- 2007, the FAA received 145 strikes involving tree swallows, 54 involved multiple tree swallows per incident becoming costly to airports in terms of mandatory aircraft damage inspections after swallow strikes, runway closings, and flight delays (Bernhardt et al. 2009).

Attractants

Species in this guild are attracted to NALFF and surrounding areas to feed on insects located over agricultural fields and fruiting trees, specifically bayberry (Figure 19). Surveys of NALFF show that bayberry trees are plentiful around the airfield, providing great foraging for swallows. Swallows were seen most often flying locally while feeding on insects (Figure 20). Swallows' feeding habits on insects on the airfield and agricultural fields occurs at a very low altitude, becoming a concern to landing and departing aircraft. Swallows also find the paved surfaces of the airfield perfect areas for loafing and resting during migrations.

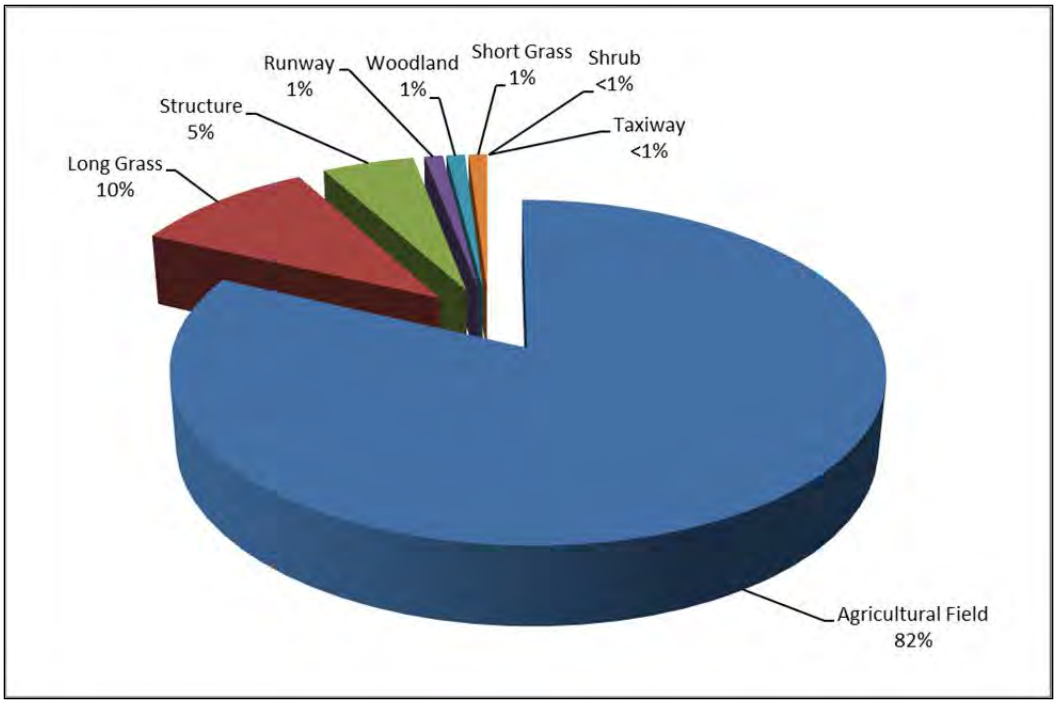

Figure 19: Swallow habitat use at NALFF, October 2011 through September 2012.

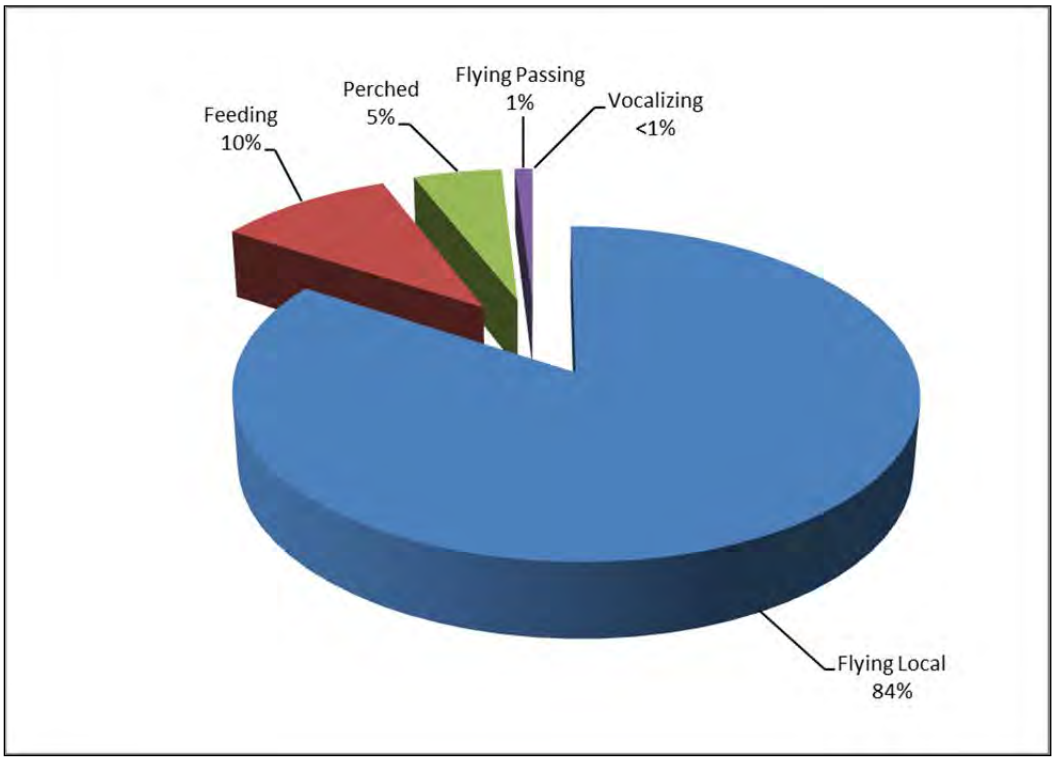

Figure 20: Swallow activity on NALFF, October 2011 through September 2012.

Management Recommendations

Flocks of birds in these guilds may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse may be removed

lethally by shooting. Shrubby habitat to include bayberry trees should be removed and graded or re-seeded to grass and mowed regularly. WS recommends that NALFF notify squadrons of the increased swallow activity at dusk due to fall migration. If possible, limits on flying should be set around dusk to help prevent bird strikes. WS recommends insecticide application to areas of short grass surrounding the airfield to remove insects attractive to swallows. Mowing of the grass tends to attract swallows to the airfield as well. WS recommends that mowing be conducted at night if possible, in order to cut down on stirring up insects during swallow feeding periods.

6.7 Small Mammals

Small mammals are attractive prey to most carnivorous mammals and predatory birds. In particular, small rodents offer a consistent diet for raptors, wading birds and carnivorous mammals. Rodent abundance is dependent upon habitat conditions, predation, dispersal rate, biological disturbance, and/or cyclic population eruptions (Fergus 2003).

Attractants

Figure 21 shows that regularly mowed or disturbed habitat, like short grass, prevents the buildup of dead vegetative (duff) layers that small mammals need for concealment and survival. Rodents are less likely to use or maintain a viable population in habitats without this duff layer due to the high rate of predation and exposure. Undisturbed habitats like secondary growth/shrubs provide excellent cover for small mammals (Table 4). High rodent populations can create an indirect hazard by attracting predators such as coyotes, fox and raptors. While hunting, these predators may create a direct threat to aviation. Rodents can also damage airfield structures due to their gnawing of wire cables which can lead to blackouts of critical airfield lighting and equipment.

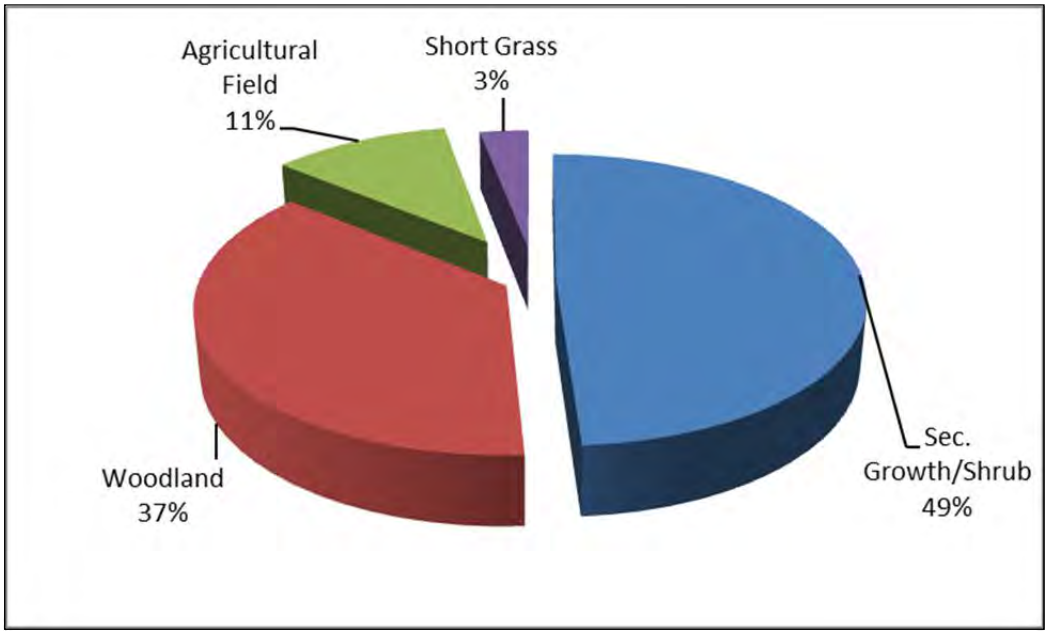

Figure 21: Small Mammal Habitat use at NALFF, fall 2011 and spring 2012.

The number of rodents captured per 100 adjusted trap nights (ATN) was significantly higher in secondary growth/shrub and woodland habitats as opposed to short grass (Table 4). This pattern indicates that the mowing height and frequency currently used at NALFF has been conducive to deterring small mammals from using short grass areas as habitat.

Table 4: Number of Small Mammals Captured per 100 adjusted trap nights (ATN) in fall 2011 and spring 2012 at NALFF.

Habitat Type	Fall Trapping 2011	Spring Trapping 2012	Average
Secondary Growth/Shrub	13	17.5	15.3
Woodland	6.7	14.1	10.4
Agricultural Field	3.6	2.1	2.9
Short Grass	0	1.4	0.7

Management Recommendations

The presence of small mammals in these secondary growth/shrub and woodland areas will be greatly reduced by removal of the trees, shrubs and secondary growth. Air operations management is currently removing areas of concern on the airfield that contain these two habitat types. WS recommends that these areas become part of the mowing and agricultural lease to prevent secondary growth from reoccurring. WS recommends that NALFF apply rodenticides to specific areas according to the Virginia Cooperative Extension pesticide management procedures to remove and deter small mammals from inhabiting areas where carnivores and raptors are actively feeding.

6.8 All Other Guilds

Appendix F lists all guilds and species observed at NALFF during wildlife surveys from October 2011 through September 2012. For all other guilds observed during wildlife surveys, many, if not all of the management recommendations listed for artiodactyls, raptors, waterfowl, pigeons/doves and swallows are applicable in reducing their threats to aviation safety. Many species utilize the same habitats, so management for one species will likely affect another. As discussed earlier in this section, habitat management and exclusion are the two most important components for reducing the threat of wildlife strikes at NALFF. Vegetation and water management will likely have the greatest impact for most bird species, while maintaining a perimeter fence will be most effective in reducing the presence of larger mammal species (such as deer and coyotes).

6.9 Threatened and Endangered Species

Appendix E lists species that are considered endangered, threatened, or of concern in the Commonwealth of Virginia. Species that may be encountered at NALFF include but are not limited to Gull-billed Tern, Roseate Tern, Upland Sandpiper, and Wilson's Plover.

7.0 DIRECT CONTROL

In addition to conducting a wildlife hazard assessment, WS also provided direct control services to NALFF from October 2011 through September 2012. Due to construction on the airfield, white-tailed deer was the only species directly controlled on the airfield during this study period. From October 2011 through September 2012, 295 deer were surveyed and 14 deer were removed.

8.0 RECOMMENDATIONS

In addition to placing an emphasis on the management of the species discussed in Section 6, WS recommends that the following actions are implemented at NALFF to improve wildlife hazard management at NALFF and further reduce the threat of wildlife/aircraft strikes:

Install a Security/Wildlife fence around the perimeter of the entire airfield

The Federal Aviation Administration (FAA) recommends that civil airports in areas of high deer populations install a 10 to 12 foot chain-link fence with outriggers supporting three strands of barbwire projecting away from the airfield. FAA also supports a 4 foot skirt of chain link fence attached at the bottom of the fence and buried at a 45 degree angle away from the airfield to exclude wildlife from digging or slipping under the fence. A properly installed wildlife fence will greatly improve safety and security of the airfield.

Update the NASO/NALFF BASH Plan (WHMP) Based on the WHA

NASO/NALFF's current BASH plan (NASOCEANAINST 3750.2B) was developed in 2008 by Geo-Marine, Inc. and was not based on a WHA. The plan provides the framework for the base to address wildlife hazards. The BASH plan lacks base specific details of wildlife hazards, and who, how and when the programs outlined in the plan will be conducted. It is recommended that the BASH plan be updated to reflect the information contained in this WHA.

Training of Airfield Personnel in Wildlife Hazard Management

FAA regulations require that civilian airport personnel who are responsible for implementing wildlife control measures are properly trained in wildlife hazard management by a qualified wildlife biologist [14 CFR Part 139.303 (c) and (e)]. NALFF currently does not have a formalized training. Formalized training topics should include: USN regulations, policies, and procedures; wildlife strike reporting; wildlife attractants; habitat management; species identification; safety; and hands-on demonstrations of wildlife management tools and techniques. It is recommended that NALFF develop formalized training for airfield personnel that may encounter wildlife on the airfield. The current BASH plan outlines this and WS recommends that NALFF develop and formalize a Bird Detection and Dispersal Team (BDDT).

Establish a Formal BASH Working Group

The current NASO/NALFF BASH Plan and the Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance (CNICINST 3700, 7 Jul 2011) both outline the functions and personnel to be involved with the BASH Working Group (BWG). WS recommends that NALFF continue the current BWG in accordance with CNICINST 3700. The functions of this group are important, as it will facilitate greater sharing of information and cooperation among those who have a stake in managing wildlife hazards at NALFF.

Utilize the Wildlife Activity Log and Report Bird Strikes

It is recommended that operations personnel begin using a wildlife activity log to include information such as the number of birds involved, cover type, and location on the airfield. WS recommends that this log also be extended to other personnel such as the crash captain and federal firefighters at NALFF. This information can be useful in determining trends and prioritizing management objectives.

Bird strikes should be reported online via WESS and a sample submitted to the Smithsonian Feather ID Lab for positive identification. Evaluation of the WESS data base has shown a lack in bird strike reporting. WS has seen an increase in strike reporting since June 2010. It is important that aircrews conducting the majority of their operations at NALFF who encounter a bird strike report the strike as occurring at NALFF if the location of the strike is unknown. WS should continue training on proper strike reporting to airfield personnel and squadrons. Damage to aircraft following a strike or wildlife incidence is seldom recorded. WS recommends that NALFF formalizes a process for recording damage. Damage should include aircraft structural damage, aircraft down time, repair, cleaning, and all other costs associated with a wildlife incidence. WS recommends that NALFF work with the Naval Safety Center to ensure that the WESS data base is being updated with species identification and associated damages. This information is usually not available at the time a WESS report is initially submitted.

Maintain Necessary Permits to Control Wildlife

As stated previously, federal and state permits are necessary for lethal take of migratory bird species and state-managed species such as deer and turkeys. In addition, a federal permit is needed before Bald Eagles may be harassed from the airfield. NALFF currently holds a migratory bird depredation permit and a state permit. WS recommends that these permits be maintained to address wildlife species as necessary. WS also recommends NALFF obtain a Bald Eagle Harassment permit from the USFWS. Without this permit, Bald Eagles using the airfield cannot be harassed and may pose a serious aviation threat if left on or near the airfield.

Have Control Supplies on Hand

WS recommends that airfield personnel that are members of the BDDT who are responsible for wildlife hazard management are provided with adequate equipment

needed to disperse wildlife. Such devices may include pyrotechnics and launchers, propane cannons, and vehicles equipped with sirens and lights. WS recommends that BDDT members are properly trained in the safe use and storage of these devices.

Evaluate Potential Wildlife Hazards When Planning New Construction or Land Use Changes

NALFF has recently completed a major expansion and improvement project. It is critical to consider wildlife attractants during these planning phases. Several aspects to consider will be the planting of new vegetation, which may provide food to wildlife in the form of seeds and fruits, and the creation of water bodies or drainage basins that provide fresh water. NALFF airfield manager currently reviews airfield maintenance projects with WS for possible BASH concerns. WS recommends that this process continue and be expanded to all construction and maintenance projects on base property. In addition, adjacent off-site projects within 5 miles of the airfield such as: industrial development, road construction, recreational development, etc. need to be considered as potential wildlife attractant hazards and reviewed for potential wildlife attractants prior to budget commitments. If the review is conducted after the project budget is established, changes to the project are unlikely.

Continue to Monitor Wildlife Populations and Habitat Use Patterns in the Airfield

The intent of this WHA has been to document general occurrence, land-use patterns, and population characteristics of wildlife at NALFF. It must be realized that wildlife abundance and use patterns on airfields are affected by a host of variables that are rarely the same from year-to-year. Hence, conclusions based on wildlife populations and patterns during this study are only meant to be a guide and may or may not be consistent in subsequent years. Survey routes and methods were established in a manner that facilitates continued monitoring. Data from this study will provide a baseline for comparison in subsequent years and NALFF should continue to monitor wildlife populations by conducting monthly surveys using the same stations established in this assessment. While surveys conducted in subsequent years may not be conducted with the same frequency or intensity as this initial hazard assessment, they will still provide general insights into wildlife use patterns over time and enable NALFF to gauge the effectiveness of its control efforts.

Habitat Modification and Exclusion

As discussed in Section 6, habitat modification and exclusion are two of the most important components of a wildlife hazard management plan. NALFF airfield maintenance personnel have been diligent in maintaining grass in the airfield at the recommended height (6 to 10 inches), and WS recommends that regular mowing is continued. Grass management is seasonal, and frequency of mowing may need to be increased during growing season as resources permit. Woody vegetation growing in drainage ditches should be removed and these areas should be maintained to prevent creating thick, shrub-like habitat that can provide cover for small mammals and perching sites for raptors. Most ditches within the airfield have been allowed to become clogged

with woody vegetation. This not only attracts wildlife but prevents water from effectively draining from the airfield compounding the problem with areas of standing water and/or high water table within the airfield. These high water tables increase the chance of field equipment rutting the airfield when driving across or avoiding the area completely during mowing operations.

Because all species are attracted to water, areas of standing water should be eliminated where possible. Low lying areas should be filled or graded to improve drainage. Underground drainage culverts in the airfield should be inspected regularly and be maintained to reduce standing water following heavy rains.

Throughout the year and WHA, observations were made regarding the airfield improvement project that likely resulted in attracting certain species of wildlife to the airfield. Loose gravel and soil remained exposed for several months providing good habitat for Mourning Doves and Killdeer. Prior to re-opening, all areas of loose soil were re-graded, compacted, and seeded to insure stabilization of the soil. These areas must be maintained and re-graded as necessary.

Agricultural Practices

Agricultural crops can attract hazardous wildlife to the airfield. Consideration should be given to the crops that are planted and the agricultural practices used for their production. Cereal grain products should be avoided. These crops attract large numbers of waterfowl for forage. Agricultural practices should minimize tilling. Tilling exposes prey (i.e. insects, worms, etc.) that attract large numbers of gulls. Care should be taken during harvest to ensure excess amounts of grains are not spilled. If spills occur they should be cleaned up or buried.

Evaluation of Off Base Aviation Hazards and Seeking Landowner Cooperation

As discussed in Section 6, wildlife on properties near the airfield may pose serious threats to aviation safety at NALFF. The FAA recommends a separation distance of 5 statute miles between the farthest edge of the airports AOA and hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace (FAA AC 150/5200-33B). WS recommends that NALFF continues to identify areas within 5 miles of the airport that may provide roosting and/or foraging areas for birds that utilize the airspace at NALFF, especially Canada Geese. NALFF should approach these landowners to seek cooperation on removing these hazards. WS has identified several potential areas that attract hazardous wildlife within the approach/departure and circling airspace of NALF Fentress. A couple areas noted: water impoundment across Mount Pleasant Rd., agricultural fields (corn, soybeans, winter wheat), Battlefield, Signature at West Neck, Virginia Beach National and Stumpy Lake golf courses (Appendix G and H). Areas identified as potential hazards should be and/or continue to be evaluated for wildlife use and BASH mitigation procedures implemented to reduce hazards.

9.0 SUMMARY

Based on data collected during the WHA, records from the WESS wildlife strike database, and control efforts by WS and NALFF personnel, several species were identified that threaten aviation safety at NALFF. The guilds/group that are of most concern to aviation safety include deer, raptors, waterfowl, pigeons/doves, blackbirds/orioles, starlings, and swallows. Several management strategies may be implemented to reduce wildlife hazards at NALFF, including habitat modification, exclusion, harassment, and lethal removal of hazardous wildlife species. WS recommends that NALFF continues to take an active approach to wildlife hazard management, utilizing the information contained in this WHA to reduce wildlife hazards and provide a safe environment for aircraft operations.

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APPENDIX A

CNICINST 3700; Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance

DEPARTMENT OF THE NAVY
COMMANDER, NAVY INSTALLATIONS COMMAND
716 SICARD STREET, SE, SUITE 1000
WASHINGTON NAVY YARD, DC 20374-5140

CNICINST 3700
N3
7 JUL 2011

CNIC INSTRUCTION 3700

From: COMMANDER, NAVY INSTALLATIONS COMMAND

Subj: NAVY BIRD/ANIMAL AIRCRAFT STRIKE HAZARD PROGRAM IMPLEMENTING GUIDANCE

Ref: (a) OPNAVINST 3750.6
(b) CNIC BASH Program Manual
(c) FAA Advisory Circular 150/5200-32 a of 22 Dec 04
(d) FAA Advisory Circular 150/5200-33 b of 28 Aug 07
(e) OPNAVINST 11010.20
(f) USDA/CNIC Work/Financial Plan

1. Purpose

a. To establish policy and procedures for implementing the Commander, Navy Installations Command (CNIC) Bird/Animal Aircraft Strike Hazard (BASH) Program.

b. To establish mandatory BASH event reporting and remains collection procedures in accordance with references (a), (b) and (c).

c. To establish BASH program procedures in accordance with reference (b) and consistent with reference (d).

2. Background

a. The Navy's first loss of life due to a bird strike occurred in 1914, coincidentally the same year it obtained its first aircraft. Since 1981, Naval Aviators have reported over 16,550 bird strikes, which resulted in over 440 aircraft mishaps, 250 foreign object damaged (FOD) engines and $372,000,000.00 in damage costs. Additionally, ten aircraft were destroyed along with one fatality. The Naval Safety Center's review of recent Navy BASH incidents found that the lack of an effective installation BASH program was a consistent contributing factor. The BASH program manages risk by addressing specific aviation safety hazards associated with

wildlife near airfields through coordination among all the entities supporting the aviation mission. The BASH program should also strive to effectively minimize secondary consequences of strikes, such as damage to aircraft, environmental cleanup due to aircraft crashes, and impairment of training. Success of the program, therefore, can be measured by the steady reduction and low recurrence rate of actual wildlife-to-aircraft strike events. Such success will be gained by the persistent application of dedicated resources, focused leadership support, execution of time-tested practices and procedures, effective monitoring programs, and institutionalized BASH training across aviation commands.

b. The goals of the guidance contained in this instruction are to increase the reporting and identification of strike events and to reduce BASH incidences at Navy airfields. These goals can be accomplished by reducing the quality and attractiveness of those airfields as habitats for identified problem wildlife, manage wildlife populations to minimize the potential for aircraft strikes, and through coordination with aircraft custodians and shore-based air operations personnel to improve the reporting and communications on both wildlife management and aircraft strikes.

3. Policy

a. CNIC is the Executive Agent, Budget Submitting Office, Program Manager, and Single Process Integrator for executing, monitoring and sustaining the BASH Program at all CNIC installations that conduct or support air operations.

b. This instruction is applicable to all CNIC commands that support fixed and rotary-wing air operations.

c. All Navy flying units that are tenants of CNIC commands shall report bird/wildlife strikes of known origin (e.g., bird remains found on an aircraft, bird remains found on the runway and correlated to a specific aircraft) in accordance with reference (a) and collect/forward remains in accordance with Appendix A-1 of reference (b).

d. All CNIC commands shall report all wildlife strikes in accordance with reference (a) and manage facilities in accordance with reference (b) and consistent with reference (d).

e. BASH manpower and equipment resourcing falls under the Chief Of Naval Operations (OPNAV) Shore Installation Readiness (N46) Base Operating Support (BOS) funding umbrella.

f. CNIC N3, as BASH Program Manager, is final authority for approval and submission to OPNAV N46 for BASH manpower and equipment resourcing requirements across the Navy shore enterprise.

g. Annual updates to those requirements beyond the basic equipment provided in appendix A-2 of reference (b) will be the province of Commanding Officers (CO) at air installations and air operations supporting facilities.

h. BASH incidents shall be reported, via the Web Enabled Safety System (WESS), in accordance with procedures contained in references (a) and (c).

4. Responsibilities

a. CNIC is responsible for execution and oversight of the BASH program.

b. Regional Commanders are responsible for execution and oversight of the BASH program in their regions.

c. COs are responsible for execution and oversight of the BASH program on installations that conduct or support air operations.

d. Air Operations Department Heads are responsible as the BASH program managers on installations that conduct or support air operations.

e. Public Works Officers (PWO) are responsible for ensuring BASH programs are supported by routine facility support services, maintenance, and management.

f. Environmental Program Directors (EPD) are responsible for ensuring BASH programs are compliant with all applicable state and federal environmental laws and regulations, and all applicable Department of Defense (DoD), Department of the Navy (DON) and U.S. Navy environmental policies, directives, and instructions.

g. Natural Resource Managers (NRM) are responsible for ensuring BASH programs are addressed in the installation Integrated Natural Resources Management Plan (INRMP) and compliant with all applicable state and federal natural resource laws and regulations as well as all applicable DoD, DON, and

U.S. Navy environmental policies, directives, and instructions related to natural resources.

5. Action

a. CNIC Headquarters shall:

(1) Assign N3 is the BASH program manager.

(2) Assign Air Operations Program Director (N32) as the executing agent for the CNIC BASH Program and will serve as principal point of contact to all agencies, internal or external, on matters involving the BASH Program. CNIC N32 shall:

(a) Resource CNIC air facilities to the recommended minimum equipment standards established in Appendix A-2 of reference (b).

(b) Centrally fund the United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services (WS) for biologists assigned to air operations departments to perform Integrated Wildlife Damage Management (IWDM) and monitoring efforts in support of the installation BASH plan.

(c) Manage BASH resource execution.

(d) Chair an annual DON BASH Working Group among major aviation stakeholders typically attended by representatives from fleet type commanders, Naval Safety Center, OPNAV Shore Readiness (N46), OPNAV Energy and Environmental Readiness (N45), Naval Facilities Engineering Command (NAVFAC), regional and installation air operations and natural resources personnel.

(e) Compile regional inputs and additional requirements inputs from air operations stakeholders at the annual BASH Working Group prior to final Program Objective Memoranda (POM) requirements submissions.

(f) Review BASH procedures, and formulate and submit budgetary planning documents to OPNAV N46 per the annual POM schedule.

(g) Conduct a formal review of this instruction every year.

(3) CNIC N4 shall:

(a) Ensure adequately trained NRMs, professional biologists, and biological technicians are available to support preparation and implementation of installation BASH plans.

(b) Ensure BASH programs are addressed in and compliant with installation INRMPs.

b. CNIC Regions shall:

(1) Regional Commanders shall charge the Regional Operations Officer (N3) with responsibility for execution oversight of BASH at the installations. In Regions with an Air Operations Program, the Operations Officer will typically appoint the Air Operations Program Director with responsibility for BASH management oversight.

(2) Regional Air Operations Program Directors shall:

(a) Support COs in establishment and reporting of BASH budget requirements for the annual POM submission cycle.

(b) Manage BASH financial execution.

(c) Monitor installation BASH program viability and BASH incident reporting.

(d) Ensure training for BASH personnel at the installations is in place and standardized.

(3) Regional Engineer Environmental Program Directors (N4) shall ensure that adequately trained NRMs, professional biologists, and biological technicians are available to support Air Department staffs in preparation and implementation of installation BASH plans.

c. CNIC Installations shall:

(1) COs of installations that conduct or support air operations shall:

(a) Issue a BASH plan and maintain its currency based on normal command review guidelines and interim changes to this instruction. The BASH plan shall, at a minimum, address the following:

1. Establishment of a BASH Working Group (BWG) to coordinate BASH issues and requirements across departments and tenants.

2. Identify bird/animal hazards to aviation in the local geographic environment. Hazards shall be identified by regular monitoring of wildlife and if necessary a Wildlife Hazard Assessment (WHA).

3. Establish BASH mitigation procedures (active and passive) relative to the identified hazards in accordance with reference (b) and consistent with reference (d).

4. Develop methods to monitor the effectiveness of the installation IWDM and associated BASH program elements to ensure changes are made as necessary. Data shall be collected and compared from one year to the next in order to document program effectiveness over time.

5. Determine how real time BASH information is made available to aviators as well as potential changes to flying operations based on current operating conditions.

6. Establish procedures for a rapid response capability to deal with emergent BASH issues that threaten daily operations.

7. Ensure compliance with all applicable state and federal environmental and natural resources laws and and regulations, and all applicable DoD, DoN and U.S. Navy environmental policies, directives, and instructions.

8. Address submittal of regular updates to the BWG for review. These reports shall detail methodology and results of all work completed as well as appropriate BASH management recommendations.

9. Training requirements for installation personnel involved with air operations to promote knowledge of BASH issues and to institutionalize standardized procedures for reporting incidents and collecting/forwarding remains.

10. Establish requirements for an annual BASH program self-assessment process that, at a minimum, incorporates appendix A-3 of reference (b).

(b) Institutionalize these procedures by ensuring training on reporting procedures is provided to all divisions and offices directly exposed to the execution of air operations.

(c) Ensure installation personnel are responsible for reporting bird/wildlife strikes of unknown origin (e.g., bird remains found on a runway and not correlated to a specific aircraft) in accordance with references (b) and (c).

(d) Ensure installation personnel collect and forward remains in accordance with Appendix A-1 of reference (b).

(2) Installation Air Operations Officer shall:

(a) Be the BASH Program Manager responsible for execution oversight of installation BASH plan. Serve as central point of contact for BASH coordination and planning with other departments, installation tenants, and the local community.

(b) Establish a WESS account for the mandatory reporting of all BASH incidents.

(c) Coordinate with aircraft custodians on the proper reporting, via WESS, and remains collection procedures of all bird/animal strikes of known origin in accordance with references (a), (b) and (c).

(d) Ensure bird/animal strikes of unknown origin (wildlife found on or near the runway) are reported, via WESS, to the Naval Safety Center in accordance with reference (b) and that any remains are appropriately packaged and forwarded to the Smithsonian Institution for positive identification in accordance with references (b) and (c).

(e) Ensure all wildlife strike reporting and identification data is provided to the members of the BWG and analyzed by the installation for development of future BASH reduction management strategies.

(f) Ensure aircraft reporting custodians receive assistance in their efforts to report strikes of known origin and forward remains.

(g) Provide local oversight of the USDA Wildlife Biologist, if one is assigned, and ensure regular coordination of efforts and strike identification with the installation NRM occur.

(h) Chair the BWG which will typically be staffed, dependent on local billets, by the Air Field Manager (AFM), PWO, Aviation Safety Officer (ASO), tenant Wing or Squadron ASOs (SSO/WSO), a USDA Wildlife Biologist, and representatives from Air Traffic Control, environmental department, Natural Resources, Public Affairs Office (PAO), and Community Plans and Liaison Officer (CPLO). Ensure installation PWOs, EPDs, and NRMs participate as key members in the BASH Working Group.

(i) At overseas installations where host nation maintains responsibility for BASH, coordinate with host nation to ensure U. S. Navy representation on airfield BASH Working Group (BWG), or its equivalent. To the extent host nation agreements require, provide cost sharing or direct support of the installation BASH program.

(3) Installation PWOs shall:

(a) Participate in the local BWG and in on-site technical reviews of installation BASH programs during periodic Naval Safety Center surveys.

(b) Provide facilities support services and maintenance (such as mowing, vegetation and landscape management, trash removal, facilities and sign maintenance, etc.) that correspond to mitigation procedures appropriate for hazards, in accordance with reference (b) and consistent with reference (d), in the local installation operational environment.

(c) Ensure BASH projects that exceed local approval authority are submitted in compliance with reference (e).

(4) Installation EPDs shall:

(a) Ensure BASH programs are in compliance with all applicable state and federal environmental laws and regulations including but not limited to the National Environmental Policy Act and the Clean Water Act.

(b) Ensure BASH programs are in compliance with all applicable DoD, DoN and U.S. Navy environmental policies, directives, and instructions including but not limited to DoD Instruction 4715.03 Natural Resources Conservation dated March 2011 and Chief of Naval Operations Instruction 5090.

(c) Participate in local BWG and in on-site technical reviews of installation BASH programs during periodic Naval Safety Center surveys.

(5) Installation NRMs shall:

(a) Be the BASH program manager on installations that do not have an Air Operations Officer.

(b) In the absence of an air operations funded USDA wildlife biologist, and in addition to other duties assigned, assist the Air Operations Officer in managing the BASH program.

(c) Ensure BASH programs and plans are in compliance with the INRMP and all applicable state and federal natural resource laws and regulations including but not limited to the Endangered Species Act, Migratory Bird Treaty Act, and Sikes Act.

(d) Coordinate INRMP revisions and updates with air operations.

(e) Coordinate and manage all applicable natural resources consultations and permits necessary to support the BASH program including but not limited to Army Corps of Engineer Section 404 permits, U.S. Fish and Wildlife Service (USFWS) Migratory Bird Depredation Permits, and Endangered Species Act Section 7 consultations.

(f) Ensure BASH program elements consider sustainable land management practices, adaptive management and scientifically sound monitoring techniques.

(g) Support the WHA and ensure data collected is able to be reproduced for annual monitoring and reporting requirements.

(h) Participate in the local BWG and in on-site technical reviews of installation BASH programs during periodic Naval Safety Center surveys. If requested, participate as a co-chair of the BWG.

(i) Coordinate with the air operations funded USDA wildlife biologist, if one is assigned.

(j) Assist with strike identifications.

(b) Participate in the local IWG.

5. Forms and Reports. BASH incidents shall be reported, via WESS, in accordance with procedures contained in references (a) and (c). Tenant aviation units shall send a copy of the WESS BASH report to the installation BASH Program Manager.

M. C. Vitale

M. C. VITALE
Vice Admiral, U. S. Navy

Distribution:
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APPENDIX B

USDA, APHIS, Wildlife Services and CNIC Work/Financial Plan

United States Department Of Agriculture (USDA)
Animal and Plant Health Inspection Service (APHIS)
Wildlife Services (WS)
and
Commander, Navy Installations Command (CNIC)

WORK/FINANCIAL PLAN FOR
BIRD/ANIMAL AIRCRAFT STRIKE HAZARD (BASH) SUPPORT ON NAVY INSTALLATIONS

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BEGINNING DATE: OCT 01, 2012
ENDING DATE: NTE 5 YEAR PERIOD

For CNIC

M. S. Remington Sep 6, 2012
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United States Department of Agriculture
APHIS Wildlife Services

for
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NEED FOR ASSISTANCE The United States Navy, Commander Navy Installations Command (CNIC) has requested that the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Program (APHIS WS) provide assistance to mitigate potential and realized wildlife hazards at United States Navy (USN) air stations in the continental United States and Hawaii.

Pursuant to this agreement between the (APHIS WS) and (CNIC), this Work/Financial Plan defines the basic objectives, plan of action, and budget for the APHIS Wildlife Services program to begin on 01 October 2012 for FY13 and continue for a period not to exceed 5 years. A new work and financial plan will be discussed between the parties prior to the initiation of the each subsequent FY for a period not to exceed 5 years.

The U.S. Department of Agriculture (USDA) is authorized to protect American agriculture and other resources from damage associated with wildlife. The primary authority for Wildlife Services (WS) is the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C.426-426b) as amended, and the Act of December 22, 1987 (101Stat. 1329-331, 7 U.S.C. 426c). Wildlife Services activities are conducted in cooperation with other Federal, State and local agencies; private organizations and individuals. Department/ agency cooperation between the USDA and DOD also is based on language contained in the Sikes Act (16 USC 670a-670o, 74 Stat. 1052), DOD Instruction 4150.07 (DOD Pest Management Program) and the memorandum of understanding (# 12-34-71-0007-MU) between the DOD and the USDA, Animal and Plant Health Inspection Service, Animal Damage Control (ADC; i.e., Wildlife Services).

The Animal and Plant Health Inspection Service (APHIS) WS program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as IPM or "Integrated Pest Management") in which a series of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of the Animal Damage Control Program Final Environmental Impact Statement (USDA, 1994). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. However, controlling wildlife damage may require that the offending animal(s) are killed or that the populations of the offending species be reduced.

I. OBJECTIVES/GOALS

To establish and continue an Integrated Wildlife Damage Management (IWDM) program incorporating direct assistance and technical recommendations at installations subject to this agreement and associated outlying fields including any private property deemed necessary for the mitigation of damage to naval aircraft operations in order to alleviate wildlife hazards to aircraft as well as for the protection of human health and safety. The secondary objective will be to reduce damage to property and natural resources caused by wildlife at the installations subject to this agreement.

APHIS WS is recognized as the appropriate agency to conduct wildlife hazard management at military installations as well as civilian airports to reduce wildlife hazards. APHIS WS has the expertise in IWDM to provide these services.

Various wildlife species have caused problems at military airports. Wildlife, especially birds within aircraft operating environment, has caused damage to aircraft and continue to pose a safety threat to aircrews. Species directly or indirectly response for damage to aircraft include but not limited to raptors and a wide assortment of passerines. Wildlife, not limited to deer, feral hogs, coyotes and jack rabbits can get onto runways and pose a threat to aircraft and property as well as interrupt take-offs and landings at these facilities.

Additional objectives include:

a. Supplement and enhance the overall Natural Resource Program (NRP) for installations subject to this agreement.

b. The IWDM program shall be compliant with the installation Integrated Natural Resources Management Plan (INRMP).

c. To monitor wildlife activity while evaluating the effectiveness of IWDM program efforts.

d. To facilitate the acquisition and renewal of an annual migratory bird depredation/salvage permit and state depredation permits, as needed.

e. To maintain a Web Enabled Safety System (WESS) account with the Naval Safety Center and assist in wildlife-strike reporting and monthly briefings on the status of the BASH program.

f. To assist with the review and revision of the installation BASH Plan to ensure updated, effective techniques are in place to reduce the threat of wildlife strikes to aircraft.

g. To assist in the collection, preparation and shipment of wildlife strike remains to the Smithsonian Institution for positive identification.

h. As directed by installation points of contact, evaluate off-station airfields frequented by military aircraft, where repeated strikes have occurred.

i. Serve as a member of the installation Bird Hazard Working Group.

j. To train USN personnel that may be part of the installation Bird Detection and Dispersal Team (BDDT) in accordance with Weapons Division Qualification/Certification program.

k. To train BDDT on use of active scare techniques, as well as placement of static wildlife deterrent devices.

l. To provide training to local squadrons detailing bird and animal strike hazards.

II. PLAN OF ACTION

APHIS WS will assign one full-time Wildlife Biologist at each installation (and where needed an additional wildlife specialist) subject to this agreement and will provide a vehicle, field supplies and equipment, unless otherwise noted in this work plan. APHIS WS personnel will conduct Wildlife Hazard Assessments and mitigate wildlife hazards at all facilities. The timing and initiation of assessments will be coordinated locally so as to not impact on-going mitigation efforts (e.g., installations where an outlying training field exists but main efforts are focused on the air station). Information collected from this effort will be used to inform and to prepare reporting requirements for installation BASH plans. IWDM activities will be performed on or near runways and primarily confined to the facility boundaries outlined in the work plan with periodic activities conducted offsite where mammals and birds pose a hazard to aircraft operations.

IWDM techniques for controlling birds include all appropriate methods such as, but not limited to, cage traps, decoy traps, pole traps, capture nets, pyrotechnics, pellet guns, firearms, Alpha Chloralose, Avitrol, DRC-1339, hand capture and various exclusion and harassment techniques. APHIS WS will be responsible for application of bird toxicants and will adhere to all chemical label restrictions. All pesticides will be stored onsite as designated by the installation commanding officer or at offsite APHIS WS facilities.

IWDM techniques for controlling mammals will include all appropriate methods such as, but not limited to, foothold traps, snares, calling/ shooting, shooting, cage traps and hand capture. Only APHIS WS, military security, or other designated personnel will remove captured animals. APHIS WS will be responsible for the application and maintenance of IWDM devices. All capture devices will be set to reduce the likelihood of non-target catches.

The installation will provide the APHIS WS employees assigned to this project with an area to dispose of carcasses, eggs and nesting material removed from the facilities outlined in this work plan. The Smithsonian Institution shall be contacted about shipment of certain species, collected from the depredated carcasses, to enhance bird strike identification and education.

III. STIPULATIONS AND RESTRICTIONS

a. All operations shall have the joint concurrence of APHIS WS and the Installation Commanding Officer.

   (1) APHIS WS personnel assigned to this project will remain under the direct supervision of APHIS WS.

   (2) Local oversight for this program will be the responsibility of the Installation Air Operations Officer. Ordnance / firearms will be approved by the Operations Officer / Airfield Manager and shall be registered with installation security

b. All APHIS WS activities must be performed in a manner that is complaint with all applicable local, state and federal environmental laws and regulations, and all applicable Department of Defense, Department of the Navy, and U.S Navy environmental policies, directives, and instructions. This includes but is not limited to such as the Endangered Species Act, Migratory Bird Treaty Act, Clean Water Act, DoD Instruction 4715.03 and OPNAV Instruction 5090.1C or latest version.

c. All APHIS WS activities shall be in accordance with CNICINST 3700 (dtd 7 JUL 2011).

d. Control on Private Lands: An agreement for Control of Animal Damage on Private Property (WS Form 12A) will be executed between APHIS WS and the landowner, lessee, or administrator before any APHIS WS work is conducted.

e. Control on Public Lands: An Agreement for Control of Animal Damage on Non-Private Property (WS Form 12C) or an appropriate National Environmental Policy Act (NEPA) document will be executed between APHIS WS and the public land administrator(s)/manager(s) before any APHIS WS work is conducted.

f. APHIS WS Biologist shall coordinate activities with the Natural Resource Program Manager, Air Operations Officer, and as appropriate local, state and federal officials.

g. APHIS WS will provide CNIC quarterly reports on program execution.

h. APHIS WS Biologists shall submit regular reports to the installation BWG for review. These reports shall be presented at a minimum every quarter and shall detail methodology; results of all work completed, and appropriate BASH recommendations. Additionally, reports shall include information and data collected during monitoring activities (for example but not limited to animal numbers, frequency of occurrence, spatial/temporal distributions, and supporting habitats.)

i. APHIS WS Biologists shall submit annual reports detailing the efforts of the past year. These reports shall compare monthly data, annual data, and associated trends. The report shall summarize IWDM actions and the depredation report needed for the MBTA Depredation Permit.

j. Release of any data collected in connection with this work plan shall be approved by the installation commanding officer after consulting with the public affairs office. This will not impede APHIS WS internal data collection activities and/or needs.

k. APHIS WS will use only APHIS WS employees. All APHIS WS employees will adhere to installation and APHIS WS guidelines/policies while conducting IWDM activities, and have successfully met APHIS firearm safety and other training standards as necessary.

l. The installation will provide APHIS WS employees with the appropriate security identification badges/passes and safety training to allow free movement within the facilities as outlined in the work plan. APHIS WS vehicles operating within the project area will be properly marked and equipped with an amber strobe light or lights provided by the installation. Naval Air Station personnel will provide escort in restricted areas when needed.

m. The installation will provide furnished office space, office/communications equipment and secure storage as well as pyrotechnic magazine(s) from which the work to be conducted under the work plan can be organized and implemented efficiently and safely. Office/communications equipment shall include computers, printers, telephone equipment, associated data lines and two-way radios to facilitate communications between APHIS WS and installation personnel.

n. Any equipment and supplies purchased under the terms of this agreement will remain the property of APHIS WS.

IV. EFFECTIVE DATES

The agreement shall commence on October 01, 2012, and the work plan/ financial plan shall be renewed annually for a term not to exceed five years or until modified or terminated by mutual consent of all parties. Additional installations will be considered as modifications to this agreement during an annual review to be done concurrent with the renewal process. This agreement may be cancelled by either party upon giving at least 90 days written notice to the other party. Fiscal year funding will be provided via MIPR prior to the commencement of the succeeding fiscal year (subject to funds availability).

V. ISSUANCE OF ORDER and AVAILABILITY OF FUNDING

This agreement is subject to CNIC's issuance of an order through a Military Interdepartmental Purchase Request (MIPR), DD Form 448, to the USDA/APHIS-WS. No work may be initiated, or any expenses incurred, until such time as the MIPR is received by USDA/APHIS-WS.

Funding for the continuation of this agreement is issued in anticipation of the enactment of the FY13 DOD Appropriations Act or passage of an FY13 Continuing Resolution Authority (CRA), and is subject to the provisions of whichever act becomes applicable. In the event of a Continuing Resolution Act for Fiscal Year 2013, funds provided herein are releasable only for the amount of time covered by any additional Continuing Resolution passed by Congress.

CNIC's obligation under this agreement is contingent upon the availability of appropriated funds. No legal liability on the part of CNIC, the Navy, or the Department of Defense for any payment may arise until funds are made available to CNIC.

VI. PREVIOUS AGREEMENTS

This agreement supersedes all previous agreements.

VII. PERSONNEL PERFORMANCE REVIEW

In the event, performance deficiencies arise with APHIS WS personnel, a performance review will be conducted by the local APHIS WS state program office. A formal request by the installation commanding officer will be made to the local APHIS WS state program office for deficiency resolution.

VIII. INSTALLATION APHIS WILDLIFE SERVICES BASH BUDGET FY13

The overall budget for this work plan/financial plan is $2,334,447. An estimated itemization of expenses is listed below. USDA/APHIS-WS may distribute costs between itemized categories at its discretion, subject to the standards, guidance, and limitations of DOD Financial Management Regulation (FMR), Volume 11A, Chapter 3, Section 306 and Volume 11A, Chapter 1.

Installations included in this agreement with one Biologist

a. NAS Whidbey Island
b. Naval Base Coronado – North Island
c. Naval Base Ventura County – Point Mugu
d. NAS Lemoore
e. NAS Fallon
f. NAS Corpus Christi
g. NAS Fort Worth
h. NAS Kingsville
i. NAS New Orleans
j. NAS Meridian
k. NAS Patuxent River
l. NAS Key West
m. NAS Pensacola

Installations included in this agreement with one Biologist and a Specialist

n. NAS Oceana and Naval Station Norfolk – Chambers Field
o. NAS Jacksonville and NAS Mayport
p. NAS Whiting Field
q. Pacific Missile Range Facility (PMRF)

Personnel (Salary - OPM rest of the U.S. base salary + average 20% locality adjustment + average 36% benefits)	
Wildlife Biologist (GS 9 at 17 installations)	$1,239,737
Wildlife Specialist (GS 7 at 4 installations)	$222,722
Supervisory and miscellaneous personnel (10%)	$146,246
Salaries	**$1,608,705**
Travel and miscellaneous training (e.g., Bird Strike Conference, etc.)	$69,500
Vehicle Usage (Lease, Mileage, Insurance)	$160,650
Equipment, and miscellaneous Supplies	$171,000
Logistics	**$401,150**
Sub-total	**$2,009,855**
Program Support (16.15%)	**$324,592**
Total FY13	**$2,334,447**
CNIC FY13 MIPR Total	**$2,334,447**

The distribution of the budget for this project financial plan may be varied by APHIS WS as necessary to accomplish the purpose of this agreement but may not exceed the TOTAL COST of $2,334,447 for FY13.

Funding is based on 100 percent utilization of both labor and non labor. Disposition of funds available due to program under utilization (e.g., vacant positions or hiring delays) will be jointly discussed between USDA and CNIC with a goal of utilizing funds to maximize delivery of service. FY14 through FY17 budgets will be negotiated by the parties, include a cost increase pursuant with the federally approved inflation rate and POM guidance, and be subject to the limitations in section V above, "Issuance of Order and Availability of Funding."

APPENDIX C

Migratory Bird Depredation Permit
Naval Auxiliary Landing Field Fentress

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

2. AUTHORITY-STATUTES
16 USD 703-712

REGULATIONS
50 CFR Part 13
50 CFR 21.41

1. PERMITTEE

U.S. NAVY, NAVFAC MIDLANT
ATTN: EMMETT CARAWAN
BLDG Z-144, 2ND FLR RM 218
VIRGINIA & TAUSSING AVE.
NORFOLK, VA 23511

3. NUMBER
MB734656-0

4. RENEWABLE ☒ YES ☐ NO

5. MAY COPY ☒ YES ☐ NO

6. EFFECTIVE 06/01/2012

7. EXPIRES 05/31/2013

8. NAME AND TITLE OF PRINCIPAL OFFICER *(If b1 is a business)*
CHERRYL F. BARNETT
ENV. PROGRAM MANAGER

9. TYPE OF PERMIT
DEPREDATION AT AIRPORTS

10. LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
(1) NAVAL AIR STATION OCEANA, VIRGINIA BEACH, VA; (2) NAVAL AUXILIARY LANDING FIELD FENTRESS, CHESAPEAKE, VA; (3) CHAMBERS FIELD, NORFOLK, VA; (4) NAVAL STATION NORFOLK, NORFOLK, VA; (5) NAVAL AMPHIBIOUS BASE LITTLE CREEK, VIRGINIA BEACH, VA; and (6) NAVAL MEDICAL CENTER PORTSMOUTH, PORTSMOUTH, NH

11. CONDITIONS AND AUTHORIZATIONS:

A. GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS.

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW.

C. VALID FOR USE BY PERMITTEE NAMED ABOVE.

D. You are authorized to take, temporarily possess, and transport the migratory birds specified below to relieve or prevent injurious situations impacting public safety. All take must be done as part of an integrated wildlife damage management program that emphasizes nonlethal management techniques. You may not use this authority for situations in which migratory birds are merely causing a nuisance.

(1) The following may be taken by firearm, with non-toxic shot:

- **(a) 50 of <u>each</u>: Herring gulls, Mallards, American Robins,Turkey Vultures, Black Vultures, Killdeers, Eastern Meadowlark, and Atlantic Brant,**
- **(b) 200 Ring-billed gulls,**
- **(c) 300 Laughing gulls,**
- **(d) 5 Cooper's Hawk,**
- **(e) 10 of <u>each</u>: Great Blue herons, Great Egrets and Northern Harrier,**
- **(f) 20 each: American Kestrel, Red-tailed Hawk, and Great Black-backed Gull,**
- **(g) 150 Canada Geese,**
- **(h) 100 Barn Swallow and Tree Swallows, in any species combination,**
- **(i) 100 Horned Larks,**
- **(j) 250 Mourning Doves.**

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12. REPORTING REQUIREMENTS

ANNUAL REPORT DUE WITH NEXT RENEWAL FORM
Forms can be found at: <u>www.fws.gov/migratorybirds/mbpermits.html</u>

ISSUED BY: V. Brumbs

TITLE
CHIEF, MIGRATORY BIRD PERMIT OFFICE - REGION 5

DATE
05/30/2012

(2) The following active nests (including eggs) may be destroyed: 50 Mallard nests and 150 Canada Goose nests

State restrictions: Peregrine Falcons and other bird species are listed as Endangered or Threatened by Virginia State law and therefore may not be taken, unless otherwise authorized by the Virginia Department of Game and Inland Fisheries.

E. You are authorized in emergency situations only to take, trap, or relocate any migratory birds, nests and eggs, including species that are not listed in Condition D (except bald eagles, golden eagles, or endangered or threatened species) when the migratory birds, nests, or eggs are posing a direct threat to human safety. A direct threat to human safety is one which involves a threat of serious bodily injury or a risk to human life.

You must report any emergency take activity to your migratory bird permit issuing office, Hadley, Ma, 413-253-8424 (fax), within 72 hours after the emergency take action. Your report must include the species and number of birds taken, method, and a complete description of the circumstances warranting the emergency action.

F. You are authorized to salvage and temporarily possess migratory birds found dead or taken under this permit for (1) disposal, (2) transfer to the U.S. Department of Agriculture, (3) diagnostic purposes, (4) purposes of training airport personnel, (5) donation to a public charity (those suitable for human consumption), or (6) donation to a public scientific or educational institution as defined in 50 CFR 10.12. Any dead bald eagles or golden eagles salvaged must be reported within 48 hours to the National Eagle Repository at (303) 287-2110 and to the migratory bird permit issuing office at fax 413-253-8424. The Repository will provide directions for shipment of these specimens.

G. You may not salvage and must immediately report to U.S. Fish and Wildlife Service Law Enforcement any migratory birds that appear to have been poisoned, shot, or otherwise injured as the result of criminal activity.

H. You may use the following methods of take: (1) firearms; (2) nets; (3) ONLY USDA Wildlife Services may use registered animal drugs (excluding nicarbazin), pesticides and repellents; (4) falconry abatement; and (5) legal lethal and live traps (including pole traps). Birds caught live may be euthanized or transported and relocated to another site approved by the appropriate State wildlife agency, if required. When using firearms, you may use rifles or air rifles to shoot any bird when you determine that the use of a shotgun is inadequate to resolve the injurious situation. The use of any of the above techniques is at your discretion for each situation.

I. You may temporarily possess and stabilize sick and injured migratory birds and immediately transport them to a federally licensed rehabilitator for care.

J. The following subpermittees are authorized: **Employees of Regional Environmental Group Oceana; employees of the Natural Resources Program, Department of the Navy, Norfolk, VA; and employees of USDA/APHIS/Wildlife Services.** In addition, any other person who is (1) employed by or under contract to you for the activities specified in this permit, or (2) otherwise designated a subpermittee by you in writing, may exercise the authority of this permit.

K. You and any subpermittees must comply with the attached Standard Conditions for Migratory Bird Depredation Permits. **These standard conditions are a continuation of your permit conditions and must remain with your permit.**

G. A "No Feeding Policy" must be in place.

For Canada Geese Egg Addling or Nest Destruction you MUST register each year between January 1 and June 30 at: https://epermits.fws.gov/eRCGR. You must return to website and report your take before October 31 each year.

For suspected illegal activity, immediately contact USFWS Law Enforcement at: Richmond, VA 804-771-2883

Standard Conditions
Migratory Bird Depredation Permits
50 CFR 21.41

All of the provisions and conditions of the governing regulations at 50 CFR part 13 and 50 CFR part 21.41 are conditions of your permit. Failure to comply with the conditions of your permit could be cause for suspension of the permit. The standard conditions below are a continuation of your permit conditions and must remain with your permit. If you have questions regarding these conditions, refer to the regulations or, if necessary, contact your migratory bird permit issuing office. For copies of the regulations and forms, or to obtain contact information for your issuing office, visit: http://www.fws.gov/migratorybirds/mbpermits.html.

1. To minimize the lethal take of migratory birds, you are required to continually apply non-lethal methods of harassment in conjunction with lethal control.
   [*Note: Explosive Pest Control Devices (EPCDs) are regulated by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). If you plan to use EPCDs, you require a Federal explosives permit, unless you are exempt under 27 CFR 555.141. Information and contacts may be found at http://www.atf.gov/explosives/how-to/become-an-fel.htm.*]

2. Shotguns used to take migratory birds can be no larger than 10-gauge and must be fired from the shoulder. You must use nontoxic shot listed in 50 CFR 20.21(j).

3. You may not use blinds, pits, or other means of concealment, decoys, duck calls, or other devices to lure or entice migratory birds into gun range.

4. You are not authorized to take, capture, harass, or disturb bald eagles or golden eagles, or species listed as threatened or endangered under the Endangered Species Act found in 50 CFR 17, without additional authorization.

   For a list of threatened and endangered species in your state, visit the U.S. Fish and Wildlife Service's Threatened and Endangered Species System (TESS) at: http://www.fws.gov/endangered.

5. If you encounter a migratory bird with a Federal band issued by the U.S. Geological Survey Bird Banding Laboratory, Laurel, MD, report the band number to 1-800-327-BAND or http://www.reportband.gov.

6. This permit does not authorize take or release of any migratory birds, nests, or eggs on Federal lands without additional prior written authorization from the applicable Federal agency, or on State lands or other public or private property without prior written permission or permits from the landowner or custodian.

7. Unless otherwise specified on the face of the permit, migratory birds, nests, or eggs taken under this permit must be:
   (a) turned over to the U.S. Department of Agriculture for official purposes, or
   (b) donated to a public educational or scientific institution as defined by 50 CFR 10, or
   (c) completely destroyed by burial or incineration, or
   (d) with prior approval from the permit issuing office, donated to persons authorized by permit or regulation to possess them.

8. A subpermittee is an individual to whom you have provided written authorization to conduct some or all of the permitted activities in your absence. Subpermittees must be at least 18 years of age. As the permittee, you are legally responsible for ensuring that your subpermittees are adequately trained and adhere to the terms of your permit. You are responsible for maintaining current records of who you have designated as a subpermittee, including copies of designation letters you have provided.

9. You and any subpermittees must carry a legible copy of this permit, *including these Standard Conditions*, and display it upon request whenever you are exercising its authority.

10. You must maintain records as required in 50 CFR 13.46 and 50 CFR 21.41. All records relating to the permitted activities must be kept at the location indicated in writing by you to the migratory bird permit issuing office.

11. Acceptance of this permit authorizes the U.S. Fish and Wildlife Service to inspect any wildlife held, and to audit or copy any permits, books, or records required to be kept by the permit and governing regulations.

12. You may not conduct the activities authorized by this permit if doing so would violate the laws of the applicable State, county, municipal or tribal government or any other applicable law.

(DPRD - 12/3/2011)

APPENDIX D

Commonwealth of Virginia VDGIF Official Kill Permit for NALF Fentress

58435

OFFICIAL KILL PERMIT

To Whom It May Concern:
Permission is herewith granted NAS OCEANA* (Name (landowner or lessee)) 757 433 2151 (Telephone)
800 OCEANA BLVD (Address) VIRGINIA BEACH (City) VA (State) 23460 (Zip) michael.f.wright@navy.mil (E-Mail)
and those persons named below: (State law prohibits persons convicted of wildlife violations from being designated as a shooter or carrying out the authorized activity for the landowner/lessee)
CO AUTHORIZED KILL PERMIT TEAM
NASO NATURAL RESOURCES STAFF
USDA WILDLIFE SERVICES STAFF

To kill unlimited (Quantity) (Bear, Beaver, Deer, Muskrat, Rabbit, Raccoon, Squirrel) (Circle appropriate species) damaging the property of NAS OCEANA*
in VA BEACH (County or City) for the period from 1 JAN 2013 to 31 DEC 2013
Time Restrictions: NONE - MAY KILL SUNDAYS / MAY TRAP AS REQUIRED
Damage control limited to the location described below or on the attachment. No one except those listed on this permit may assist or be present during the damage control activities. Additionally, the landowner/lessee acknowledges that all damage control operations will comply with local firearm ordinances. This permit authorizes the killing of wild animals pursuant to Sections 29.1-516, 29.1-517, 29-1-518, and 29.1-529 Code of Virginia. ~~Unless otherwise authorized on this permit, deer killed on this permit must be antlerless. No animals may be killed between 12:00 midnight Saturday and 12:00 midnight Sunday.~~ Permit is not valid unless signed by the landowner/lessee and the authorizing Department representative. Permit must be carried and available for inspection during damage control activities.
Has the landowner/lessee been issued a kill permit previously on the requested parcel? Yes ☒ No ☐
Has the parcel been hunted in the previous hunting season for deer or bear? Yes ☒ No ☐ Indicate the number of days hunted 90
How does the landowner/lessee plan to dispose of carcass(es) (*Required within 24 hours after killing a deer or bear*):
☒Burial ☒ Personal Use ☐ Charitable Organization ☒ Other CREMATION
The undersigned landowner/lessee agrees to the conditions of this permit and understands that failure to comply with these conditions may lead to its revocation or criminal prosecution.

Signature of Landowner or Lessee: _____ Date _____
Signature of Department Representative: TG Timmons Date 01/08/13

1. Describe the type of damage or hazard: AIRCRAFT STRIKE	Description and/or map of control area: *NAS OCEANA AIRFIELD MALF FENTRESS NASO DAM NECK NSA NORTHWEST ANNEX ** ANTLERED DEER SUNDAY KILL TURKEY BOBCAT } APPROVED TRAPPING APPROVED
2. Area type: Commercial/Agricultural ☐ Urban ☐	
3. Type of crop/fruit trees/livestock/other: CORN / BEANS	
4. Total acres in property/parcel: N/A	
5. Total acres of damage within property/parcel: N/A	
6. Total acres of crop/orchard: N/A	
7. Total animals killed under previous permit: ATTACHED	
8. Total number of animals killed under this permit: ATTACHED	
9. Complete if this permit was for deer:	
Antlered Bucks	
Button Bucks	
Does	
10. DCAP Yes ☐ No ☐	

Copies: Sergeant: Final Report, Green-Issuing Game Warden, Yellow-Lieutenant, Pink-Deer Program, Gold-Landowner/Permittee

WILD 4 (7/10)

APPENDIX E

List of Threatened and Endangered Species in the Commonwealth Of Virginia

Virginia Department of Game and Inland Fisheries

Special Legal Status Faunal Species in Virginia

Common Name	Scientific Name	Federal[1]	State	WAP Tier
FRESHWATER FISHES				
Blackbanded sunfish	*Enneacanthus chaetodon*		SE	I
Blackside dace	*Chrosomus (=Phoxinus) cumberlandensis*	FT	ST	III
Carolina darter	*Etheostoma collis*		ST	II
Duskytail darter	*Etheostoma percnurum*	FE	SE	I
Emerald shiner	*Notropis atherinoides*		ST	III
Golden darter	*Etheostoma denoncourti*	SOC	ST	
Greenfin darter	*Etheostoma chlorobranchium*		ST	II
Longhead darter	*Percina macrocephala*		ST	II
Orangefin madtom	*Noturus gilberti*	SOC	ST	II
Paddlefish	*Polyodon spathula*		ST	II
Roanoke logperch	*Percina rex*	FE	SE	I
Sharphead darter	*Etheostoma acuticeps*		SE	I
Shortnose sturgeon	*Acipenser brevirostrum*	FE	SE	I
Slender chub	*Erimystax cahni*	FT	ST	I
Spotfin chub	*Erimonax monachus*	FT	ST	I
Steelcolor shiner	*Cyprinella whipplei*		ST	III
Tennessee dace	*Chrosomus tennesseensis*		SE	I
Variegate darter	*Etheostoma variatum*		SE	II
Western sand darter	*Ammocrypta clara*		ST	II
Whitemouth shiner	*Notropis alborus*		ST	IV
Yellowfin madtom	*Noturus flavipinnis*	FT	ST	I
AMPHIBIANS				
	Frogs			
Barking treefrog	*Hyla gratiosa*		ST	II
	Salamanders			
Eastern tiger salamander	*Ambystoma tigrinum tigrinum*		SE	II
Mabee's salamander	*Ambystoma mabeei*		ST	II
Shenandoah salamander	*Plethodon shenandoah*	FE	SE	I
REPTILES				
	Lizards			
Eastern glass lizard	*Ophisaurus ventralis*		ST	II
	Snakes			
Canebrake rattlesnake (Coastal Plain population of timber rattlesnake)	*Crotalus horridus*		SE	II
	Turtles			
Bog (= Muhlenberg) turtle	*Glyptemys (=Clemmys) muhlenbergii*	FT(S/A)	SE	I
Eastern chicken turtle	*Deirochelys reticularia reticularia*		SE	I
Green sea turtle	*Chelonia mydas*	FT	ST	
Hawksbill sea turtle	*Eretmochelys imbricata*	FE	SE	
Kemp's ridley sea turtle	*Lepidochelys kempii*	FE	SE	

[1] FE=Federal Endangered; FT=Federal Threatened; S/A=Similarity of Appearance; FC=Federal Candidate; SOC=Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); SE=State Endangered; ST=State Threatened; WAP Tier = Virginia Wildlife Action Plan Tiered Species, from the Species of Greatest Conservation Need list that is defined in the plan: Tiers I-IV (not a legal status, Tier levels defined in the Virginia Wildlife Action Plan).

Virginia Department of Game and Inland Fisheries

Special Legal Status Faunal Species in Virginia

Common Name	Scientific Name	Federal[1]	State	WAP Tier
Leatherback sea turtle	*Dermochelys coriacea*	FE	SE	
Loggerhead sea turtle	*Caretta caretta*	FT	ST	I
Wood turtle	*Glyptemys insculpta*		ST	I
BIRDS				
Bachman's sparrow	*Aimophila aestivalis*		ST	I
Bachman's warbler (=wood)	*Vermivora bachmanii*	FE	SE	
Bald eagle	*Haliaeetus leucocephalus*	SOC	ST	II
Bewick's wren	*Thryomanes bewickii*		SE	I
Gull-billed tern	*Sterna nilotica*		ST	I
Henslow's sparrow	*Ammodramus henslowii*		ST	I
Kirtland's warbler (=wood)	*Dendroica kirtlandii*	FE	SE	IV
Loggerhead shrike	*Lanius ludovicianus*		ST	I
Peregrine falcon	*Falco peregrinus*		ST	I
Piping plover	*Charadrius melodus*	FT	ST	I
Red-cockaded woodpecker	*Picoides borealis*	FE	SE	I
Red knot	*Calidris canutus*	FC		IV
Roseate tern	*Sterna dougallii dougallii*	FE	SE	IV
Upland sandpiper	*Bartramia longicauda*		ST	I
Wilson's plover	*Charadrius wilsonia*		SE	I
MAMMALS				
American water shrew	*Sorex palustris*		SE	II
Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	FE	SE	I
Delmarva Peninsula fox squirrel	*Sciurus niger cinereus*	FE	SE	II
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*		ST	IV
Eastern puma (=cougar)	*Puma (=Felis) concolor cougar*	FE	SE	
Gray bat	*Myotis grisescens*	FE	SE	II
Gray wolf	*Canis lupus*	FE	SE	
Indiana bat	*Myotis sodalis*	FE	SE	I
Rafinesque's eastern big-eared bat	*Corynorhinus rafinesquii macrotis*		SE	I
Rock vole	*Microtus chrotorrhinus*		SE	II
Snowshoe hare	*Lepus americanus*		SE	I
Virginia big-eared bat	*Corynorhinus (= Plecotus) townsendii virginianus*	FE	SE	II
Virginia northern flying squirrel	*Glaucomys sabrinus fuscus*	FE	SE	I
MOLLUSKS				
	Freshwater Mussels			
Appalachian monkeyface (pearlymussel)	*Quadrula sparsa*	FE	SE	I
Atlantic pigtoe	*Fusconaia masoni*	SOC	ST	II
Birdwing pearlymussel	*Conradilla caelata (= Lemiox rimosus)*	FE	SE	I
Black sandshell	*Ligumia recta*		ST	III
Brook floater	*Alasmidonta varicosa*		SE	II
Cracking pearlymussel	*Hemistena lata*	FE	SE	I
Cumberland bean (pearlymussel)	*Villosa trabalis*	FE	SE	I
Cumberland monkeyface (pearlymussel)	*Quadrula intermedia*	FE	SE	I
Cumberlandian combshell	*Epioblasma brevidens*	FE	SE	I
Deertoe	*Truncilla truncata*		SE	IV

[1] FE=Federal Endangered; FT=Federal Threatened; S/A=Similarity of Appearance; FC=Federal Candidate; SOC=Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); SE=State Endangered; ST=State Threatened; WAP Tier = Virginia Wildlife Action Plan Tiered Species, from the Species of Greatest Conservation Need list that is defined in the plan: Tiers I-IV (not a legal status, Tier levels defined in the Virginia Wildlife Action Plan).

Virginia Department of Game and Inland Fisheries

Special Legal Status Faunal Species in Virginia

Common Name	Scientific Name	Federal[1]	State	WAP Tier
Dromedary pearlymussel	*Dromus dromas*	FE	SE	I
Dwarf wedgemussel	*Alasmidonta heterodon*	FE	SE	II
Elephantear	*Elliptio crassidens*		SE	IV
Fanshell	*Cyprogenia stegaria*	FE	SE	I
Finerayed pigtoe	*Fusconaia cuneolus*	FE	SE	I
Fluted kidneyshell	*Ptychobranchus subtentum*	FC		II
Fragile papershell	*Leptodea fragilis*		ST	IV
Green blossom (pearlymussel)	*Epioblasma torulosa gubernaculum*	FE	SE	I
Green floater	*Lasmigona subviridis*		ST	II
James spinymussel	*Pleurobema collina*	FE	SE	I
Littlewing pearlymussel	*Pegias fabula*	FE	SE	I
Ohio pigtoe	*Pleurobema cordatum*		SE	III
Oyster mussel	*Epioblasma capsaeformis*	FE	SE	I
Pimpleback	*Quadrula pustulosa pustulosa*		ST	IV
Pink mucket (pearlymussel)	*Lampsilis abrupta*	FE	SE	I
Pistolgrip	*Tritogonia verrucosa*		ST	IV
Purple bean	*Villosa perpurpurea*	FE	SE	I
Purple lilliput	*Toxolasma lividus*	SOC	SE	II
Pyramid pigtoe	*Pleurobema rubrum*	SOC	SE	II
Rough pigtoe	*Pleurobema plenum*	FE	SE	I
Rough rabbitsfoot	*Quadrula cylindrica strigillata*	FE	SE	I
Sheepnose	*Plethobasus cyphyus*		ST	II
Shiny pigtoe	*Fusconaia cor*	FE	SE	I
Slabside pearlymussel	*Lexingtonia dolabelloides*	FC	ST	II
Slippershell mussel	*Alasmidonta viridis*		SE	II
Snuffbox	*Epioblasma triquetra*		SE	II
Spectaclecase	*Cumberlandia monodonta*		SE	II
Tan riffleshell	*Epioblasma florentina walkeri (= E. walkeri)*	FE	SE	I
Tennessee heelsplitter	*Lasmigona holstonia*		SE	II
	Freshwater & Land Snails			
Appalachian springsnail	*Fontigens bottimeri*	SOC	SE	II
Brown supercoil	*Paravitrea septadens*	SOC	ST	I
Rubble coil	*Helicodiscus lirellus*	SOC	SE	I
Shaggy coil	*Helicodiscus diadema*	SOC	SE	I
Spider elimia	*Elimia arachnoidea*		SE	II
Spiny riversnail	*Io fluvialis*	SOC	ST	III
Spirit supercoil	*Paravitrea hera*	SOC	SE	I
Springsnail (no common name)	*Fontigens morrisoni*	SOC	SE	I
Thankless ghostsnail	*Holsingeria unthanksensis*	SOC	SE	I
Virginia fringed mountain snail	*Polygyriscus virginianus*	FE	SE	I
FRESHWATER CRUSTACEANS				
Big Sandy crayfish	*Cambarus veteranus*	SOC	SE	II
Lee County Cave isopod	*Lirceus usdagalun*	FE	SE	I
Madison Cave amphipod	*Stygobromus stegerorum*	SOC	ST	I
Madison Cave isopod	*Antrolana lira*	FT	ST	II

[1] FE–Federal Endangered; FT–Federal Threatened; S/A–Similarity of Appearance; FC–Federal Candidate; SOC–Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); SE–State Endangered; ST–State Threatened; WAP Tier – Virginia Wildlife Action Plan Tiered Species, from the Species of Greatest Conservation Need list that is defined in the plan: Tiers I-IV (not a legal status, Tier levels defined in the Virginia Wildlife Action Plan).

Virginia Department of Game and Inland Fisheries

Special Legal Status Faunal Species in Virginia

Common Name	Scientific Name	Federal[1]	State	WAP Tier
MILLIPEDES				
Ellett Valley pseudotremia	*Pseudotremia cavernarum*	SOC	ST	II
Laurel Creek xystodesmid	*Sigmoria whiteheadi*	SOC	ST	I
ARACHNIDS				
Spruce-fir moss spider	*Microhexura montivaga*	FE	SE	
INSECTS[2]				
American burying beetle	*Nicrophorus americanus*	FE		I
Appalachian grizzled skipper	*Pyrgus wyandot (=Pyrgus centaureae wyandot)*	SOC	ST	I
Buffalo Mountain mealybug	*Puto kosztarabi*	SOC	SE	I
Holsinger's cave beetle	*Pseudanophthalmus holsingeri*	SOC	SE	I
Mitchell's satyr butterfly	*Neonympha mitchellii*	FE	SE	I
Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	FT	ST	II
Virginia Piedmont water boatman	*Sigara depressa*	SOC	SE	I
MARINE MAMMALS				
Blue whale	*Balaenoptera musculus*	FE	SE	
Finback whale	*Balaenoptera physalus*	FE	SE	
Humpback whale	*Megaptera novaeangliae*	FE	SE	
North Atlantic Right whale	*Eubalaena glacialis*	FE	SE	
Sei whale	*Balaenoptera borealis*	FE	SE	
Sperm whale	*Physeter catodon (= macrocephalus)*	FE	SE	
West Indian manatee	*Trichechus manatus*	FE	SE	

[2] all insects listed as federal or state endangered or threatened are protected by regulations that fall under the Virginia Department of Agriculture and Consumer Services' jurisdiction

For further information or details regarding this list or any species listed herein, please contact:

Bureau of Wildlife Resources, Statewide Resources
Virginia Department of Game and Inland Fisheries
4010 W. Broad St.
Richmond, Virginia 23230
(804) 367-6913

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[1] FE=Federal Endangered; FT=Federal Threatened; S/A=Similarity of Appearance; FC=Federal Candidate; SOC=Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); SE=State Endangered; ST=State Threatened; WAP Tier = Virginia Wildlife Action Plan Tiered Species, from the Species of Greatest Conservation Need list that is defined in the plan: Tiers I-IV (not a legal status, Tier levels defined in the Virginia Wildlife Action Plan).

APPENDIX F

Species Guilds Observed at NALFF Airfield, October 2011 through September 2012

GUILDS AND SPECIES	TOTAL OBSERVATIONS
Blackbirds/Orioles	**27,252**
Mixed Blackbirds	25,918
Red-winged Blackbird	1,074
Common Grackle	251
Brown-headed Cowbird	9
Swallows	**8,325**
Tree Swallow	7,703
Purple Martin	464
Barn Swallow	158
Starlings	**3,801**
European Starling	3,801
Thrushes	**1,075**
American Robin	1,064
Eastern Bluebird	11
Pigeons/Doves	**880**
Rock Pigeon	551
Mourning Dove	329
Waterfowl	**715**
Snow Goose	530
Canada Goose	141
Tundra Swan	43
Mallard	1
Warblers	**595**
Yellow-rumped Warbler	578
Common Yellowthroat	16
Yellow-breasted Chat	1
Meadowlarks	**474**
Eastern Meadowlark	474
Raptors	**212**
Turkey Vulture	126
Red-tailed Hawk	49
American Kestrel	11
Black Vulture	9
Cooper’s Hawk	7
Northern Harrier	7
Bald Eagle	2
Sharp-shinned Hawk	1
Shorebirds	**210**
Killdeer	209
Least Sandpiper	1
Crows/Ravens	**202**
American Crow	202

Cont. next page.

GUILDS AND SPECIES	TOTAL OBSERVATIONS
Finches/Bunting	**163**
Northern Cardinal	107
Blue Grosbeak	37
Indigo Bunting	10
American Goldfinch	9
Jays/Magpies	**98**
Blue Jay	98
Sparrows	**90**
Song Sparrow	34
Unknown Sparrow	23
White-throated Sparrow	17
Chipping Sparrow	15
House Sparrow	1
Woodpeckers	**79**
Northern Flicker	67
Pileated Woodpecker	9
Red-bellied Woodpecker	2
Downy Woodpecker	1
Mimics	**75**
Northern Mockingbird	42
Brown Thrasher	28
Gray Catbird	5
Chickadees/Titmice/Wrens	**70**
Carolina Chickadee	29
Carolina Wren	33
Tufted Titmouse	8
Gallinaceous Birds	**30**
Wild Turkey	23
Northern Bobwhite	7
Waxwings	**25**
Cedar Waxwings	25
Herons/Bitterns	**19**
Great Blue Heron	15
Green Heron	4
Towhees	**15**
Eastern Towhee	15
Gulls	**13**
Laughing Gull	7
Unknown Gull	3
Ring-billed Gull	2
Herring Gull	1
Egrets	**9**
Great Egret	9

Cont. next page.

GUILDS AND SPECIES	TOTAL OBSERVATIONS
Swifts	**8**
Chimney Swift	8
Flycatchers	**7**
Eastern Kingbird	3
Eastern Phoebe	3
Great Crested Flycatcher	1
Unknown	**6**
Unknown	6
TOTAL	**44,448**

APPENDIX G

Wildlife Attractants on the Active Operating Area and within 10,000 feet, Naval Auxiliary Landing Field Fentress

NALF Fentress Wildlife Attractants on the Airfield Operating Area (AOA)

Specific areas surrounding NALF Fentress have been identified as significant wildlife attractants that pose a potential risk to aviation safety (Figure 22).

1. Airfield Drainage

    1.1. Observations of the AOA following long periods of heavy rain did not show any sign of standing water.

2. Vegetation Management

    2.1. 5 approach secondary growth and woodlands.
    2.2. 23 approach secondary growth and woodlands.
    2.3. Secondary growth and woodlands adjacent to the runway.
    2.4. Secondary growth and woodlands adjacent to the taxiway.

NALF Fentress Wildlife Attractants within 10,000 feet of Operating Area

3. Wetland Features

    3.1. Man-made linear pond in agricultural field (on Navy property).
    3.2. Wooded wetland (on Navy property).
    3.3. Two freshwater pond impoundments.
    3.4. Intracostal waterway/Saltwater marsh.

4. Agricultural Features

    4.1. Agricultural fields are the dominating land feature surrounding NALF Fentress.

5. Golf Courses

    5.1. Battlefield Golf Course.

Figure 22: Identified Wildlife Attractants on the AOA and within 10,000 feet of NALFF.

APPENDIX H

Wildlife Attractants within 5 miles,
Naval Auxiliary Landing Field Fentress

NALF Fentress Wildlife Attractants within 5 miles of Operating Area

Specific areas surrounding NALF Fentress have been identified as significant wildlife attractants that pose a potential risk to aviation safety (Figure 23). Numbers 1 and 2 were used to identify attractants on the active operating area and therefore were left off of this section.

3. Wetland Features

    3.01. Neighborhood pond impoundments.
    3.02. Intracoastal Waterway/Saltwater Marsh.
    3.03. Borrow pit.

4. Agricultural Features

    4.01. Agricultural fields are the dominating land feature surrounding NALF Fentress.

5. Golf Courses

    5.01. Signature at West Neck
    5.02. Virginia Beach National
    5.03. Stumpy Lake

Figure 23: Wildlife Attractants within 5 miles of NALFF.

Enclosure 3. NAS Oceana Bird Animal Strike Hazard (BASH) Program (NASOCEANAINST 3750.4) and Airfield Obstruction Vegetation Management Zones Maps

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DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO
NASOCEANAINST 3750.4
N32
4 Feb 2014

NAVAL AIR STATION OCEANA INSTRUCTION 3750.4

Subj: NAVAL AIR STATION OCEANA BIRD/ANIMAL AIRCRAFT STRIKE HAZARD (BASH) PROGRAM AND INSTALLATION BASH PLAN

Ref: (a) 14 CFR 139.337
(b) USDA APHIS AGREEMENT #34-WT-13-7100-0323-IA
(c) FAA Manual: Wildlife Hazard Management at Airports
(d) FAA Advisory Circular 150/5200-32
(e) FAA Advisory Circular 150/5200-33
(f) FAA Advisory Circular 150/5200-34
(g) FAA Advisory Circular 150/5200-36
(h) FAA Advisory Circular 150/5200-37
(i) FAA Report: Wildlife Strikes 1990-2011
(j) FAA Eastern Region Bulletin AEA-03-10
(k) DODINST 4150.07
(l) OPNAVINST 3500.39
(m) OPNAVINST 3750.6
(n) OPNAVINST 5090.1
(o) OPNAVINST 5530.13
(p) OPNAVINST 6250.4
(q) NAVFAC P-73 Volume II
(r) NAVAIR 00-80T-114
(s) CNIC BASH Manual
(t) CNICINST 3700
(u) CNICINST 3700.3
(v) NAS Oceana/NALF Fentress Integrated Natural Resources Management Plan
(w) NAS Oceana/NALF Fentress/Dam Neck Annex Integrated Pest Management Plan

Encl: (1) BASH Program Reference Navigator
(2) Airfield Wildlife Activity Log
(3) BASH Strike Report
(4) Aircraft Wildlife Strike Triggering Event Checklist
(5) NAS Oceana Gridmap
(6) NALF Fentress Gridmap
(7) BASH Birdstrike Remains Collection Flowchart
(8) Wildlife Hazard Management Plan Build Checklist
(9) Wildlife Hazard Management Plan Annual Evaluation
(10) BASH Program Self-Assessment Checklist
(11) USDA Wildlife Hazard Assessment for NAS Oceana
(12) USDA Wildlife Hazard Assessment for NALF Fentress

1. Purpose. This instruction establishes an Integrated Wildlife Damage Management (IWDM) strategy as the foundation for the installation's daily bird/animal aircraft strike hazard (BASH) Plan and BASH Program. This instruction also provides the intra-departmental collaborative actions required to conduct daily BASH mitigation onboard Naval Air Station (NAS) Oceana and Naval Auxiliary Landing Field (NALF) Fentress. The NAS Oceana

BASH Program is an environmentally compatible animal mitigation strategy, developed to sustain an operational margin for aviation safety. The goal is to identify and sustain IWDM practices across each installation department with the BASH Program and BASH Plan responsibilities. The IWDM strategy works to synchronize BASH Program actions with the installation Integrated Natural Resources Management Plan (INRMP), the Installation Pest Management Plan (IPMP) and other pertinent installation environmental plans in accordance with references (a) through (w), and enclosures (1) through (12).

2. Cancellation. NASOCEANAINST 3750.2B and 3750.3.

3. Scope. The January 15, 2009 commercial A320 jetliner crash on the Hudson River in New York City might be the most public BASH-related aircraft mishap in recent history. From 1960 to the present, 333 military aircraft have been destroyed, killing 150 personnel due to bird/animal aircraft strikes. Consequently, airport bird and animal aircraft strike hazards that are left unmanaged are likely to damage and/or destroy aircraft, as well as pose a lethal threat to the aircrew that fly them.

To mitigate this unacceptable risk to aviation safety, this instruction will blend airport management best practices from the Federal Aviation Administration (FAA), Department of Defense (DOD), and Department of the Navy (DoN). This process will underpin the NAS Oceana BASH Program and define the airfield management practices utilized in the NAS Oceana IWDM and BASH cycles. The NAS Oceana BASH Program orchestrates each department's preparation for flight operations through the integration of grounds maintenance, wildlife habitat modification and wildlife harassment and depredation within the airport operations area.

The NAS Oceana BASH Program also represents a significant safety pillar in the NAS Oceana Safety Management System (SMS). The integration of the FAA's SMS and Safety Risk Management (SRM) methodology into this instruction to identifying potential aviation hazards at airports and defining mitigation strategies will focus and align the DoN's Operational Risk Management (ORM) practices into definable airport program actions and daily routines. These daily airport safety routines will be merged to manage airfield equipment, procedures, and personnel as a system greatly enhancing BASH Program awareness and effectiveness.

C. W. CHOPE

Distribution: Electronic only

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TABLE OF REVISIONS & CHANGES

NAS OCEANA INSTRUCTION	DATE SIGNED
BASH PROGRAM AND INSTALLATION BASH PLAN	4 Feb 14

CHANGE #	INTERIM CHANGE IMPLEMENTED	DATE APPROVED	SIGNATURE

1. BASH Program Definitions. The following terms and definitions apply to this instruction:

a. AFF. Airfield Facilities Division. The personnel responsible for transient line and airfield support. AFF is responsible for the parking and servicing of transient aircraft, and the airfield maintenance for visual landing aids and E-28 arresting gear.

b. AFM. Airfield Manager. The AFM is responsible for the maintenance and safe operation of the airfield.

c. AICUZ. Air Installation Compatible Use Zones. Land compatibility areas defined in relation to aircraft noise and flight patterns to provide the safest possible airport operation with existing surrounding communities.

d. AMC. Acceptable Maintenance Condition. Used in the airport wildlife hazard management plan, the AMC is the threshold to which a facility (land, water, building) characteristic can be allowed to deteriorate to before it becomes attractive to wildlife, defeating the protective measures put in place to effectively manage the wildlife hazards.

e. AOA. Airport Operations Area. The total surface area of the airport, to include all paved surfaces, and the areas bounded by the taxiway, takeoff, and landing surfaces.

f. AODO. Air Operations Duty Officer. 24-hour Airfield Operations representative located at Base Operations.

g. ARFF. Aircraft Rescue and Fire Fighting. The Fire and Emergency Services (F&ES) personnel that are specifically assigned to perform aircraft crash and rescue response at the airfield.

h. ASAP. Aviation Safety Awareness Program. The online aviation hazard reporting program sponsored by Commander, Naval Air Forces (CNAF).

i. ATC. Air Traffic Control Division. The personnel responsible for Radar Approach and Departure Control, Tower and Ground control of aircraft, and all movement of ground vehicles.

j. ATIS. Automatic Terminal Information Service. A radio broadcast to deliver non-controlling airport/terminal area meteorological and flight planning information in real-time.

k. Active Dispersal. Harassment techniques employed to disperse birds and/or animals from airfield and surrounding areas. Methods may include chase, pyrotechnics, bioacoustics, and depredation.

l. Aircraft Strike. Any contact between a bird and/or animal, and an aircraft, whether or not damage occurred. Any carcass within 250 feet of runway centerline, or 1,000 feet of a runway end, or on a taxiway or anywhere else on or off the AOA that has no compelling reason that death occurred any other way.

m. BDDT. BASH Detection and Dispersal Team. The trained and designated transient line airfield support crew who reports BASH Hazard Conditions and disperses problem birds and/or animals via harassment techniques – commonly vehicle chase, bioacoustic, or propane cannon operation. The BDDT can respond to immediate BASH threats as reported by the tenant commands, pilots, transient aircraft, and/or as observed by the Facility Watch Supervisor (FWS), AODO, or the airfield management staff.

n. BHC. Bird Hazard Condition. A bird hazard alert condition used to warn aircrew of bird activity. While BHC does not state animal aircraft strike hazards, the FAA uses BHCs to report all BASH concerns for standardization.

o. BHC Heavy. A heavy concentration of birds (more than 15 large or 30 small) on or immediately adjacent to the active runway or aircraft approach areas that present an immediate hazard to flight operations.

p. BHC Moderate. A BHC indicating moderate concentrations of birds (5-15 large or 15-30 small) is observable, and are in a location that represents a probable hazard to flight operations.

q. BHC Light. Sparse bird activity (less than BHC Moderate) on the airfield and/or AOA posing a low probability of aircraft striking hazard.

r. BMP. Best Management Practice. An identified procedure used to standardize a BASH Program element or outcome.

s. BWG. BASH Working Group. Local committee of base and unit offices tasked with the management of bird/animal aircraft strike hazards. Executes and makes recommendations to the BASH Program.

t. BASH. Bird/Animal Aircraft Strike Hazard. General term to describe bird/animal aircraft strike hazards and programs.

u. BASH Advisory. A radio transmission from ATC or aircrew reporting specific bird and/or animal hazard information. May be real time or disseminated in ATIS broadcasts.

v. Bioacoustics. Recorded tapes of bird and/or animal distress calls used by the Natural Resources department, the USDA WS division, and/or the BDDT to scare birds and/or animals off the airfield.

w. Depredation. Technique used to remove problem birds and animals permanently from the airfield and hangars when other scare tactics are ineffective. Methods may include shooting, trapping, and the use of registered toxicants. All lethal controls will be completed by the Natural Resources staff or USDA-Wildlife Services staff.

x. FIFRA. The Federal Insecticide, Fungicide, and Rodenticide Act. The predominant law governing herbicide, insecticide, pesticide, and rodenticide use.

y. Facility Watch Supervisor (FWS). The senior-most qualified air traffic control supervisor on watch, unless the entire facility is closed by official naval message.

z. Ground Electronics Maintenance Division (GEMD). The personnel responsible for airfield operation and maintenance of airport lighting control, radar operation, and airport communications systems.

aa. Integrated Natural Resources Management Plan (INRMP). A federal requirement under the Sike's Act, the INRMP is the long term environmental planning document used to guide installation management of natural resources to support the installation mission. This guidance ensures that natural resources conservation measures and military operations on the installation are integrated and consistent with federal and state stewardship and legal requirements.

bb. Natural Resources (NR). Installation department tasked to help actively and responsibly manage the natural resources on DOD lands. The Natural Resources Manager (NRM) is responsible to the Public Works Officer (PWO) via the Environmental Program Director (EPD).

cc. Propane Cannon. A stationary, non-projectile, sound producing device used to disperse birds.

dd. Pyrotechnics. Noise producing devices discharged from 6mm pistols, 15mm launchers or 12 gauge shotguns. Used by USDA-WS and NR to disperse birds away from runways and airfield.

ee. SA. Safety Assurance. A critical element of airport safety management systems. The SA process proactively identifies airport hazards and constructs blended hazard mitigation through improved procedural guidance, training, and airport program self-inspections.

ff. SFFO. Safe for Flight Operations. A condition of operational readiness for airfield operations. Performance of SFFO is a critical Safety Assurance link for the airfield safety management system.

gg. SMS. Safety Management Systems. SMS is the FAA's systematic approach to managing airport safety, including the necessary organizational structures, accountabilities, policies, and procedures.

hh. Snarge. The residue on an airplane after a bird/animal aircraft strike.

ii. SRM. Safety Risk Management. SRM is the core operational component of SMS, and is a four step process. At a minimum, SRM: Establishes a system for identifying safety hazards; establishes a systematic process to analyze hazards and their risks; provides regular assessment to ensure mitigations are effective; establishes and maintains records that document the airport's SRM processes.

jj. USDA-WS. The United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services (WS). A federal agency partnered with CNIC to provide daily BASH Program technical assistance, integrated wildlife damage management on the installation and provide BASH training to reinforce the integrated wildlife damage management practices necessary to provide sustainable levels of aviation safety.

kk. WESS. Web-Enabled Safety System. The Naval Safety Center's online aviation hazard reporting and data retrieval system. The U.S. Navy standard for reporting bird and/or animal aircraft near-misses and aircraft strikes.

2. BASH Program Framework. Any program as complex as BASH onboard a Naval Air Station requires a framework to coordinate the collaborative equities and action necessary to protect aircraft and personnel, while preserving the mission. Consequently, the BASH Program must provide a framework that, at a minimum, addresses the following:

a. Establishment of a BASH Working Group (BWG). Ensure BWG convenes quarterly to address seasonal migration, BASH adaptability and tenant awareness.

b. Identify wildlife aircraft strike hazards in the local geographical environment. Hazards shall be identified by regular monitoring of wildlife through the development and monitoring of a Wildlife Hazard Assessment on at least an annual basis.

c. Establish BASH mitigation procedures (active and passive) relative to the identified hazards.

d. Develop methods to monitor the effectiveness of the installation BASH program elements to ensure changes are made as

necessary. Data shall be collected and compared from one year to the next in order to measure program effectiveness over time.

e. Make real-time BASH data available to aircraft operating to and from the NAS Oceana and NALF Fentress facilities via ATIS.

f. Establish procedures for a BDDT to deal with emergent issues that threaten flight operations.

g. Ensure compliance with all applicable DOD and DoN policies and directives, as well as all federal, state, and local environmental laws and natural resource regulations and policies through the maintenance of the Installation Natural Resource Management Plan (INRMP).

3. Integrated Wildlife Damage Management Cycle. In eastern Virginia, there is an abundance of wildlife and a generally mild climate conducive to the migration of all bird types in and around the Chesapeake Bay Region. The geographic proximity of NAS Oceana and NALF Fentress to the Atlantic Ocean ensures they remain replete with all types of wildlife.

At NAS Oceana and NALF Fentress, wildlife presents a clear danger to the conduct of all types of aircraft operations. As such, NAS Oceana and NALF Fentress shall implement the Integrated Wildlife Damage Management (IWDM) Cycle, Plate 1, to identify and mitigate Bird/Animal Aircraft Strike Hazards (BASH) to flight operations. IWDM shall be used as the main strategic focus within the BASH Program by all departments, including tenant aviation activities, to form BASH Program actions.

a. Step One: Defining and Refining Wildlife Aviation Hazards. The NAS Oceana and NALF Fentress Wildlife Hazard Assessments (WHAs) and installation INRMP provide the biological science behind what kind of wildlife – insects, rodents, raptors, mammals – that make these air facilities home. By definition, the 2012 WHAs provide the baseline for initial installation hazardous wildlife management practices. A WHA is always under review to identify new wildlife species, and therefore, determine the need for possibly refining the methods for how hazardous wildlife management should be conducted. When discovered, these refinements will be considered by the BASH Working Group (BWG).

b. Step Two: Conduct Wildlife Habitat Evaluations. As the seasons change, wildlife change their feeding, nesting, reproduction, and hibernation patterns – subsequently changing their immediate hazard to aircraft operations in all three strategic priority zones. Step two involves the identification of seasonal changes and their effects on the overall BASH management of the existing habitat in strategic management zones

one, two, and three. This step is under constant evaluation, 365 days a year.

c. Step Three: Determine Wildlife Habitat Modifications. As the first two stages of the IWDM Cycle occur naturally, the existent habitat in strategic management zones one and two will be evaluated for effectiveness in accordance with BWG prescribed and approved modifications. These prescribed changes may be as simple as the introduction of wildlife harassment, changing the wildlife habitat to be less attractive, or as complicated as preparing infrastructure projects that require the review and approval of the BWG, and inclusion in the overall Wildlife Hazard Management Plan (WHMP) or its elements. This will be at the discretion of the Air Operations Officer and the BWG.

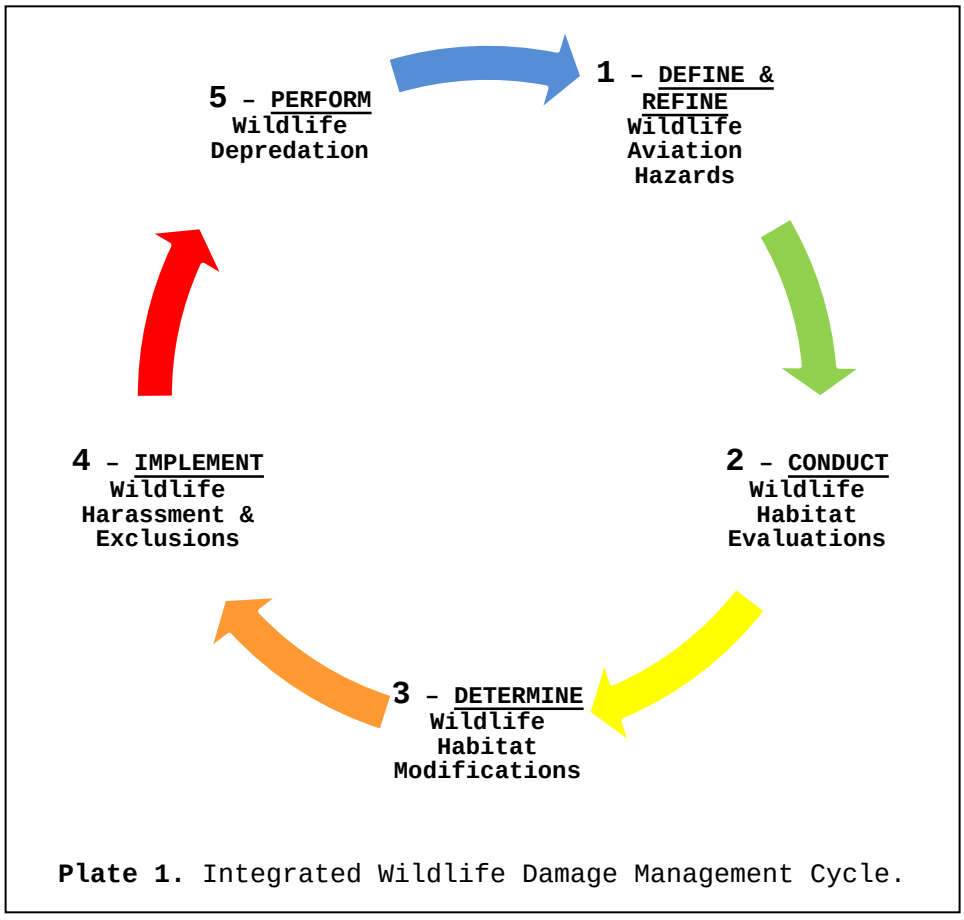


Plate 1. Integrated Wildlife Damage Management Cycle.

d. Step Four: Implement Wildlife Harassments and Exclusions. Implementing wildlife harassments includes the application of bioacoustic sounds, loud booming from propane cannons, bright lights, vehicles, man on foot, sirens, USDA-WS expended non-lethal pyrotechnics, etc. Also included in this category are wildlife deterrent devices that discourage the roosting, nesting, foraging, and other habits of wildlife. Direct harassment of hazardous wildlife is the preferred immediate wildlife hazard clearing methodology at NAS Oceana and

NALF Fentress. Unfortunately, some species become accustomed to the harassment methodologies, making step five, depredation, a required final step in managing wildlife hazards to aviation safety.

e. Step Five: Performing Wildlife Depredation. Step five in the IWDM Cycle is depredation. All depredation actions conducted at NAS Oceana and NALF Fentress shall be carried out by USDA and Natural Resources personnel, and only under the approved and appropriate wildlife harassment and depredation federal, state, and if necessary, local permits.

(1) Depredation. The removal of a species from the air facilities is the last resort in the IWDM Cycle, and is only determined to be the correct course of action if all other methodologies have failed to manage the wildlife hazard. There are, however, some instances when depredation is the only option available to make the flying environment safe.

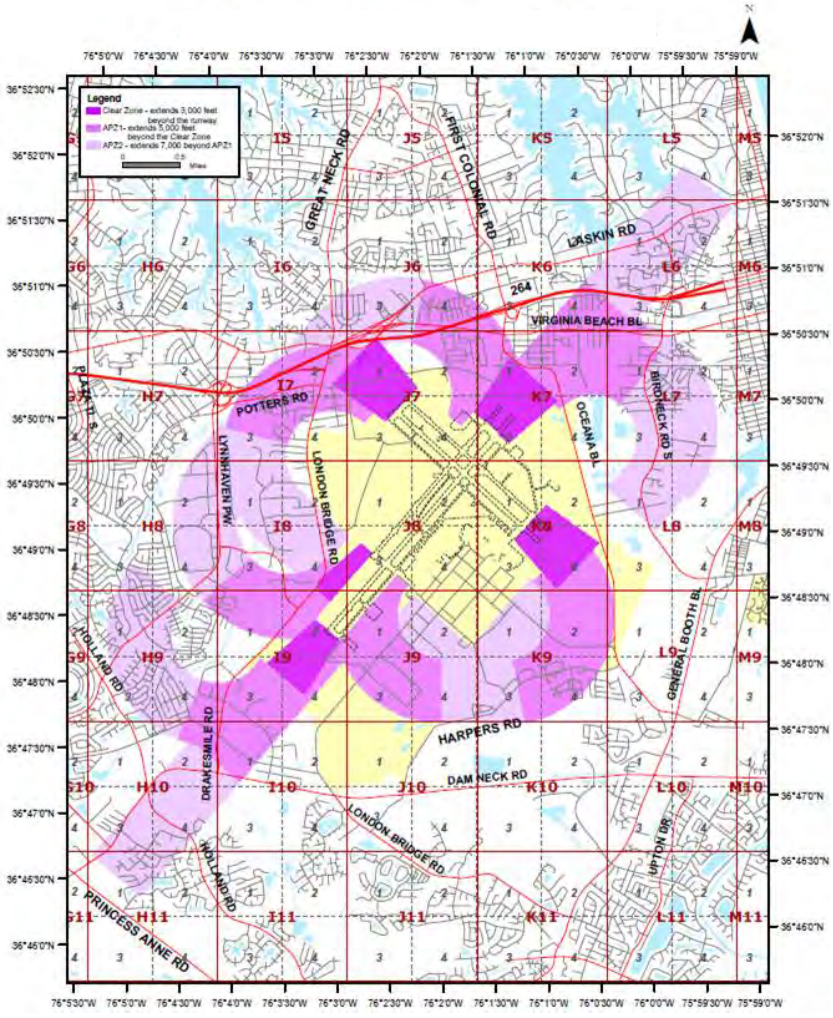


Plate 2. NAS Oceana AOA and control zones.

4. Wildlife Hazard Assessments. Through a Commander, Navy Installations Command (CNIC) initiative with the USDA-WS, a Wildlife Hazard Assessment (WHA) was completed for both NAS Oceana and NALF Fentress, enclosures (11) and (12). The WHAs provide accurate data on the types and numbers of wildlife observed at both airfields. The WHAs also document the indigenous wildlife's behaviors and habitat attractants. This biological data, in

conjunction with the INRMP data and requirements, produces the framework necessary to apply Operational Risk Management (ORM) to the airfields' BASH Program by defining a balance of reported BASH hazards from the observed daily and seasonal monitoring of the wildlife hazards for aircraft operating at or in the vicinity of NAS Oceana and NALF Fentress.

Both of the installation WHAs are focused on the Airport Operations Area (AOA), and the aircraft approach and departure corridors. The areas highlighted in yellow over the runway and taxiway surfaces in Plates 2 and 3 depict the primary AOAs for NAS Oceana and NALF Fentress, and the aircraft control zone areas in magenta.

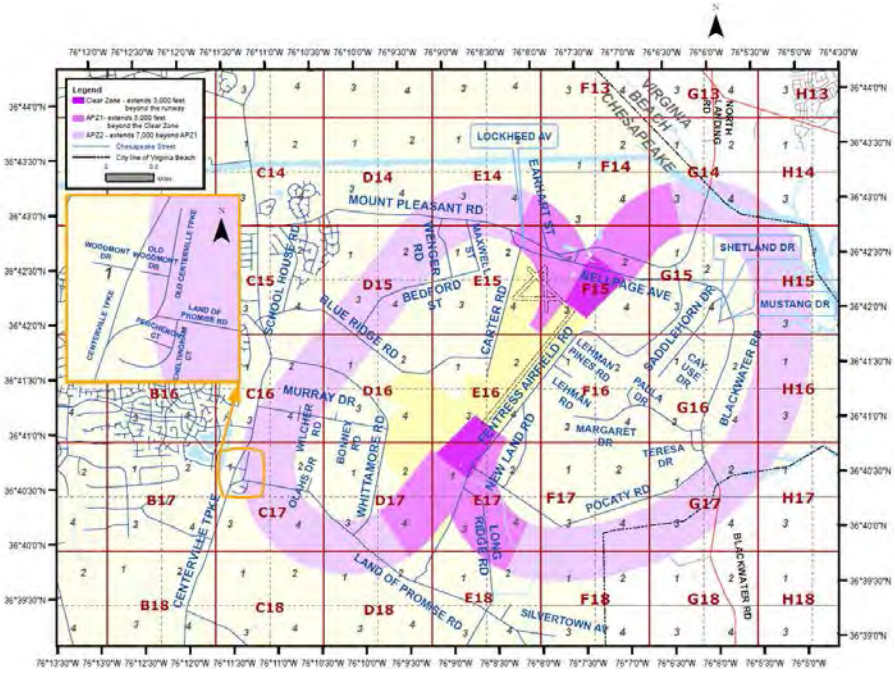


Plate 3. NALF Fentress AOA and control zones.

Currently there are over 300 turbine engined aircraft stationed at NAS Oceana to include 18 F/A-18 squadrons, T-34C turboprop aircraft, and a C-40 squadron. Due to the regionalization of DOD assets, every kind of propeller-driven, rotary-wing, turbine powered transport, and tactical jet aircraft in the DOD inventory routinely conduct aircraft operations from NAS Oceana and NALF Fentress each day. The FAA recommends that airports that primarily operate turbine engine powered aircraft follow a BASH plan that manages wildlife attractants based on a perimeter of 10,000 feet of separation distance from the AOA, Plate 4. This is not possible due to the geographic reality that NAS Oceana is situated within a 2 statute mile radius of the Atlantic Ocean. Also, significant portions of certain aircraft instrument approaches are actually located off-shore. As such, there will be areas suggested for BASH management that will always be out of the control of any BASH effort.

Accordingly, the IWDM practices for the Installation BASH Program are tailored to fit the existing geographical and

aeronautical constraints, focusing the primary wildlife damage management to the depicted AOAs and aircraft travel corridors. These are the areas that the NAS Oceana Installation BASH Program will prioritize into zones to establish the safest flying environment achievable.

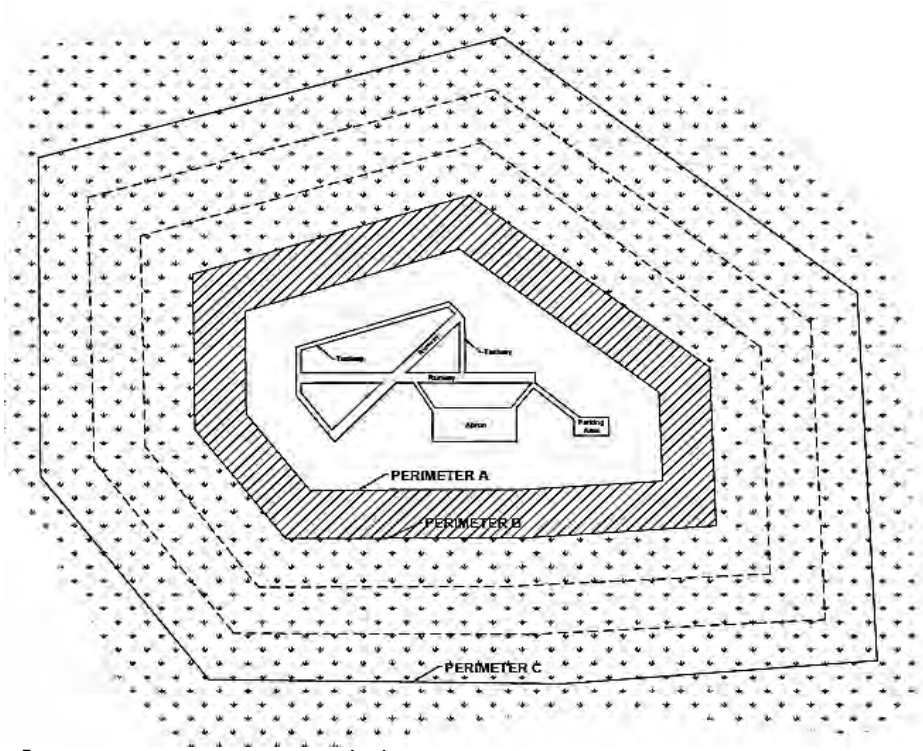


Plate 4. FAA recommended BASH attractants management zones.

5. BASH Strategic Priority Zones. Due to government property management constraints and geographic realities of the NAS Oceana and NALF Fentress air facilities locations, there will be three active BASH management priority zones that will implement the NAS Oceana BASH Program strategy:

a. First Strategic Priority Zone*:* Perimeter “A” represents the NAS/NALF AOAs.

b. Second Strategic Priority Zone*:* Perimeter “B” represents the Aircraft Control Zones on government property.

c. Third Strategic Priority Zone*:* Perimeter “C” represents the Aircraft Control Zones off government property.

References (a) through (j) underscore the fact that 90 percent of all aircraft strikes occur between the surface and 3,000’ Above Ground Level (AGL), with 78 percent occurring from the surface to 1,000’ AGL. Managing wildlife aircraft strike hazards requires managing not only wildlife habitats and attractants located on the airport’s operating surfaces, but also the land located under the primary flight paths of our military aircraft.

From time to time, this means that BASH Program activities will be proposed for IWDM operations outside the boundaries of our federal property, on a case-by-case basis. It is important to understand that successful IWDM is an ongoing process that slowly, over time, hardens our installation airfields against BASH hazards. The Commanding Officer will put forth all reasonable efforts to collaborate with the cities of Virginia Beach and Chesapeake to bring the highest level of BASH

awareness and sustain the most realistic, and continuous IWDM program possible.

6. BASH Operational Risk Management (ORM). The Naval Aviation Safety Program (NASP)requires the integration of the five-step ORM process for all aviation procedures and programs: 1-Identify Hazards; 2-Assess Hazards; 3-Make Risk Decisions; 4-Implement Controls; and 5-Supervise/Monitor for Necessary Changes. Proper ORM for the Installation BASH Program starts by identifying the wildlife risks to aircraft operations at the airfields. This is the function of the airfield WHAs. By applying proven IWDM methodologies based on the observed wildlife behavioral data in the WHAs, informed risk decisions can be made by deciding on the probability and severity of the risks of wildlife to flight operations. This is the methodology for the Installation BASH Plan to define the necessary risk mitigation steps of the NASP ORM and SMS SRM processes. The final ORM/SRM process is the responsibility and function of the BASH Working Group.

Note

The Air Operations/Assistant Air Operations Officer and Airfield Manager shall be notified any time local BASH conditions change to Heavy AND are judged to present an imminent threat to ongoing flight operations.

a. BHC Situational Awareness/Making Active Risk Decisions. In order to allow both airfield operators and aircraft operators to make acceptable real-time risk decisions, the BHC must be observed and reported to the aircraft operating at these airfields, with an understanding that the BHC is a report of a temporary condition, as wildlife is constantly in motion on the airfields. This process is completed through the following procedures:

(1) Establishing SFFO. At least twice in each 24-hour operational period, typically just after sunrise and just prior to sunset, the NAS Oceana and NALF Fentress airfields are “certified safe for flight operations (SFFO),” to include being assessed for BHCs. In addition, SFFO is “reset” after every significant weather event, aircraft emergency, and prior to each runway change. This ensures SMS Safety Assurance prior to airfield operations.

(a) During the SFFO period, for NAS Oceana, AFF and GEMD work together to perform the “airfield set-up” requested by the ATC FWS that is favorable based on existing and forecasted airfield meteorological conditions. AFF will adjust, as necessary, the visual landing aids to the duty runways, FOD check all runway and taxiway surfaces, and perform airfield arresting gear checks while GEMD adjusts and verifies airfield lighting, radio communications, and other essential airfield equipment checks.

(b) At NALF Fentress, a similar routine will be conducted, led by the NALF Fentress Airfield Maintenance Crew and ARFF duty crew.

(c) Once all Air Operations Divisions report their airfield checks are complete and satisfactory, the NAS Oceana FWS will report airfields are SFFO to the AODO. Integral to this SFFO report is the recommendation to the FWS of the initial BHC setting, based on observations from each airfield’s BDDT.

b. BHC Observation and Active Reporting. The Air Operations Officer, Air Traffic Control Facility Officer (ATCFO), AODO, FWS, or designated representative ensures hazardous conditions are reported. Declaration of a BHC will be based on the following:

(1) Visual observation of bird activity on or near airfield by Tower or BDDT personnel.

(2) Information relayed by ATC RADAR, airborne or taxiing aircraft.

(3) Observations relayed to Tower by any of the following personnel: AFF, weather observers, GEMD, Public Works airfield lighting technicians, FOD Sweepers, grass mowers, ARFF crews, security police, tenant squadrons, and transient aircraft crews, or any other personnel driving on the airfield.

c. BHC Airfield Settings. The following BHCs will be utilized at NAS Oceana and NALF Fentress to inform aircrew and support personnel of the currently observed bird threat to operations. Bird locations should be given with the condition code.

(1) BHC Heavy (Severe). Defined as heavy concentrations of birds (more than 15 large or 30 small) on or immediately adjacent to the active runway or aircraft approach areas that present an immediate hazard to flight operations. Active dispersal MUST BE CONSIDERED during this condition. BHC Heavy may also be declared when birds of any size or quantity present an immediate hazard.

****** WARNING ******

Landing or departing in condition HEAVY may result in aircraft damage from a bird strike.

(2) BHC Moderate. Defined as moderate concentrations of birds (typically 5-15 large or 15-30 small) observable in locations that present a probable hazard to flight operations. Positive actions may be required to disperse the birds away from the AOA.

(3) BHC Light. Sparse bird activity on and above the AOA (less than BHC Moderate) with a lower probability of aircraft striking hazard.

Note

Personnel making BHC reports may not necessarily follow the exact bird counts as mentioned, as flying birds must sometimes be estimated as a mass. As such, these numbers for BHCs are just a guide. If, in the judgment of the Tower Supervisor or Landing Signal Officer (LSO), the number of birds is less than those indicated for a specific BHC, but a hazard is believed to exist, a higher BHC may be declared. Example: Condition HEAVY may be declared if one Canada Goose is immediately adjacent to the active runway.

d. Seasonal BHC Phases. The seasonal migration as wildlife prepares for winter and spring causes a change in the otherwise normal wildlife activities, and populations. The FAA has completed several studies relating to the change of seasons effect on BASH conditions, references (c) and (i). As such, NAS Oceana and NALF Fentress will align BASH activities and aircraft notifications with seasonal changes as well to provide an additional ORM-layer of protection for our station and transient aircraft. Specifically:

(1) Passive Aircrew Notification: BASH Phase I. The Phase I portion of the year is the part of the season that occurs outside the normal migratory habits of the local indigenous wildlife species. This represents the portions of the year that are less likely to produce an abnormally high amount of BASH hazards to aircraft. This condition will be reported in the DOD FLIP publications for general flight planning purposes to all transient and local aircraft custodian activities.

(2) Passive Aircrew Notification: BASH Phase II. The Phase II portion of the year is the most active migratory periods of the year at NAS Oceana and NALF Fentress due to the high levels of wildlife migration of indigenous and transitory species. This has been determined to be the most likely periods of the year to produce a BASH event. This condition will be

reported in the DOD FLIP publications for general flight planning purposes to all transient and local aircraft custodian activities.

****** WARNING ******

During NAS Oceana and NALF Fentress BASH Phase II periods of the year, performing aircraft operations below 3,000' AGL within +/- 1 hour of local sunrise and sunset, when bird activity is generally at the highest statistical period for a bird strike with an aircraft, is not advisable. It is during these times

that airfield BASH prevention efforts may be overwhelmed, and ineffective at wildlife dispersal. Aircraft operating at or below 1,000' AGL should exercise extreme caution, and should only be of an operational necessity due to the increased potential of a bird strike event.

7. BASH Detection and Dispersal Team (BDDT). The primary responsibility for wildlife detection and dispersal falls under the control of the BDDTs for NAS Oceana and NALF Fentress. A trained BDDT will be established for each airfield to carry out detection and non-lethal dispersal activities. Lethal dispersal activities will only be carried out by the Natural Resources department and USDA-WS personnel, under the depredation permits issued by the U.S. Fish and Wildlife Service and Virginia Department of Game and Inland Fisheries (VDGIF).

a. Personnel Composition. The BDDT shall be comprised of personnel from NAS Oceana's transient line airfield support crew, NALF Fentress airfield maintenance personnel, the Airfield Manager (AFM), Public Works FOD Sweepers, and select Aircraft Rescue Fire Fighting (ARFF) personnel. While every person on the airfield or within the AOA has a responsibility to maintain BASH detection situational awareness, the BDDTs have the specific tasks of daily airfield monitoring and wildlife cataloging, as well as performing active dispersal for imminent BASH threats to flight operations.

b. Training Requirements. Each member of the BDDT must complete BASH Program familiarization training as defined by the FAA in reference (g). These requirements will be met through a USDA-WS approved IWDM training class, and on-the-airfield practical application of wildlife identification, harassment, and dispersal skills.

(1) Weapons Training. The NAS Oceana Security Department shall provide weapons and pyrotechnics training to U.S. Navy personnel that are determined to have a need to possess weapons currency to properly execute their assigned wildlife harassment and depredation responsibilities. As such, *not all BDDT members shall possess weapons qualifications or recurrency requirements*.

(2) The USDA-WS, as a separate federal agency, is responsible to obtain and maintain their weapons qualifications training and recurrency under USDA-WS guidelines, reference (b).

c. Initial Qualification. All prospective BDDT personnel that complete the airfield's USDA-WS approved IWDM training, and successfully demonstrate BDDT skills to correctly identify wildlife, and safely harass wildlife away from flight critical areas, shall be qualified BDDT personnel, and designated in writing by the Air Operations Officer. Qualified BDDT personnel should have training records to document their USDA-WS IWDM

training and BDDT qualifications.

d. Recurrency Training Requirements. All BDDT personnel will be required to complete 12-month recurrency IWDM training to maintain their qualifications, and to allow for BASH Program growth and adaptation to WHA observations, and WHMP adjustments in IWDM. BDDT initial and recurrent training provides an essential link in the Safety Assurance of NAS Oceana's SMS.

e. BDDT Designation and Currency. Air Operations will maintain a list of qualified and current BDDT members for monitoring by the BASH Working Group and the Natural Resources Manager to be kept along with installation official wildlife harassment and depredation permits.

f. Bioacoustic Harassment Equipment Operation. The BDDT will be trained to operate acoustic harassment equipment, to include sound making devices, and propane cannons. The Air Operations department will conduct training to operate this equipment in accordance with manufacturer's operating instructions, with additional operational risk management procedures in place, and approved by the Air Operations Officer.

g. Normal Routines. The BDDT will perform the following normal working routines:

(1) Be active on the airfield as needed and be on call 24 hours a day to carry out bird/animal strike hazard detection and dispersal activities. The BDDT shall have immediate access to bioacoustic equipment for wildlife dispersal (if required).

(2) Convey all BHC observations at NAS Oceana to the AODO and/or ATC FWS; at NALF Fentress, make BHC observations to the NALF Fentress Airfield Observers and the Squadron Landing Signal Officers.

(3) Report any bird and/or animal strike discovered on airfield. Report any changes in wildlife activity to the AODO.

(4) Create and maintain a wildlife remains collection kit to enable the efficient processing of animal remains for

identification.

(5) Have authority to request temporary taxiway/runway closure for imminent wildlife strike hazards.

8. Installation BASH Plan. The daily conduct of BASH activities and procedures required to manage current BASH conditions at NAS Oceana and NALF Fentress is called the Installation BASH Plan. The Installation BASH Plan works in tandem with the normal airfield maintenance routines to establish the BASH Airfield Safety Triangle, Plate 5, at the same time as the airfields are readied for normal flight operations, as specified in the following steps:

a. Step One – Assess and Set the Airfield BHCs. During the daily airfield SFFO preparation periods, at NAS Oceana, AFF will perform an assessment of existing BHCs on the airfield. At NALF Fentress, a similar routine is being conducted, led by the NALF Fentress OIC, the Airfield Maintenance Crew and ARFF duty crew. During each SFFO preparation period, the BDDT members for both airfields shall perform Step One of the BASH Airfield Safety Triangle, assessing and documenting their wildlife observations utilizing enclosures (2), (3), (4), (5), (6) and (7).

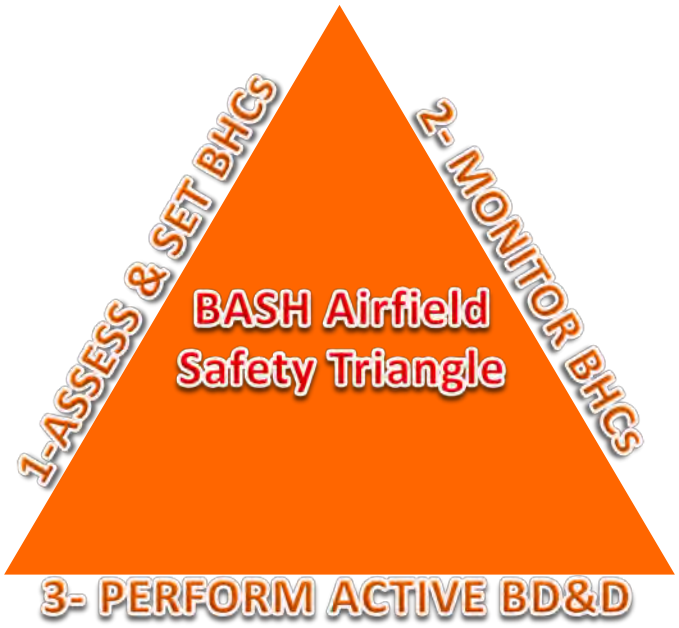


Plate 5. The BASH Airfield Safety Triangle.

Once all Air Operations Divisions report their BHC assessments, and both airfield checks are complete and satisfactory, the NAS Oceana FWS will report airfields are SFFO to the AODO, and begin or continue flight operations. At this time, the initial BHC is set, and the BASH Airfield Safety Triangle is established at both airfields, and flight operations commence or continue uninterrupted.

b. Step Two – Monitor the BHCs. Wildlife activities are dynamic. Wildlife is constantly transiting the airfield environment - foraging, loafing, feeding, etc. These dynamic activities are related to the time of day, the time of year, weather conditions, and habitat. This is why the BASH Safety Triangle must be re-established during all SFFO preparation periods.

As the day progresses, the BDDTs monitor the airfields and recommend changes to the airfields' BHC to the NAS Oceana FWS and AODOs as necessary based on actual wildlife observations.

c. Step Three – Perform Active BASH detection and dispersal (BD&D). From time to time, Active BD&D is necessary to respond to immediate wildlife incursions on the airfield.

When a wildlife incursion is observed, the BDDT will be activated to respond to the wildlife threat. A determination will be made by the BDDT Leader of what action needs to be taken

to lessen or disperse the menacing wildlife away from the flight path of aircraft in the airfield pattern. Once the wildlife hazards are dispersed, the BASH Airfield Safety Triangle must be reset by performing a new SFFO inspection period, and resetting the airfield BHC.

9. Aircraft Strike Categories and BASH Reporting Guidelines. Everyone involved in the conduct of aviation, including flight crews, aircraft maintenance personnel, and airfield support personnel, have a responsibility to report bird/animal strike events. U.S. Navy Aviation Squadrons must also remember to include squadron man-hours used to capture BASH cost per event, and report these events to the Naval Safety Center via WESS in accordance with reference (m).

There are differences in the management of civilian and military aircraft when it comes to BASH reporting. Reference (t) requires each U.S. Navy air-capable facility to "report all wildlife strikes in accordance with reference (m), manage all facilities in accordance with reference (s), and maintain procedural consistency with reference (e)."

To achieve both the spirit and intent of the FAA's and DoN's BASH Program safety goals, and to maintain an accurate Installation Wildlife Strike Record, the NAS Oceana BASH Program will blend the following existing FAA aircraft strike reporting guidelines, reference (d), with the following amplifying reporting clarifications, reference (m).

a. FAA Aircraft Strike Categories. The FAA defines that an aircraft wildlife strike has occurred when one or more of the following conditions occur:

(1) A pilot reports striking one or more birds or other wildlife during any taxi, takeoff, low level, or landing evolution

(2) Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike

(3) Personnel on the ground report seeing an aircraft strike one or more birds or other wildlife

(4) Bird or other wildlife remains, whether in whole or part, are found within 250 feet of a runway centerline, unless another reason for the animal's death is identified

(5) An animal's presence in the AOA has had a significant negative affect on a flight (aborted takeoff, landing waveoff, high-speed emergency stop, or aircraft leaving the paved surfaces to avoid collision with an animal)

Note

Aircrews are encouraged to report near-misses that involve evasive action or whenever the proximity of the miss is "too close for comfort."

b. BASH Reporting Guidelines. Post-flight aircraft inspections and follow-up reporting of bird and/or animal strikes are an essential and important part of the BASH program. Whenever possible, for all DoN Aircraft Custodians, Squadron Aviation Safety Officers are required to submit WESS reports for incidents involving their aircraft in accordance with reference (m). In general, if an aircraft strike occurs within the NAS Oceana/NALF Fentress AOAs, it shall be reported as a BASH incident for the airfield where the strike occurred. If the location of the strike is unknown, attribute the strike to the airfield where the aircraft spent most of its flight time below 1000' AGL. Data shows that nearly 80 percent of all strikes occur below this elevation.

(1) All aircraft operating at NAS Oceana and NALF Fentress shall notify their controlling authority as soon as able after a suspected BASH incident has occurred.

(a) Upon receiving notification from an aircraft that a suspected BASH incident has occurred, the NAS Oceana Tower Supervisor or NALF Fentress LSO or Airfield Observer will notify the NAS Oceana AODO. The AODO will dispatch the appropriate airfield BDDT to try and locate and/or collect any wildlife remains to give to the local U.S. Navy Aviation Squadron for processing and reporting.

(b) If the aircraft experiencing the strike in NAS Oceana airspace does not belong to a tenant squadron, then the wildlife sample will be gathered by the appropriate BDDT, and enclosure (3) shall be completed by that BDDT. The wildlife sample and the completed enclosure (3) will be delivered to the NAS Oceana Installation Aviation Safety Officer (ASO) to construct the required WESS report.

(c) Once the WESS report has been generated to document the wildlife strike, the sample and completed WESS report should be taken to the Natural Resources Manager, Public Works Department, building 800. The Natural Resources Manager (NRM) will ensure correct submission and reporting to the Smithsonian Institute.

Note

It is vitally important that the date and WESS Report serial number be included on the sample in case it gets separated from the report.

(d) If the strike is discovered by airfield personnel and the BASH aircraft is known, the AODO shall be informed to facilitate ATC contact with the aircrew in the suspected BASH incident aircraft.

(1) If a wildlife strike has resulted in animal remains on or near the active runway, SFFO will need to be reset for the airfield. To complete this action, the appropriate BDDT will be deployed to collect any available wildlife remains and FOD from the airfield surface, returning the flying environment to SFFO.

(2) Once the airfield is reset to SFFO, the BDDT will turn over the wildlife sample to the AODO for transfer to the local squadron for correct processing and WESS reporting. If the aircraft is not a tenant squadron, then the appropriate BDDT shall complete enclosure (3) and deliver the wildlife sample and the completed enclosure (3) to the NAS Oceana Installation ASO to construct the required WESS report.

(e) If the strike is discovered by airfield personnel and the BASH aircraft is unknown, the BDDT will be deployed to collect any available remains from the airfield surface, and will turn over the wildlife sample, with a completed enclosure (3), to the AODO for coordination with the NAS Oceana ASO to complete the aircraft strike report via WESS, in accordance with reference (m).

c. Triggering Wildlife Aircraft Strike. Reference (a) defines a “triggering strike” as:

(1) An aircraft that experiences multiple wildlife strikes

(2) An aircraft that experiences substantial damage from striking wildlife. Substantial damage is defined as damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component(s)

(3) An aircraft experiences an engine ingestion of wildlife

(4) Wildlife of a size, or in numbers, capable of causing a wildlife strike triggering event is observed to have access to any airport flight pattern or aircraft movement area

Note

When an aircraft experiences a triggering wildlife strike at NAS Oceana or NALF Fentress, a BWG review of the Installation BASH Program, including associated WHMP criteria, and the BWG minutes of outstanding BASH Program discrepancies shall be completed utilizing enclosures (4) and (10).

After the Installation ASO has received a BASH Strike Report, enclosure (3), he/she shall make a determination to validate the wildlife strike as a triggering event in accordance with reference (a). If such a determination is made, the Installation ASO shall complete a Wildlife Strike Triggering Event Checklist, enclosure (4), and route to the members of the BWG for disposition.

10. Bird/Animal Remains Collection and Identification. All strike data is entered into Naval Safety Center data bases (WESS) to help track and identify BASH hazards. It is necessary to know which species are causing BASH strike problems so appropriate measures can be taken. Identification of bird remains is essential. Whenever bird remains are found, the following preservation procedures should be followed referencing enclosure (7):

a. Collect a sample of the remains and place in a zip lock bag. Use alcohol only, never bleach or water to collect snarge from aircraft surfaces. Even if sample is just a small part, feather or bloody smear, the species can be identified by the Smithsonian Institute Feather Identification Lab through microscopic and DNA techniques.

b. Approved BASH reporting forms for transient aircrew will be located at the AODO Watch Desk or NALF Fentress Quarterdeck. Once the approved BASH report is completed, the wildlife strike incident will be filed as a WESS report by the Installation ASO. A wildlife strike sample, along with the WESS report, will be submitted to the NRM for submission to the Smithsonian Institute.

c. Label both the bag and the form with the date, time, initials, and unit POC. Any other relevant information concerning the nature and circumstances of the aircraft wildlife strike will help refine the quality of the BASH report, and should be included.

d. Give form to AODO and place remains at the USDA-WS animal recovery station, as directed by the AODO.

e. Either USDA-WS personnel or the NRM are available to assist with bird/animal aircraft strikes sample collection, reporting, and submission requirements.

f. Carcasses will be placed at the USDA-WS animal collection station after the sample has been taken. Carcasses MUST be bagged and properly labeled PRIOR to deposit in the collection station. Disposal of carcasses will be handled through USDA-WS.

11. BASH Working Group (BWG). The BWG shall serve as the primary advisory group to the Installation Commanding Officer to help shape and guide installation BASH Program initiatives. The overarching agenda of the BWG is to manage the entire IWDM process, completing the critical ORM/SMS-SRM process: "supervise/monitor for necessary changes."

Note

In order for the Installation BASH Plan and Installation IWDM strategy to work effectively, the BWG must provide oversight and recommendations for consideration to Installation instructions, plans, working routines, or construction projects that may have an impact on wildlife populations and habitats. This mandatory prior coordination is especially important for actions that occur in or directly influence the First and Second BASH Strategic Priority Zones, Plate 4.

a. BWG Membership. The BWG membership will be constructed by skill set and constituency necessary to provide complete IWDM and BASH Program management for the installation's airfields. Whereas all BWG members are vital for proper BASH Program definition and execution, not all BWG members have daily BASH Program responsibilities assigned. These members may be requested to participate in the BWG on an 'as desired and/or required basis' by the Air Operations Officer, functioning to provide their expert advice for complete Installation BASH Program management. Group membership shall consist of:

(1) Air Operations Officer (Chair)

(2) Assistant Air Operations Officer (Co-Chair)

(3) Aviation Safety Officer (Co-Chair)

(4) USDA-WS Biologist(s) (as assigned)

(5) Airfield Manager

(6) Air Traffic Control Facility Officer

(7) Airfield Facilities Division Officer (as req'd)

(8) NALF Fentress Officer-in-Charge (as req'd)

(9) CSFWL Aviation Safety Officer

(10) CSFWL Maintenance Officer (as req'd)

(11) Installation Public Works Officer

(12) Installation Environmental Programs Director

(13) Installation Natural Resources Program Manager

(14) Staff Judge Advocate (as req'd)

(15) Security Officer (as req'd)

(16) Air Installation Compatible Use Zones (AICUZ) Manager (as req'd)

(17) Public Affairs Officer (as desired)

(18) City of Virginia Beach or Chesapeake representative(s) (as desired)

b. BWG Quarterly Meeting. The BWG shall hold a quarterly working meeting to assess the status of the Installation BASH Program. The BWG quarterly meeting agenda shall be published ahead of the meeting to allow members to prepare for the meeting with any research required to support ongoing BASH projects or plans.

c. BWG Installation Responsibilities. The BWG must review, monitor, adapt, and develop guidance that implements the Installation IWDM process.

(1) This key oversight extends to the installation Integrated Natural Resources Management Plan (INRMP), the installation Integrated Pest Management Plan (IPMP), and the four elemental plans that create the Installation Wildlife Hazard Management Plan (WHMP). The WHMP shall be constructed and reviewed utilizing historical reviews of wildlife habitat management, wildlife harassment, and wildlife depredation, in conjunction with enclosures (4) and (8).

(2) The BWG must establish requirements for an annual BASH Program self-assessment process in accordance with appendix A-3 of reference (s). This annual review checklist will include, at a minimum, the elements contained in enclosure (10).

(3) Oversee and approve changes to the training of the BDDT, conduct periodic BDDT qualification reviews, and perform inspections of the BASH Program using enclosure (10).

(4) The BWG is charged with the responsibility to review the currency and the demonstrated effectiveness of all Installation IWDM Cycle and BASH Program working guidances, during the performance of the installation annual BASH Program review, utilizing enclosures (9) and (10).

d. BWG actions for a Wildlife Strike Triggering Event. In the event of a wildlife strike triggering event, the BWG must perform a review of the Installation WHMP and BASH Program to determine if BASH program elements or procedures attributed to the aircraft wildlife strike event.

(1) Each wildlife strike at NAS Oceana and NALF Fentress requires the completion of the NAS Oceana BASH Strike Report. The Installation ASO is the lead agent to ensure the timely completion of all BASH Strike Reports, and to facilitate BWG reviews of wildlife strike triggering events. With the completion of each BASH Strike Report, the ASO shall determine if the wildlife strike meets the criteria for a wildlife strike triggering event.

(2) If the triggering event criteria are met, upon notification from the ASO, each member of the BWG shall:

(a) Complete the Wildlife Strike Triggering Event Checklist, enclosure (4), in accordance with reference (a), to determine if the current BASH Program Daily Routines and/or WHMP or component plans failed to meet adequate IWDM practices.

(b) The Installation ASO shall provide the membership of the BWG a copy of the wildlife strike triggering event specific BASH Strike Report, and a serialized enclosure (4) via email for BWG member review. BWG members are encouraged to request the ASO provide any/all BASH Program documentation to include copies of the Installation Wildlife Activity Logs necessary to facilitate a timely BWG review of the strike incident, and a comprehensive review of current BASH Program elements.

(c) The findings of each WHMP Triggering Event Review shall be coordinated by the Installation ASO, and reported to the Installation Commanding Officer via the Air Operations Officer. All BWG program reviews or BWG decisions shall be detailed in the installation BWG minutes for BASH program management. This continuous historical record will provide airport compliance with the Safety Risk Management elements of the airport SMS program, and help to develop improved BASH Program management practices for NAS Oceana and NALF Fentress.

12. Wildlife Hazard Management Plan (WHMP). The BWG shall research, develop, author, maintain, and monitor the Installation WHMP, utilizing enclosures (3), (4), (8), (9) and (10). The review cycle for the WHMP shall be every 12 months, at a minimum, and after each wildlife strike triggering event. The WHMP will consist of several key elements, and include, at a minimum:

a. Food/Prey Management Plan. This includes installation pest identification and management practices, hunting practices, garbage collection and disposal practices, and insect management.

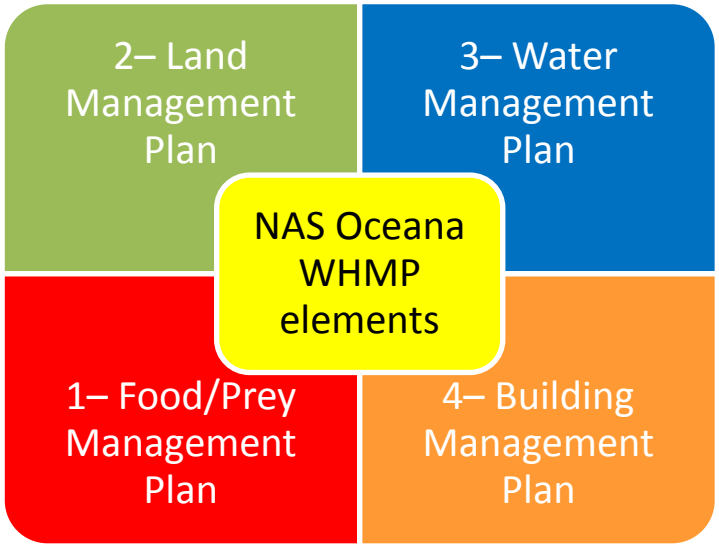


Plate 6. NAS Oceana WHMP elements.

b. Land Management Plan. This includes agricultural lease management and interaction, AOA vegetation, grass cutting, landscaping, drainage ditch vegetation management, and tree cutting.

c. Water Management Plan. This includes permanent water, wetlands, canals/ditches/streams, sewage, ponds, and ephemeral water (runways, taxiways, aprons), and other wet areas.

d. Building Management Plan. This includes all structures, inhabited / planned / abandoned, existing on the airfield, and within the AOA, as well as navigational, cell, water, and communications towers, and other roosting spots.

The goal of the WHMP will be to draw together the separate element plans with the Integrated Natural Resources Management Plan (INRMP) in order to provide a seamless, all installation participative BASH Plan that actively manages each contributing factor to wildlife habitat management and modification, resource protection, repelling and exclusion, and removal of installation BASH hazards. As such, the development of an integrated WHMP brings every installation department together in an orchestrated methodology that serves as the engine to continue productive BASH Program efforts indefinitely.

13. BASH Program Responsibilities. The responsibility assigned to the NAS Oceana and NALF Fentress departments for the content and conduct of the NAS Oceana BASH Program are as follows:

a. Installation Commanding Officer (ICO):

(1) Issue and maintain this instruction that creates the Installation BASH Program. The BASH Program shall detail the IWDM integration and sustainment actions, and a BASH plan used for daily BASH activities.

(2) Designate the Installation Air Operations Officer as the Installation BASH Program Manager.

(3) Review quarterly BWG meeting minutes to ensure ongoing BASH issues and working plans are being addressed and solved in an expeditious manner. Initiate regional coordination when required to address installation specific concerns.

(4) Direct an annual BASH Program self-assessment process in accordance with appendix A-3 of reference (s).

b. Air Operations Officer shall:

(1) Determine and direct all BASH abatement actions and training for NAS Oceana and NALF Fentress to include (at a minimum) all responsibilities, actions, and techniques applied in this instruction. Serve as the installation lead action officer, supported by all other departments in the completion of these duties, specifically:

(a) Be designated in writing as the Installation BASH Program Manager responsible for the execution and oversight of the installation BASH Plan. Serve as central point of contact for BASH coordination and planning with other installation departments, installation tenants, and the local community.

(b) Ensure a WESS account for the Installation is established for the mandatory reporting of all BASH incidents.

(c) Ensure aircraft reporting custodians receive assistance in their efforts to report strikes of known and unknown origin, to include remains collection and unknown remains forwarding procedures.

(d) Provide local oversight of the USDA-WS personnel, as assigned, and ensure regular coordination of USDA-WS BASH efforts with other installation departments is accomplished in order for the DOD/USDA IWDM-modeled Installation BASH Program to succeed. Utilize the USDA-WS personnel to complete installation and tenant BASH training standardization. Ensure a smooth working relationship between USDA-WS and all

installation departments required to support BASH efforts, to include regional NRM and legal support.

(e) Chair and facilitate the BWG. Utilize the expertise of the BWG to coordinate and perform periodic reviews of the BASH program to ensure BASH priorities are funded and completed in as timely a manner possible, utilizing enclosure (10). Ensure quarterly BWG Minutes are produced to sustain a focused Installation IWDM Cycle, and report the health of the Installation BASH Program to the ICO.

(f) Ensure BASH formal training requirements for installation personnel involved with air operations is completed and monitored. These training requirements will be different for the BWG, the BDDT, and tenant personnel. This training must include at a minimum: establishing and renewing BASH Program understanding, safe operation and storage of BASH devices (not to include pyrotechnics or weapons), BASH remains collection criteria and procedures, and correct BASH reporting procedures. This training shall be initial and annually recurrent.

c. Installation Aviation Safety Officer (ASO) shall:

(1) Co-Chair the installation BWG to support the Air Operations Officer. Utilize monthly installation Aviation Safety Council meetings to develop installation BASH awareness of this instruction among all participants in the BWG and among tenant commands. Tailor BASH awareness and provide tenant liaison to help gather BASH training requests from tenant commands.

(2) Establish a WESS account for the mandatory reporting of all BASH incidents.

(3) Coordinate with aircraft custodians on the proper reporting, via WESS, and remains collection procedures of all bird/animal strikes of known origin in accordance with references (d), (m), and (s).

(4) Ensure installation personnel are reporting bird/animal aircraft strikes of unknown origin (e.g., bird remains found on a runway and not correlated to a specific aircraft) in accordance with references (s) and (d). Ensure personnel collect and forward remains in accordance with Appendix A-1 of reference (s).

(5) Ensure bird/animal strikes of unknown origin (wildlife found on or near with runway) are reported, via WESS, to the Naval Safety Center in accordance with references (m) and (s). Ensure remains are appropriately packaged and forwarded to the Smithsonian Institution for positive identification per references (d) and (s).

(6) Produce quarterly BWG minutes to document IWDM and the Installation BASH Program. Report attendance of significant stakeholders in the quarterly BWG minutes. Track required initial and recurrent training by BWG, BDDT, and tenant commands as appropriate for installation BASH awareness. Distribute these minutes to ensure installation intra-departmental and tenant BASH awareness. Include available and required training opportunities, wildlife strike reporting results, and remains identification data to the quarterly BWG minutes, and ensure results are analyzed by the BWG for future BASH reduction management strategies.

(7) With the completion of each BASH Strike Report, the ASO shall perform a Wildlife Strike Triggering Event review in accordance with reference (a). If an aircraft wildlife strike event meets the 14 CFR 139.337 wildlife strike triggering event criteria, the membership of the BWG shall be provided a copy of the incident BASH Strike Report and the completed enclosure (4) in order to facilitate a timely BWG review of the strike incident, and a review of current BASH Program elements.

(8) Facilitate annual reviews of the Installation BASH Program utilizing enclosures (4), (9), and (10). The ASO shall ensure installation participation, BASH priority projects are reviewed, and all BASH training is scheduled and performed to support tenant commands.

(9) Assist USDA-WS and Airfield Facilities Division to obtain BASH bioacoustic wildlife harassment equipment for outfitting the BDDT. Monitor all BASH bioacoustic equipment for safe operating procedures, and general safe material conditions. Report discrepancies to the AFM for correction.

d. Airfield Manager shall:

(1) Lead the identification of BASH Program requirements for all airport facilities, runways, taxiways, aprons, drainage areas, and aircraft operations zones at NAS Oceana and NALF Fentress.

(2) Monitor grass height, drainage ditches, and any low areas on the airport surface, especially after rains. Maintain a priority list for facility corrective actions required in order to repair these areas in a fashion that is least attractive to wildlife.

(2) Participate in the Installation BWG. Ensure BWG membership develops practical guidance for the promulgation of the BASH Program as it relates to airfield facilities, planned construction, and daily and seasonal flight operations.

(3) Coordinate the implementation of each element of the Installation Wildlife Hazard Management Plan (WHMP) to ensure

all natural resource specific plans (water management, plant management, waste management, and land management) contain and/or consider the necessary requirements of IWDM.

(4) Coordinate with the Air Traffic Control Facility Officer (ATCFO) to develop and utilize an airfield BASH Hazard Condition (BHC) warning notification protocol. This protocol will ensure seamless routine updates to aircraft operating at NAS Oceana or NALF Fentress.

(5) Coordinate with the ATCFO to ensure the correct Air Traffic Control (ATC) and airfield maintenance operations protocols are maintained to respond to emergent BASH hazards on the NAS Oceana and NALF Fentress airfields as wildlife hazards occur.

(6) Assist USDA-WS in the design and fabrication of USDA-WS acceptable wildlife collection stations for use in temporarily storing wildlife remains discovered on the airfield.

e. Air Traffic Control Facility Officer shall:

(1) Serve as a member of the BWG.

(2) Coordinate with the AFM to develop and utilize an airfield BASH Hazard Condition (BHC) warning notification protocol to ensure BHCs are set at NAS Oceana or NALF Fentress when the airfields are made SFFO.

(3) Ensure seamless BHC notifications are made by appropriate ATC Division personnel to aircraft under ATC positive control via ATIS and Ground/Tower/Radar Control radio communications as BHCs change. This includes issuing flight advisory warnings for BHCs of Heavy (Severe).

(4) Coordinate with the AFM to ensure the correct ATC protocols are maintained to respond to emergent BASH hazards on the NAS Oceana and NALF Fentress airfields as wildlife hazards occur, utilizing the BDDT.

(5) Author and modify local ATC BASH flight safety routines utilizing the authority granted in reference (r) in the NAS Oceana ATC Facility Manual (FACMAN). Ensure the ATC FACMAN reflects the BASH protocols and individual personnel procedures to understand and operate the BASH Program for NAS Oceana and NALF Fentress. Include proper FAA ATC terminology and procedures for bird/animal strike hazard avoidance to the greatest extent possible.

(6) Prepare and maintain current the appropriate facility DOD Flight Information Program (FLIP) flight planning BASH notifications for the Air Operations Officer’s approval.

f. ATC Tower Supervisor shall:

(1) Under the supervision of the ATCFO and the Facility Watch Supervisor (FWS), the ATC Tower Supervisor shall issue BHC updates via ATIS.

(2) Issue BHC Heavy (Severe) Warnings directly to aircraft operating under positive control via radio communication.

(3) Temporarily suspend flight operations if a Heavy (Severe) BASH hazard exists that presents an immediate threat to flight safety, taking the following action in order of precedence:

(a) Attempt contact with USDA-WS personnel if present on the airfield during an emergent BASH event to disperse the wildlife hazard and prevent undue flight operations delays.

(b) If USDA-WS personnel are unavailable, the ATC Tower Supervisor shall contact the AODO to mobilize any or all of the BDDT to immediately disperse the wildlife hazard in order to expedite resumption of normal flight operations.

(4) Facilitate movement of the BDDT on the airfield to disperse bird/animal strike hazards on or near the runway as needed.

g. Air Operations Duty Officers shall:

(1) Activate the BDDT as may be necessary due to airfield observations, or when requested by the ATC Tower Supervisor to disperse emergent BASH hazards in order to resume uninterrupted flight operations.

(a) Notify the Air Operations Officer/Assistant Air Operations Officer and Airfield Manager any time active wildlife dispersal is underway that has caused a taxiway/runway closure or resulted in a temporary suspension of flight operations at NAS Oceana or NALF Fentress.

(2) Accept BASH reports at the Air Operations Duty Office on behalf of the ASO and USDA-WS in their absence. Provide approved BASH Report Forms and sample collection kits in the event personnel who discover wildlife remains on the airfield do not have a WESS account.

h. Airfield Facilities Division Officer shall:

(1) Provide Airfield Facilities Division personnel to assist installation Natural Resources department and USDA-WS

personnel in wildlife dispersal activities as primary members of the BDDT for NAS Oceana.

(2) Facilitate and ensure that BASH formal training requirements for installation personnel involved with air operations, to include the members of the BDDT, is completed and monitored. This training must include (at a minimum):

(a) Familiarization with BASH Program.
(b) Demonstrated understanding of the safe operation and storage of BASH devices (not to include pyrotechnics or weapons).
(c) BASH remains collection criteria and procedures, and correct BASH reporting procedures.
(d) Initial and annually recurrent training.

(3) Investigate all bird/animal strikes involving unknown aircraft. Collect and label all remains involved in the collision and turn into the USDA wildlife collection station for safe keeping until USDA-WS can take custody of the wildlife remains. Collect all known wildlife strike data for report of the BASH incident to turn in to the AODO, ASO, or USDA-WS personnel.

(4) Serve as a member or designate representative for the BWG.

(5) Monitor grass height and condition of drainage features, requirements for filling or street sweeping low areas that collect water following rain events and report requirements as necessary to the AFM.

i. NALF Fentress Officer-in-Charge shall:

(1) All NAS Oceana departments shall make every effort to maintain and support parallel facility compliance with this instruction as it applies to the NALF Fentress facility, to include but not limited to the implementation of the BASH Program, facility sustainment requirements, and BASH procedural and training support.

(2) The NALF Fentress Officer-in-Charge (OIC) shall be a member of the BWG.

(3) The NALF Fentress OIC shall provide airfield maintenance personnel for a BDDT at NALF Fentress.

(4) The NALF Fentress OIC shall work with the Airfield Facilities Division Officer to facilitate and ensure that BASH formal training requirements for NALF Fentress personnel involved with air operations, to include the members of the NALF Fentress BDDT, is completed and monitored. This training must include (at a minimum):

(a) Familiarization with BASH Program.
(b) Demonstrated understanding of the safe operation and storage of BASH devices (not to include pyrotechnics or weapons).
(c) BASH remains collection criteria and procedures, and correct BASH reporting procedures.
(d) Initial and annually recurrent training.

(5) The NALF Fentress OIC shall investigate all bird/animal strikes and collect all remains involved in the collision and turn into the NALF Fentress USDA wildlife collection station for safe keeping until USDA-WS can take custody of the wildlife remains. Collect all known wildlife strike data for report of the BASH incident to turn in to the AODO, ASO, or USDA-WS personnel.

(6) The NALF Fentress Airfield Observers and/or LSO at NALF Fentress may set BHCs based on bird activity near or above the runway at NALF Fentress.

(7) In BHC Heavy (Severe) or Moderate, the NALF Fentress OIC, or the Senior Fire Officer present (in his/her absence) shall determine whether to deploy the NALF Fentress BDDT to disperse the wildlife threat to immediate aircraft flight operations. If such a determination is made, the OIC or Senior Fire Officer present (in his/her absence) shall also notify the Air Operations chain of command at NAS Oceana via the AODO so that a determination can be made to deploy NRM or USDA-WS assets to NALF Fentress for IWDM activities.

(8) The NALF Fentress OIC shall maintain historical records of wildlife harassment conducted by the NALF Fentress BDDT for the NALF Fentress air facility, utilizing enclosure (2), to be included in the BWG quarterly minutes.

j. Installation Public Works Department. The Public Works Department plays a critical role in the overall success of the Installation BASH Program. As such, the Installation Public Works Officer shall ensure that the Installation BASH Program's IWDM methodologies are fully supported within the work division specialties in the Public Works Department as follows:

(1) Participate in the Installation BWG, to include on-site technical reviews of installation BASH programs during periodic Naval Safety Center surveys.

(2) Provide Regulatory Compliance. Be familiar with Federal law 14 CFR 139.337, reference (a), and other specific DOD, Naval Facilities Engineering Command (NAVFAC), and CNIC guidances. Enable timely BASH Program regulatory compliance advice to the BWG Chairman to help build and operate an Installation WHMP, to achieve successful installation INRMP and IWDM integration, and routinely support BASH Program actions.

(a) Review ongoing BASH Program actions to ensure that the program is in compliance with all applicable Federal, State, and Local laws and regulations including, but not limited to, the National Environmental Policy Act and the Clean Water Act, the Endangered Species Act, Migratory Bird Treaty Act, Sikes Act, and the Bald and Golden Eagle Protection Act.

(b) Ensure BASH Program actions are in compliance with all applicable DOD and DoN environmental policies, directives, and instructions including, but not limited to, DOD Instruction 4715.03 and references (k), (n), (p), and (q).

(3) Provide facilities support services and maintenance that correspond to mitigation procedures appropriate to support BASH requirements. Any project exceeding the limit of local approval authority shall be submitted to the Commander, Navy Region Mid-Atlantic and Commander, Navy Installations Command as appropriate for processing and approval.

(4) Coordinate the INRMP and IPMP revisions and annual addendum updates with the Air Operations Officer and the BWG to enable installation participation and input to CNIC regionally produced installation guidance or project planning that impacts the airport operations area, Plate 4. This coordination is critical to the IWDM strategy’s ability to succeed.

(5) Provide BASH Program support to assist installation USDA-WS Biologist(s), and in their absence, to the Air Operations Officer.

(6) Coordinate and manage all applicable natural resources consultations and permits necessary to support BASH Program requirements in a timely manner. These permits include, but are not limited to; U.S. Army Corps of Engineers (USACE) section 404 permits, U.S. Fish and Wildlife Service (USFWS) Migratory Bird Depredation Permits, and Endangered Species Act section 7 consultations.

(7) Through the BWG, ensure BASH Program elements, to include development, maintenance, and sustainment of the installation WHMP, consider sustainable land management practices, adaptive management and scientifically sound monitoring methodologies.

(8) Support WHA periodic updates to ensure data collected is able to be reproduced for monitoring and reporting requirements.

(9) Assist, when needed, in wildlife strike identification, and remains collection. Maintain historical installation wildlife aircraft strike records. Maintain historical records of depredation and wildlife dispersal for the installation properties.

(10) Submit wildlife strike samples to the Smithsonian Institution for positive identification as per references (d) and (s).

k. Installation Security Officer shall:

(1) Provide weapons and pyrotechnics training to U.S. Navy personnel who are determined by the BWG to have a need to possess weapons currency to properly execute their assigned wildlife harassment and depredation responsibilities. *Not all BDDT members shall possess weapons qualifications or recurrency requirements*.

(2) The USDA-WS personnel, as members of a separate federal agency, are responsible to obtain and maintain their weapons qualifications training and recurrency under USDA-WS guidelines, reference (b).

l. Aviation Tenant Commands shall:

(1) Collect a sample of bird remains following aircraft strikes in accordance with enclosure (7). Ensure a WESS report and samples are submitted to the NRM as accurate species identification is important for identifying aviation hazards.

Note

Incomplete wildlife aircraft strike reports weaken the entire aircraft safety chain. In order for the Installation BASH Plan and Installation IWDM strategy to work effectively, all tenant commands must comply with the OPNAV 3750.6, reference (m). Aircraft custodians shall report the costs associated with each BASH incident. By utilizing enclosure (3), detailed aircraft strike data will yield the right level of infrastructure support to the Installation.

(2) Ensure any applicable Installation BHCs, and other facility aviation flight planning ORM data is readily available to aircrews during mission planning.

(3) Issue specific guidance for units on:

(a) Procedures and restrictions to be followed under hazardous BHCs.

(b) Bird strike reporting, damaging and non-damaging.

(c) Bird remains collection and submission.

(4) When able, have a representative attend monthly aviation safety council meetings and disseminate BASH information to aircrews. Emphasis should be placed on the

importance of reporting all significant bird and animal activity that may pose an aircraft strike hazard.

(5) Provide membership to the Installation BWG as desired.

Ultimately, the BASH Program’s effectiveness is dependent upon the active participation of the Naval Air Station staff and the airfield users. Together, the threat of wildlife to naval aviation can be mitigated, one species, one habitat, and one season at a time.

BASH PROGRAM REFERENCE NAVIGATOR

References (a) through (w) have been chosen as a framework to define the technical sub-specialties required to adequately explore each area of performance to promulgate the NAS Oceana BASH Program. These references are extensive, and available upon request.

References

a. 14 CFR 139.337. 14 Code of Federal Regulations (CFR) is the U.S. federal law for Aeronautics and Space. Within 14 CFR is Federal Aviation Regulation (FAR) Part 139. This is the primary guidance for the conduct of flight operations in the U.S., specifically detailing the federal requirement for airport safety standardization and certification. FAR 139, Section 337 specifically details the requirements for airport Wildlife Hazard Assessments (WHAs), Wildlife Hazard Management Plans (WHMPs), and required actions and uses of these airport safety management documents.

b. USDA APHIS Agreement #34-WT-13-7100-0323-IA. This is the Work/Financial Plan for Bird/Animal Aircraft Strike Hazard (BASH) Support on Navy Installations agreement between the USDA-WS and CNIC. This details the requirement for IWDM integration, development of the BDDT, and specifies the IWDM work details that USDA-WS will provide CNIC to help integrate FAA required aviation safety practices with DoN safety practices.

c. FAA Manual: Wildlife Hazard Management at Airports. A complete study of the science and challenges of BASH written for the airport operator.

The FAA Advisory Circular 150 (Airports) Series. An FAA Advisory Circular is the FAA “version” of a DOD or US Navy “instruction.” These are signed out by the FAA Director as a direct interpretation of the U.S. CFR 14. The 150 Series defines every federal requirement that has been developed to effectively, safely, and completely manage airports under U.S. law.

d. 150/5200-32. “Reporting Wildlife Aircraft Strikes” - is the FAA wildlife strike reporting guidance.

e. 150/5200-33. “Hazardous Wildlife Attractants On or Near Airports” – is the FAA guidance for the proper utilization and maintenance of airport operations areas (i.e., airport property) as well as property near airports defined as up to 3 miles from the AOA.

f. 150/5200-34. “Construction or Establishment of Landfills Near Public Airports” – is the FAA guidance

identifying the need for municipal and commercial authorities to work with airport managers to police geographic areas near airports that may attract or harbor animals hazardous to safe aircraft operations, thereby defeating wildlife mitigation efforts within airport operations areas themselves.

g. 150/5200-36. “Qualification for Wildlife Biologist Conducting Wildlife Hazard Assessments and Training Curriculums for Airport Personnel Involved in Controlling Wildlife Hazards on Airports” – is the FAA guidance that details the processes required to build a WHA, WHMP, and provides standards for initial and recurrent BASH training for airfield management.

h. 150/5200-37. “Safety Management Systems for Airports” – is the FAA guidance how airports develop explicit, pro-active, and engaged processes to identify and quantify potential hazards and risks to airport safety – and how to manage these hazards and risks in a systematic, coherent, logical, and reasonable manner.

i. FAA Report: Wildlife Strikes 1990-2011. Released in July 2012, this FAA data has been gathered in conjunction with USDA Wildlife Services. It provides additional source documentation for the NAS Oceana WHA and BWG for formulation of BASH Program actions, and the development of the NAS Oceana WHMP.

j. FAA Eastern Region Bulletin AEA-03-10. This guidance provides the regulation bridge ahead of an under-development FAA AC specifically for WHMPs. The FAA divides the U.S. into regions. Each FAA Region HQ releases interim guidance once it is vetted, to permit airport and airspace management standardization ahead of finalized Federal Law. This FAA bulletin provides essential WHMP guidance, to include specific guidance for WHMP build, and review checklists.

k. DODINST 4150.07. “DOD Pest Management Program,” reflects U.S. Code of Federal Regulations, Title 7, Section 10 and 136 regarding the identification and management of pests onboard military installations.

l. OPNAVINST 3500.39. “Operational Risk Management (ORM),” provides the enabling logic to require an active risk assessment operational methodology. While designed not to inhibit flexibility, initiative, or accountability, ORM mandates U.S. Navy leadership accept no unnecessary risk. “If all detectable hazards have not been identified, then unnecessary risks are being accepted.”

m. OPNAVINST 3750.6. “Naval Aviation Safety Program,” which specifies the requirement to conduct aviation safety hazard reporting for Bird/Animal Aircraft Strike Hazards (BASH). The OPNAVINST 3750.6 introduces several ATC and facility safety

concepts and practices. This reference is a requirement specified in the NAVAIR 00-80T-114 (ATC NATOPS) as an inspection criteria for compliance.

n. OPNAVINST 5090.1. "Environmental Readiness Program Manual," requires the establishment of environmental policies that allow United States Navy forces to operate worldwide in an environmentally responsible manner, heeding federal, state, and local laws to achieve this goal. Included is the requirement to produce an Integrated Natural Resources Management Plan (INRMP), with an annual addendum to allow for the INRMP to be current. The INRMP then functions to serve as the National Environmental Protection Act (NEPA) bridge to define and approve any/all required land management uses onboard the installation, to include active support for the BASH program.

o. OPNAVINST 5530.13C. "Department of the Navy Physical Security Instruction for Conventional Arms, Ammunition, and Explosives (AA&E). This instruction specifies the AA&E requirements to safeguard the pyrotechnics and weapons utilized by NRM and USDA-WS for depredation.

p. OPNAVINST 6250.4. "Navy Pest Management Programs" reflects the DODI 4150.07 requirements, specifically defining NAVFAC and Natural Resource Management (NRM) to work directly to support installations development of practices and procedures that reflect and support all applicable laws necessary to manage installation environmental policies.

q. NAVFAC P-73 Volume II. "Real Estate Operations and Natural Resources Management Procedural Manual" provides the standing orders for influencing NRM's involvement in active management of Navy installations in support of BASH requirements.

r. NAVAIR 00-80T-114 (ATC NATOPS). This is the primary guidance from the U.S. Navy that defines the U.S. Navy aeronautical relationship with the FAA. This reference requires each Naval Air Facility to establish and maintain aviation safety programs and reporting compliance with the OPNAVINST 3500.39 and OPNAVINST 3750.6.

s. CNIC BASH Manual. This is Commander, Navy Installations Command's guidance to broadly define the basis, need, and foundational elements of each air installation's BASH Program. This CNIC Manual mirrors the USAF Pamphlet 91-212 "Bird/Wildlife Aircraft Strike Hazard (BASH) Management Techniques" in Navy language.

t. CNICINST 3700. This is the Commander, Navy Installations Command's guidance that mandates each air-capable installation shall have a BASH Program. The "Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance," that delineates

the BASH Program's scope and responsibilities at the TYCOM, Regional, and each supporting BASH program element at the installation level, integrating DON and FAA guidance to manage airport hazards to aircraft operations.

u. CNICINST 3700.3. The "Airfield Management Operations Program" reference is included for Airfield Inspection continuity, and delineates Installation Commanding Officer and Air Operations Officer direct responsibilities.

v. NAS Oceana/NALF Fentress Integrated Natural Resources Management Plan (INRMP). The Installation INRMP is the long term environmental planning document used to guide installation management of natural resources to support the installation mission. This guidance ensures that natural resources conservation measures and military operations on the installation are integrated and consistent with federal and state stewardship and legal requirements.

w. NAS Oceana/NALF Fentress/Dam Neck Annex Integrated Pest Management Plan (IPMP). The Installation IPMP is the long range plan that integrates the management of pests that visit or live on the installation. This plan guides the use of herbicides, insecticides, pesticides, and rodenticides for pest management in accordance with federal FIFRA laws.

NASOCEANAINST 3750.4
N32
4 Feb 2014

NAS OCEANA AIRFIELD WILDLIFE ACTIVITY LOG

Date	Time	Personnel (Initials)	Species	#	Grid Location	WCA	# Dispersed	Comments
						W: C: A:		
						W: C: A:		
						W: C: A:		
						W: C: A:		
						W: C: A:		
						W: C: A:		
						W: C: A:		
Additional Comments:								

WCA LEGEND	
WEATHER	Select W Code: 1=Sunny; 2=Partly Cloudy; 3=Cloudy; 4=Rain; 5=Fog; 6=Snowing
COVER	Select C Code: 1=Runway; 2=Taxiway; 3=Tow Road; 4=Grass; 5=Ditch; 6=Airport Buildings; 7=Trees; 8=Shrubbery; 9= Short Grass; 10=Tall Grass; 11=Agricultural Lands; 12=Water
ACTIVITY	Select A Code: 1=Feeding; 2=Flying; 3=Running; 4=Perched; 5=Nesting; 6=Transiting

Enclosure (2)

NAS OCEANA BASH STRIKE REPORT

1. Name/Rank of Operator	2. Aircraft Make/Model	3. Engine Make/Model
4. Aircraft BUNO	**5. Date of Strike**	**6. Local Time of Strike**
7. Airfield of Strike	**8. Runway Used**	**9. Location if Enroute**
10. Altitude (AGL)	**11. Speed**	

12. Phase of Flight

A. Parked	
B. Taxi	
C. Take-off Run	
D. Climb	
E. En Route	
F. Descent	
G. Approach	
H. Landing Roll	

13. Part(s) of Aircraft Struck or Damaged

	S	D		S	D
A. Radome			I. Wing/Rotor		
B. Windshield			J. Fuselage		
C. Nose			K. Landing Gear		
D. Engine #1			L. Tail		
E. Engine #2			M. Lights		
F. Engine #3			N. Antenna(s)		
G. Engine #4			O. Other		
H. Propeller					

14. Effect on Flight

None	
Aborted Take-off	
Precautionary Landing	
Land ASAP	
Engine Shutdown	
Other	

15. Sky Condition

Clear/No Clouds	
Cloudy	
Overcast	

16. Precipitation

Fog	
Rain	
Snow	
None	

17. Bird/Wildlife Type:

18. # Seen or Struck

#	Seen	Struck
1		
2-10		
11-100		
>100		

19. Size of Bird(s)

Small	
Medium	
Large	

20. Pilot Warned of BHC? Y N

21. BHC on ATIS? Y N

22. Remarks (Describe damage, injuries, etc.)

23. Reported By	24. Title	25. Phone Number

26. *(Installation ASO Use Only)* **Should this be a Triggering Event?**

Damage & Cost Information Provided by the Aircraft Custodian

27. Time A/C Down to Repair	28. Estimated Cost $	29. Other Cost $

30. WESS STRIKE REPORT #	31. Strike Report Completed: Y/N

32. Recommended for Review by the BWG? Y N

NAS OCEANA AIRCRAFT WILDLIFE STRIKE TRIGGERING EVENT CHECKLIST

There has been an aircraft wildlife strike triggering event at NAS Oceana or NALF Fentress. *The following checklist shall be utilized by the NAS Oceana BWG to conduct a review of the Installation BASH Program to determine if the present IWDM practices and WHMP are effective at sustaining an acceptable margin for aviation safety in accordance with 14 CFR 139.337.*

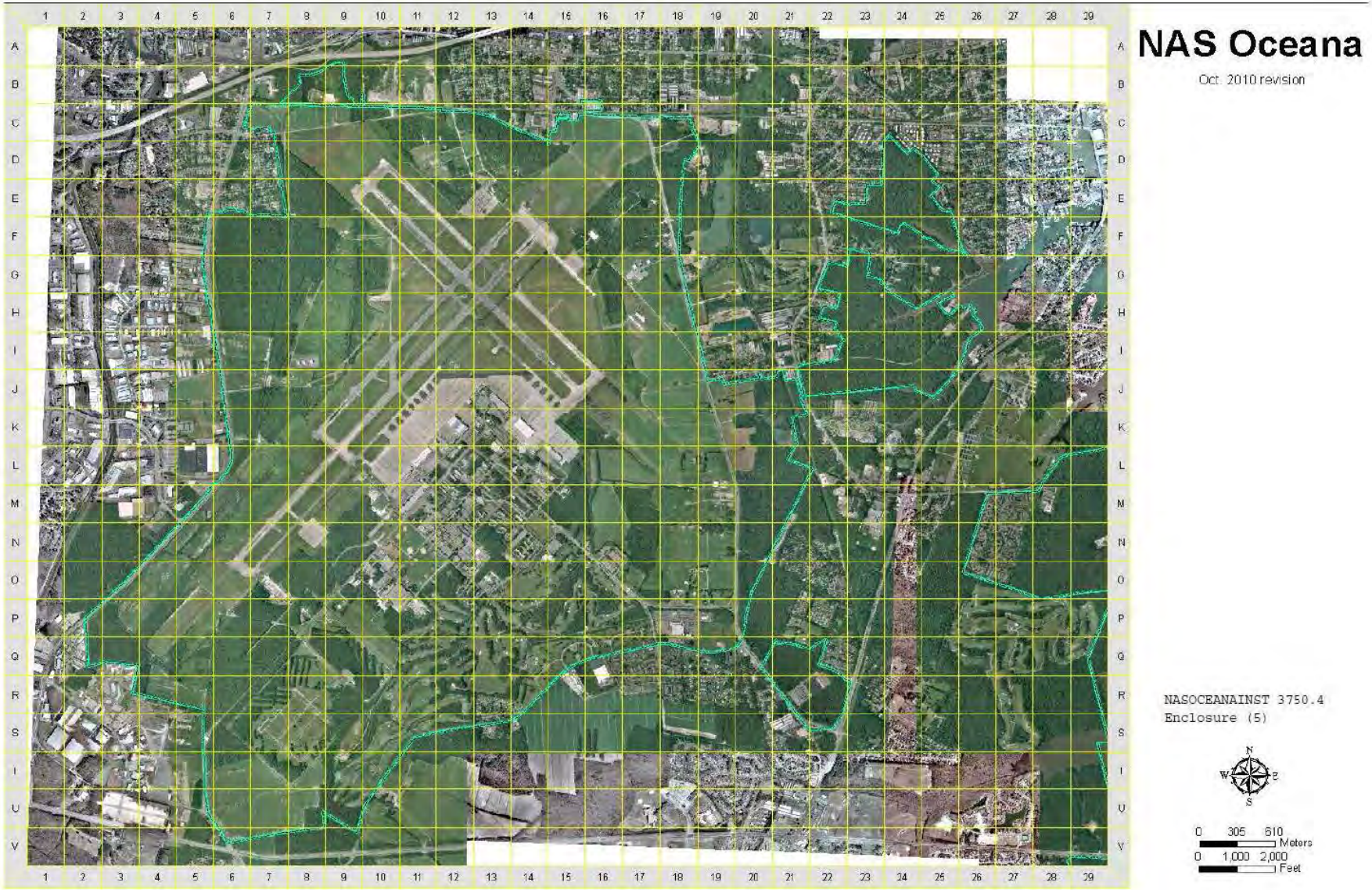
1. WESS STRIKE REPORT #	**2. Date of Strike**	**3. Aircraft Make/Model**
4. Airfield of Strike:	**5. Effect on Flight:**	
6. Synopsis of Triggering Event:		
7. BWG Member	**8. Email**	**9. Phone Number**

10.	**Triggering Event Discussion & Review Analysis**	**Vote T or F**
A	*Is there a current Wildlife Hazard Management Plan (WHMP) that outlines IWDM practices for NAS Oceana and NALF Fentress Airfields?*	
B	*During the Triggering Event, was the NAS Oceana BASH Airfield Safety Triangle in place?*	
C	*Review the last 12 months of wildlife strikes at this Airfield. Is there a trend in similar wildlife strikes that would suggest that the Land, Water, Food/Prey, or Building Management Plan components of the WHMP is being overwhelmed or is lacking in a particular IWDM practice?*	
D	*Is the presumed species of the wildlife strike a new wildlife hazard not yet identified for mitigation in the current Airfield Wildlife Hazard Assessment?*	
E	*Were there trained members of the BASH Detection & Dispersal Teams presently available at the Airfield at the time of the wildlife strike?*	
F	*Are there any previously identified BASH Program discrepancies that are still outstanding that if implemented, could have helped prevent this wildlife strike triggering event?*	

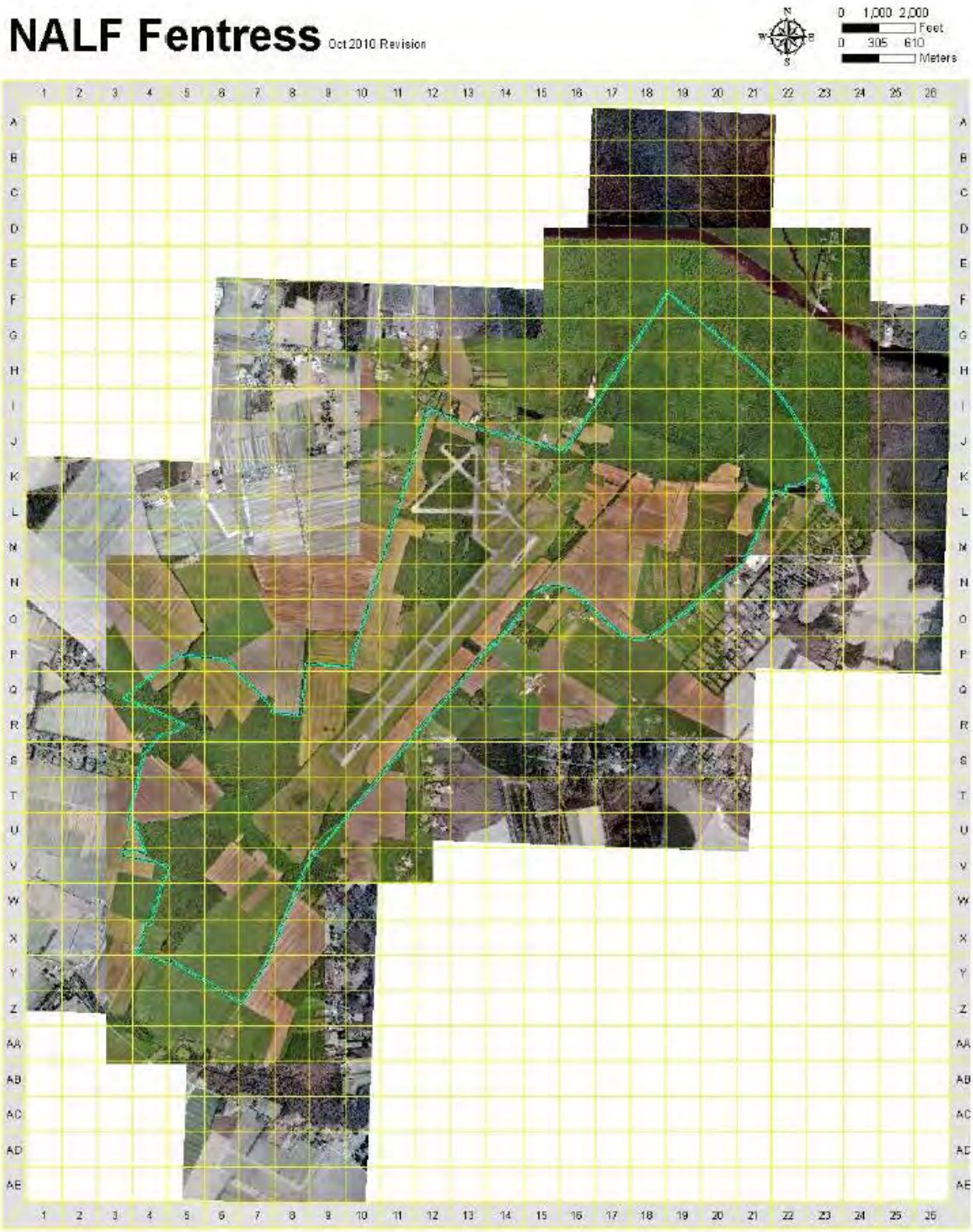
BWG MEMBER WILDLIFE STRIKE TRIGGERING EVENT RECOMMENDATIONS

11. Triggering Event WHMP & IWDM Practices Assessment:
12. BASH Training/IWDM Program/WHMP Changes Identified:

NAS Oceana Gridmap



NALF Fentress Gridmap



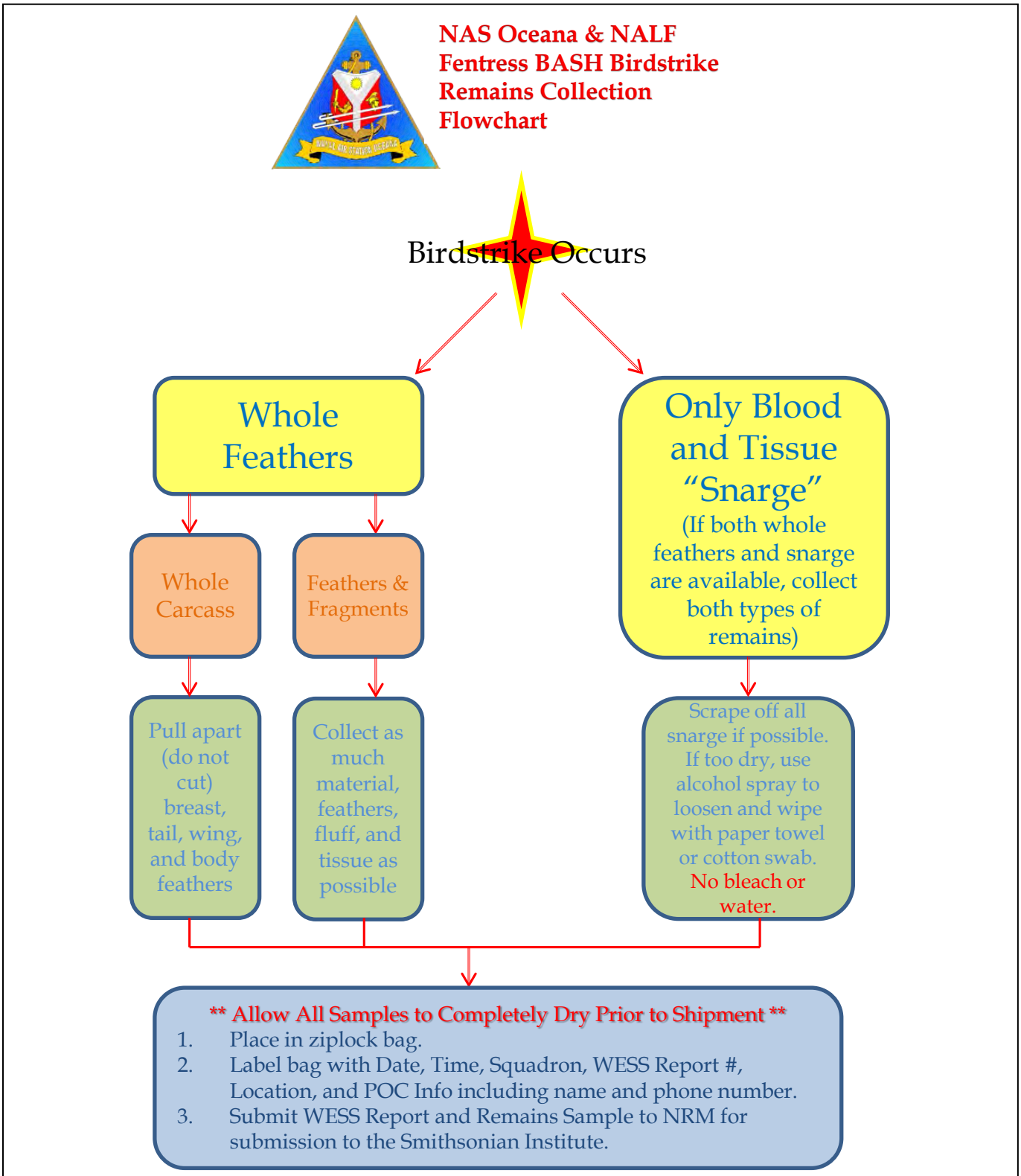


Plate 7. BASH Birdstrike Remains Collection Flowchart.

WILDLIFE HAZARD MANAGEMENT PLAN (WHMP) BUILD CHECKLIST

The development of the Wildlife Hazard Management Plan (WHMP) is a critical link in the Installation BASH Program, as it provides the backbone to the Integrated Wildlife Damage Management (IWDM) strategy. Reference (a) directs the minimum content of a WHMP to seven elements. This enclosure is the template for constructing the Installation WHMP that will define all required WHMP actions for both the NAS Oceana and NALF Fentress airfields.

#	14 CFR Part 139.337 Requirements	NAS Oceana WHMP Elements
0	139.337(d), a brief summary of the airport WHA(s), airport topography, and wildlife attractants on and near the airport that define the necessity of an airport WHMP.	Both the NAS Oceana and NALF Fentress airfields will be described in the NAS Oceana WHMP, to include tenant aircraft activity. This description will be consistent with the NAS Oceana Airfield Master Plan.
	(e), based from actual wildlife hazard data compiled in the airfield WHAs, with the determination for the need of a WHMP made, a WHMP shall be constructed. Once completed, the WHMP shall be included as an integral part of the airport self-inspection program.	The NAS Oceana WHMP serves an integral role in the airport self-inspection process, and shall be included as an Appendix in the NAS Oceana Air Operations Manual, to provide for the required annual review cycle. The WHMP shall detail all actions required to actively alleviate wildlife aircraft strike hazards.
1	(f)(1), a list of the individuals having authority and responsibility for implementing each aspect of the WHMP.	The NASOCEANAINST 3750.4 defines the personnel that have BASH Program authority and responsibility. These same personnel will have WHMP Element tasks and authorities. WHMP decision making roles and authorities will be specified in the WHMP, and approved by the Commanding Officer.
2	(f)(2) a list that prioritizes the following actions identified in the WHA(s), with target dates for their initiation and completion.	The NAS Oceana and NALF Fentress WHAs identify each airfield's predominant wildlife species, their behaviors, and their food, water, and shelter/cover attractants. From these attractants, a categorized mitigation hierarchy can be developed, assigning Duties and Tasks across installation departments.

#	14 CFR Part 139.337 Requirements	NAS Oceana WHMP Elements
2	(f)(2) con't	These tasks will be prioritized from the three identified Strategic Priority Zones defined in the NASOCEANAINST 3750.4. With these tasks developed and assigned, a historical record can then be made to accurately track wildlife mitigations, pending and accomplished.
	(f)(2)(i) Wildlife population management;	Construct Species-Specific population Habitat Maps and species management plans for each Airfield Environment to help identify specific wildlife control BMPs/methodologies for: * Prioritized habitat modification * Resource protection * Repelling/Exclusion * Hazardous Wildlife Removal
	(f)(2)(ii) Habitat management;	The WHMP shall detail a Food & Prey Management Plan Appendix for the WHMP, providing a link for Installation Pest Management Plan/FIFRA elements and environmentally responsible wildlife control BMPs required to sustain aircraft flight operations. * Rodents / Rodenticide * Insects / Insecticide * Earthworms * Local Grain/Seed Types/Handouts * Garbage Receptacles/Disposal * Other prey

#	14 CFR Part 139.337 Requirements	NAS Oceana WHMP Elements
2	(f)(2)(ii) Habitat management, con't;	The WHMP shall detail a Land Management Plan for approved "installation land uses," land management techniques, and establishment of the FAA concept of "Acceptable Maintenance Condition (AMC)," and the development of an annual Airport Work Plan. * AOA Vegetation / Herbicides * Landscaping (Mowing, Pruning) * Agricultural Leases/Compatibility * Drainage Ditch (DD) Vegetation Management * DD – Sediment/Vegetation Removal * DD – Bank Protection * DD – Storm Debris Removal * DD – Repairing Structures/Slope
		The WHMP shall detail a Water Management Plan as a stand-alone Appendix to address: * Permanent Water * Wetlands * Canals/Ditches/Streams * Holding Ponds * Sewage Treatment

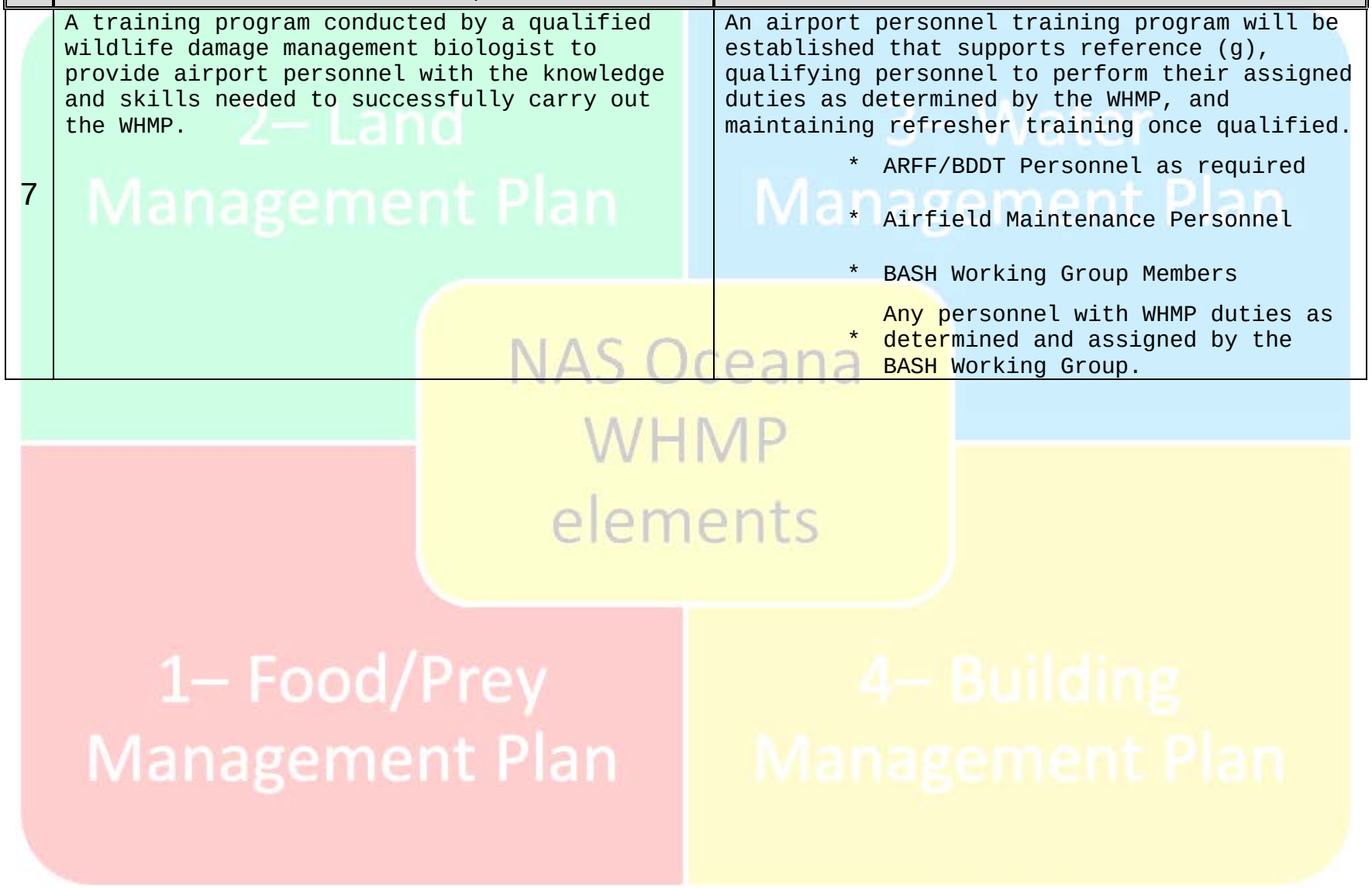
#	14 CFR Part 139.337 Requirements	NAS Oceana WHMP Elements
2	(f)(2)(ii) Habitat management, con't;	* Ephemeral Water (Taxiways, Runways, Aprons) * Other Water Areas/Wet Areas
		The WHMP shall detail a Building Management Plan as a stand-alone Appendix to address all buildings in the AOA or on the airfield property for nesting/roosting minimizations. * Airfield Structures in the AOA * Towers (navigation, cell, water, communications, etc.) * Abandoned structures * Planned construction. * AICUZ review of off-airfield property management practices that may be non-compatible with good BASH Program practices.
	(f)(2)(iii) Land use changes.	The Airport Master Plan should be reviewed by the BASH Working Group to assure that planned on-airfield property management practices are compatible with established BASH Program goals. * Develop a non-compatibility land use list to monitor and manage activities and property uses that attract wildlife, and defeat wildlife hazard mitigation efforts. * Ongoing Recordkeeping/NEPA Review

#	14 CFR Part 139.337 Requirements	NAS Oceana WHMP Elements
3	(f)(3) Permitting & Wildlife Control. Identify the requirements for all local, state, and federal wildlife control (harassment, trapping, and depredation) permits.	Here, the NAS Oceana WHMP should address each wildlife species determined to present a hazard as defined in the WHAs for each airfield, with a BMP for wildlife control assigned. Consideration must be given the chosen BMPs to clarify any/all Local, State, and Federal wildlife control permitting requirements; include copies of these permits in the WHMP. * F – Bald & Golden Eagle Protection Act * F – Endangered Species Act * F – Migratory Bird Treaty Act * F – Sikes Act * S – Commonwealth of Virginia * L – City of Chesapeake * L – City of Virginia Beach * F/S/L - Additional permitting for BMP identified pesticide, insecticide, rodenticide, herbicide uses.
4	(f)(4) Identification of resources the Airport will provide that will be required to implement the WHMP.	NAS Oceana's WHMP will identify the resources that each department will be required to provide to support IWDM at NAS Oceana and NALF Fentress, to include: * Personnel Tasking(s)

#	14 CFR Part 139.337 Requirements	NAS Oceana WHMP Elements
4	(f)(4) con't	* Dedicated time to surveying the airfields for WHMP element(s) wildlife control measures to determine effectiveness * Equipment (Mower guides, radios, guns, traps, propane cannons, exclusion devices, night vision aids, binoculars, etc. * Expendable supplies (pyrotechnics, plastic bags, labeling items) * Pesticides, Insecticides, Herbicides, Rodenticides, etc., and application equipment as needed * Installation Grid Maps * Vehicles * Any BWG approved item or resource not listed, but determined to be required to support the WHMP.
5	(f)(5) Procedures to be followed during flight operations have been established, that at a minimum includes:	The NASOCEANAINST 3750.4 uses the Daily BASH Plan and the BASH Airfield Safety Triangle to completely prepare/reset each airfield for use. Each active wildlife hazard control, personnel assignment, standing wildlife control action, and airfield ORM/SRM level of wildlife hazard awareness for airfield users is predetermined to create an active wildlife control environment to sustain uninterrupted flight operations.
	(f)(5)(i) Designation of personnel responsible for implementing active hazardous wildlife controls	* Personnel are designated 24 hours

#	14 CFR Part 139.337 Requirements	NAS Oceana WHMP Elements
5	(f)(5)(ii) Provisions identified for the conduct of physical inspections of the AOA and other areas critical to successfully manage known wildlife hazards before flight operations begin	* Duties and Tasks have been identified to establish airfield preflight inspections to set "Safe for Flight Operations (SFFO)." The SFFO period normally occurs each day during the observed wildlife peak times of 30 minutes +/- sunrise and sunset, after every major weather event, and after any active wildlife dispersal event on or near the runways or taxiways. * Documentation of wildlife activity is accomplished with the Wildlife Activity Log
	(f)(5)(iii) Wildlife control measures	* Active wildlife control measures are defined for both airfields, to include BHC setting, wildlife observations, as well as NRM, USDA-WS, and BDDT active dispersal and wildlife monitoring actions
	(f)(5)(iv) Ways to communicate effectively between personnel conducting wildlife control, or observing wildlife hazards and the air traffic control tower	* Airfield communications routines and communications hierarchy are defined, and practiced in accordance with FAA guidelines
6	(f)(6) Procedures to review and evaluate the WHMP every 12 consecutive months or following an event described in (b)(1), (b)(2), or (b)(3) of this section, including	Intervals for WHMP periodic and required reviews have been decided for each required circumstance according to federal law, and FAA guidelines.
	(f)(6)(i) The WHMP's effectiveness in dealing with known wildlife hazards on and in the airport's vicinity;	* The WHMP's effectiveness is assessed continually by the BWG quarterly, at a minimum.
	(f)(6)(ii) Aspects of the wildlife hazards described in the WHA that require reevaluation	* The WHA for each airfield is updated annually.

#	14 CFR Part 139.337 Requirements	NAS Oceana WHMP Elements
7	A training program conducted by a qualified wildlife damage management biologist to provide airport personnel with the knowledge and skills needed to successfully carry out the WHMP.	An airport personnel training program will be established that supports reference (g), qualifying personnel to perform their assigned duties as determined by the WHMP, and maintaining refresher training once qualified. * ARFF/BDDT Personnel as required * Airfield Maintenance Personnel * BASH Working Group Members * Any personnel with WHMP duties as determined and assigned by the BASH Working Group.



WILDLIFE HAZARD MANAGEMENT PLAN (WHMP) ANNUAL EVALUATION

The annual evaluation of the Wildlife Hazard Management Plan (WHMP) is a critical link in the Installation BASH Program, as it provides the backbone to the Integrated Wildlife Damage Management (IWDM) strategy. Reference (a) directs the minimum review periodicity of a WHMP. This enclosure is the "airport self-inspection" checklist for annual evaluation of the Installation WHMP for both the NAS Oceana and NALF Fentress airfields.

Inspection Date:	Reviewer Name:	Email:	

#	Installation WHMP Contents	Y or N	Reviewer Comments
0	*Brief introduction describes the greatest hazards identified in the Wildlife Hazard Assessment (WHA)?* * (i.e. the most hazardous species, the highest priority attractants, highest priority habitats requiring wildlife control)		
	Plan follows the order of the 14 CFR 139.337 federal law, with section headings that include the regulation language as provided in the WHMP Build Checklist?		
	Procedures in the WHMP are concise and specific including who, what, when, and why WHMP elements are to be completed?		
1	*(f)(1) "A list of the individuals having authority and responsibility for implementing each aspect of the plan"* * Including decision-making roles and responsibilities for implementing the WHMP within the Chain of Command:		
	* Designation of responsibility for determining and responding to wildlife hazard conditions, for all hours of airfield operations?		
	* Reference to any mutual agreements on hazardous wildlife attractant coordination within BWG, planning or zoning authorities?		

#	Installation WHMP Contents	Y or N	Reviewer Comments
2	*(f)(2) "A list prioritizing the following actions identified in the wildlife hazard assessment and target dates for their initiation and completion?"* *(As prioritized in the WHA and/or based on ongoing wildlife data collection and analysis, long-term species-specific or attractant-specific measures with target dates for completion. Examples: Installation of deer-proof fence, grass management strategy, removal of specific attractants, trapping or other population control programs, off-airport cooperative management programs)* * (i) Wildlife population management		
	* (ii) Habitat Modification		
	* (iii) Land Use Changes		
3	*(f)(3) "Requirements for, and where applicable, copies of local, State, and Federal wildlife control permits?"* * If lethal control or use of pesticides is part of this WHMP, appropriate permits are needed and applicable regulations are cited. Note: Citation of applicable regulations only – transcript of regulations is not necessary.		
4	*(f)(4) "Identification of resources that the airport will provide that will be required to implement the WHMP?"* * Lists identifying what resources each department at NAS Oceana will be required to provide to support IWDM at each airfield.		

#	Installation WHMP Contents	Y or N	Reviewer Comments
5	*(f)(5) "Wildlife Control Procedures to be followed during flight operations that at a minimum includes:* * *(i) "Designation of personnel responsible for implementing the procedures?"* (Wildlife patrol staffing, position titles, hours of availability, hours of airport operation.)		
	(ii) "Provisions to conduct physical inspections of the aircraft movement areas and other areas critical to successfully manage known wildlife hazards before flight operations begin?" * Routine airfield inspection procedures including documentation of wildlife inspections and observations. These should include daily runway sweeps sufficient to detect and retrieve carcasses.		
	* *(iii) "Wildlife hazard control measures, including:"* Procedures for continuous monitoring of wildlife conditions on the airfield during times, seasons, and conditions with potential for wildlife activity as identified in the WHAs?		
	* Wildlife dispersal procedures including species or guild specific procedures for hazardous species identified in the WHA?		
	* Specific actions and/or criteria for courses of action to respond to unusually heavy wildlife activity, such as due to weather or seasonal migration?		

#	Installation WHMP Contents	Y or N	Reviewer Comments
5	*(iii) "Wildlife hazard control measures" - con't* * Any special procedures for wildlife control during periods of heavy air traffic?		
	(iv) "Ways to communicate effectively between personnel conducting wildlife control or observing wildlife hazards and the air traffic control tower * Training in communication procedures and airfield familiarization (139.303)?		
	* Equipment needed, such as radios, cell phones, and lights?		
	* Reference to mutually agreed upon procedures for wildlife dispersal that may require runway access or may impact air traffic?		
	* Procedures for immediate coordination and response to pilot-reported wildlife strikes or observations?		
	* Procedures for short-term heavy wildlife activity requiring airfield users reporting?		
6	*(f)(6) "Procedures to review and evaluate the WHMP every 12 consecutive months, or following a (b)(1), (b)(2), or (b)(3) event, including the following:"* (One or more meetings to formally review progress and challenges implementing the WHMP are documented; Any standardized monitoring procedures (i.e. wildlife surveys); Procedures for documenting communication coordination, and prevention of off-airport attractants; Procedures for reviewing and analyzing data (strikes, observations, control actions, and standardized surveys) frequently and long-term, such as for annual review and update.)		

#	Installation WHMP Contents	Y or N	Reviewer Comments
6	*(f)(6) con't* * *(i) The WHMP's effectiveness in dealing with known wildlife hazards on and in the vicinity of the airfields?*		
	* *(ii) Aspects of the wildlife hazards described in the WHA that should be reevaluated?*		
7	*(f)(7) "A training program conducted by a qualified wildlife damage management biologist to provide airport personnel with the knowledge and skills needed to successfully carry out the WHMP?"* * Certification that the training curriculum and instructor meet the FAA requirements of reference (g)?		
	* Procedures to document training participation?		
	* Training and documentation procedures to meet any additional training requirements, such as species identification, firearms safety, or pesticide application?		

NAS OCEANA BASH SELF-ASSESSMENT CHECKLIST

The NAS Oceana and NALF Fentress BASH Self-Assessment Checklist is provided in support of references (a), (s), and (t). The NAS Oceana BASH Self-Assessment Checklist shall be used, at a minimum, to guide each critical performance area to ensure BASH Program compliance. This checklist shall be reviewed and updated via quarterly BWG meetings.

Inspection Date:	Reviewer Name:	Email:	

#	Installation BASH Program Element	Y or N	Reviewer Comments
1	**Plans and Instructions.**		
	* Does the Facility have a current BASH Instruction within the last 5 years?		
	* Is the BASH Program referenced accurately in the Air Facility Integrated Natural Resources Management Plan?		
	* Does the INRMP contain essential BASH elements (i.e., Land Management Plan, Water management Plan, Building Management Plan, Food/Prey (Pest) Management Plan) to measure ongoing successful natural resource management with BASH program requirements?		
	* Are all required installation departments actively involved in the BWG?		
	* Does the BWG meet quarterly?		
	* Is the ICO involved in the BWG processes?		

#	Installation BASH Program Element	Y or N	Reviewer Comments
2	**Reporting.** * Are both damaging and non-damaging wildlife strikes reported to the Naval Safety Center via the WESS System?		
	* Is there a wildlife remains collection and reporting process established that also supports maximum participation with tenants and transient aircraft custodians, and the Smithsonian Institution when required?		
	* Is the wildlife strike data collected for both air facilities, then used by the BWG to perform trend analysis and develop BASH Program management decisions, to include possible procedural and training adjustments necessary to adjust to wildlife hazard awareness and demand?		
	* Does the NRM and/or the USDA wildlife biologist(s) assist the installation, tenant squadrons, and transient aircrews with strike identification, sample collection, and reporting processes?		
3	**Surveys.** * Has a WHA or similar survey been conducted for the air facilities?		

#	Installation BASH Program Element	Y or N	Reviewer Comments
3	**Surveys, con't.** * Are routine wildlife observation surveys conducted to support the refinement of the existing WHAs?		
	* Are essential wildlife hazard mitigation actions defined in the INRMP as wildlife attractants explained at every stage in the essential BASH elements (i.e., Land Management Plan, Water management Plan, Building Management Plan, Food/Prey (Pest) Management Plan) set forth in an installation WHMP?		
	* Have each of the Strategic Priority Zones been evaluated for potential corrective actions required to support BASH Program preparedness?		
	* Has the Public Works Officer, NRM, and/or Airfield Manager developed a methodology to track all required BASH discrepancies requiring correction, to include work orders, to enable the prioritization of BASH emergent and routine corrective actions?		
4	**Communications.** * Does the ASO provide and ensure BASH Awareness through monthly Aviation Safety Council meetings, BWG meetings, and through Installation and tenant outreach with posters, pictures, maps, planning data?		

#	Installation BASH Program Element	Y or N	Reviewer Comments
4	**Communications, con't.** * Does the ATC Tower Supervisor relay wildlife hazard information to aircraft operating in the local flying areas?		
	* Does the ATCFO ensure that daily BHC are issued from the ATC Control Tower, ATIS, and FLIP publications as required?		
	* Is there BASH awareness, wildlife reporting procedures, and remains collection training included in the Installation Airfield Vehicle Operators Course?		
	* Do all ATC personnel have a good understanding of their role in the air facilities BASH program?		
5	**Natural Resources Management.** * Does the NRM work diligently to support the BASH Program by actively managing the agricultural leases for the Air Facilities within the AOAs?		
	* Is the INRMP utilized by the BWG to measure effectiveness of presently planned BASH Program initiatives, evaluate planned construction and MILCON projects, to include active agricultural lease management and evaluation for wildlife attractants?		
	* Is the air facility hunting program managed using appropriate wildlife depredation and local/state hunting permits to support the BASH Program?		

#	Installation BASH Program Element	Y or N	Reviewer Comments
5	**Natural Resources Management, con't.** * Is there an ongoing effort with local land owners adjacent to the air facilities to help minimize wildlife attractants and thereby, decrease BASH potential?		
6	**Wildlife Control.** * Does each Air Facility maintain a BDDT that has completed mandatory initial and recurrent wildlife hazard training by USDA biologist(s) on the BASH Program? Is the BDDT for each air facility active, equipped with approved wildlife dispersal equipment, and maintain a deployable methodology for wildlife dispersal 24hrs a day?		
	* Is a USDA Wildlife Services biologist present on the air facilities? Has the biologist been afforded the opportunity to complete USDA Wildlife Services Airport Certification?		
	* Is the USDA allowed to participate in the BWG?		
	* Does the USDA Wildlife Services biologist participate with BASH outreach to tenant commands maintenance and aviation safety personnel through direct liaison and training at Safety Standdowns?		

#	Installation BASH Program Element	Y or N	Reviewer Comments
6	**Wildlife Control, con't.** * Does the USDA Wildlife Services biologist(s) work with the NRM to share responsibility in obtaining and maintaining all necessary harassment and depredation permits required to sustain the BASH Program in accordance with required U.S. Fish & Wildlife Service and Virginia Department of Game & Inland Fisheries (VDGIF) permits?		
	* Does the USDA Wildlife Services biologist(s) utilize reference (o) to properly control, store, and operate all BASH pyrotechnics and weapons required to perform harassment and depredation in accordance with required U.S. Fish & Wildlife Service and Virginia Department of Game & Inland Fisheries (VDGIF) permits?		

WILDLIFE HAZARD ASSESSMENT

For

NAVAL AIR STATION OCEANA

June 1, 2010 through May 31, 2011

Prepared by

United States Department of Agriculture

Animal and Plant Health Inspection Service

Wildlife Services

Timothy J. Linder, Wildlife Biologist

July 20, 2012

Table of Contents

EXECUTIVE SUMMARY

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program (WS) conducted a 12-month wildlife hazard assessment (WHA) to identify wildlife hazards to aviation safety at Naval Air Station Oceana (NASO) from June 2010 through May 2011. To assess daily and seasonal patterns of wildlife use, we conducted bird surveys twice per month throughout the airfield and twenty-two night-time surveys to observe deer abundance and distribution. Data collected included species abundance, behavior, and habitat use. In addition, WS identified and monitored areas outside of the airfield that may attract hazardous wildlife species to NASO. Bird species observed were grouped into guilds (species that display similar behavioral characteristics) for analysis. Data collected during surveys were analyzed and compared with records from the Navy Safety Center Web Enabled Safety System (WESS) BASH database, control efforts by NASO and WS personnel, and a wildlife hazard ranking list (Dolbeer and Wright 2009) to identify the species that are most hazardous to aviation safety at NASO.

Based on information collected during the WHA, 1 mammal group and 7 guilds identified at NASO from June 2010 through May 2011 that presented the greatest threats to aviation safety. These group/guilds included deer, gulls, raptors (hawks, vultures, eagles), waterfowl (ducks and geese), pigeons/doves, crows/ravens, starlings, and blackbirds/orioles. Though blackbirds/orioles were the most abundant guild, deer were the most hazardous due to their large size, strike record, availability of habitat at or near NASO, and general abundance in the area. There were 4 species observed during the WHA that ranked as an extremely high hazard to aviation safety, and one species ranked as very high.

WS recommends a variety of methods to reduce or eliminate the threat of wildlife strikes from the group and guilds observed during the WHA. Habitat management can include: eliminating or excluding areas of standing water; vegetation management in the airfield; reducing or excluding bird perching/loafing areas; reducing abundance of prey species (such as small rodents and insects) in the airfield; installation of an Air Operations Area (AOA) fence, and ensuring that the perimeter fence is in good repair and prevents mammals such as deer from entering the airfield. WS also recommends harassment methods such as pyrotechnics, sirens, paintballs, propane cannons, and other acoustic dispersal devices to disperse birds from the airfield. Lethal control of hazardous species should be exercised when necessary utilizing firearms and/or traps. Permits for lethal control of species protected under federal and state laws should be maintained from the U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries.

Additional recommendations include updating the NASO's Bird/Animal Aircraft Strike Hazard (BASH) Plan, establishment of a formal BASH Working Group (BWG), establish a Bird Detection and Dispersal Team (BDDT), establish formal BASH training and evaluating potential wildlife hazards when planning new construction or land use changes. It is recommended that NASO continue to monitor wildlife abundance and habitat use in order to provide insight into wildlife use of the airfield and to gauge the effectiveness of control efforts.

1.0 INTRODUCTION

1.1 Purpose and Need for Action

Birds and other wildlife in the vicinity of airports are an increasing threat to aviation safety (Dolbeer et al. 2011). Since 1980, the Navy's national wildlife/aircraft strikes database accounted for 440 A, B, C and D Class-rated incidents that included two fatalities to Naval pilots and over $372 million dollars in damages (Naval Safety Center). Based on the Naval Safety Center analysis and statistics, the average damage cost over the last 31 years is one million dollars per month. It is estimated that wildlife/aircraft strikes cost the U.S. civil aviation industry more than $614 million annually, while worldwide the total cost is over $1.2 billion per year (Keirn et al. 2010). In addition to costly aircraft repairs and down time, wildlife strikes sometimes result in serious injury or death. In January 2009, the wildlife/aircraft strike issue was dramatically illustrated when U.S. Airways Flight 1549 crash landed in New York's Hudson River after ingesting Canada Geese into both engines shortly after takeoff from LaGuardia Airport (Dolbeer 2009). This incident has been referred to in the media as "The Miracle on the Hudson" since all 155 passengers and crew survived despite the aircraft being a total loss. Less than two weeks prior to this incident, eight people were killed and one was seriously injured when a helicopter transporting workers to an offshore site in Louisiana struck a Red-tailed Hawk and crashed into a marsh (Wright 2011).

The Commander, Naval Installations Command (CNIC) established the Navy Bird/Animal Strike Hazard Program Implementing Guidance (CNICINST 3700, Appendix A). The instruction establishes the guidance for all installations that conduct or support air operations to conduct a Wildlife Hazard Assessment (WHA). Although the U.S. Navy is not required to follow the regulations set down by the FAA, the Navy does implement the FAA's guidance and expertise whenever practical and appropriate.

The Federal Aviation Administration (FAA) is responsible for setting and enforcing the Federal Aviation Regulations (FAR) and policies to enhance public safety at civil airports. To ensure compliance with Code of Federal Regulations (CFR) 14 Part 139.337, the FAA requires certificated airports to conduct a wildlife hazard assessment (WHA), and if necessary, establish a wildlife hazard management plan (WHMP) when any of the following triggering events occur on or near an airport:

(1) An air carrier aircraft experiences multiple wildlife strikes;

(2) An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph, substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component;

(3) An air carrier aircraft experiences an engine ingestion of wildlife; or

(4) Wildlife of a size, or in numbers, capable of causing an event described above are observed to have access to any airport flight pattern or aircraft movement area.

The WHA must be conducted by a qualified wildlife biologist (see FAA Advisory Circular 150/5200-33B) and should include the following information:

(1) An analysis of the events or circumstances that prompted the assessment;

(2) Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences;

(3) Identification and location of features on and near the airport that attract wildlife;

(4) A description of wildlife hazards to air carrier operations; and

(5) Recommended actions for reducing identified wildlife hazards to air carrier operations.

Naval Air Station Oceana

In June 2010 NASO entered into a cooperative service with the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (hereafter referred to as WS) to initiate bird and deer surveys, evaluate current Wildlife Damage Management (WDM) program and provide direct control of hazardous wildlife using the airfield and hangars. In August 2010, CNIC entered into a cooperative service agreement with WS to conduct a WHA and to establish and continue an Integrated Wildlife Damage Management program (IWDM) at NASO. Oversight and direction of the IWDM will fall under direct supervision of the NAS Oceana Air Operations Department. Prior to 2010 a WHA had not been conducted at NASO. In March of 1999 Geo-Marine, Inc. provided NASO with a BASH Plan. This BASH Plan did not include a formal evaluation of airfield specific hazards.

1.2 Legal Authority of Wildlife Services

The U.S. Navy, Commander Navy Installations Command (CNIC) and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program (WS) have entered into a Work/ Financial Plan where WS will provide assistance to mitigate potential and realized wildlife hazards at USN air stations in the continental United States (Appendix B). The Plan establishes WS as the appropriate agency to conduct wildlife hazard management at Navy installations.

The primary statutory authority by which WS operates is the Animal Damage Control Act of March 2, 1931, as amended (7 U.S.C. 426-426c; 46 Stat. 1468). WS has the authority to manage migratory bird damage as specified in the CFR. In addition, the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988

authorizes and directs the Secretary of Agriculture to cooperate with States, individuals, public and private agencies, organizations, and institutions in the control of nuisance mammals and birds deemed injurious to the public.

The Plan and legislation authorizes WS to conduct initial on-site investigations, biological assessments (short-term studies), WHA, and wildlife management techniques to assist USN air stations.

1.3 Legal Status of Wildlife Species

Most species of wildlife are protected by one or more Federal, State, and/or local laws and regulations. As such, several agencies may be responsible for implementation of these regulations and specific permits may be required prior to taking action to reduce wildlife threats to aviation safety.

Federal laws passed by Congress to protect wildlife include (but are not limited to) the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and the Endangered Species Act (ESA). Federal wildlife laws are generally administered by the U.S. Fish and Wildlife Service (USFWS), which is the lead agency responsible for migratory birds protected under the MBTA, BGEPA, and ESA. The USFWS may issue depredation permits to take or harass migratory birds when those species are causing damage to various resources or threaten human health and safety (Appendix C).

The Commonwealth of Virginia defers to the Federal depredation permit for take of non-game migratory bird species, though a separate permit is required to take mammals and game bird species managed by the Virginia Department of Game and Inland Fisheries (VDGIF). As detailed in § 29.1-529 of the Code of Virginia, airport operators may obtain authorization from VDGIF to take wildlife (that are not federally protected) as necessary to protect aviation safety (Appendix D).

The Commonwealth of Virginia hosts a number of threatened and endangered (T&E) species that are granted protection under Federal and State regulations (Appendix E). Prior to conducting operational control work such as harassment, shooting, trapping, or habitat manipulation, the list of species of concern should be reviewed to ensure compliance with Federal and State regulations.

2.0 OBJECTIVES

The objectives of this WHA were to:

1. Identify wildlife species, numbers, locations, behavior, and habitat use in and around the airfield, with particular emphasis on species most hazardous to aircraft safety;
2. Identify and locate features on and in the vicinity of the airport that attract wildlife;
3. Describe wildlife hazards to aviation safety at NASO;
4. Provide NASO with management recommendations to reduce or eliminate wildlife hazards to aviation safety and serve as a basis for updating the current BASH Plan.

3.0 DESCRIPTION OF STUDY AREA

Figure 1: Aerial view of NASO (photo from GoogleEarth, 2010).

Naval Air Station Oceana is located within the City of Virginia Beach, VA. NASO's 4 runways, 2 sets of parallel runways (5R/23L, 5L/23R, 14R/32L, and 14L/32R), supported 76,296 aircraft operations in calendar year 2010. There are 19 squadrons based at NASO housing approximately 315 military aircraft. NASO property incorporates approximately 5,900 acres, of which 3,200 acres makeup the airfield. The airfield is comprised of open grassland (~920 acres), agricultural leases (~720 acres), woodlots, and areas of secondary growth (~1,560 acres). The woodlots are primarily comprised of mixed hardwoods and evergreens. The remaining 2,700 acres of base not included in the airfield are comprised of facility buildings, two 18-hole golf courses, woodlots, agricultural areas, wetland mitigation sites, and open, grasslands. A 7-foot fence with a three strand barbed-wire outriggers surrounds the perimeter of the base. NASO is bordered by a mixture of residential, woodland, industrial, agricultural, and open water areas.

4.0 METHODS

Data collection for the WHA began in June 1, 2010 and continued through May 31, 2011. Bird survey procedures were based on the North American Breeding Bird Survey methodology. Surveys were conducted twice per month for 12 months at 18 observation points on the airfield (Figure 2). The beginning observation point for each survey was randomly selected, with 2 repetitions of the survey route per day (1/2 hour after sunrise and 2-3 hours prior to dusk).

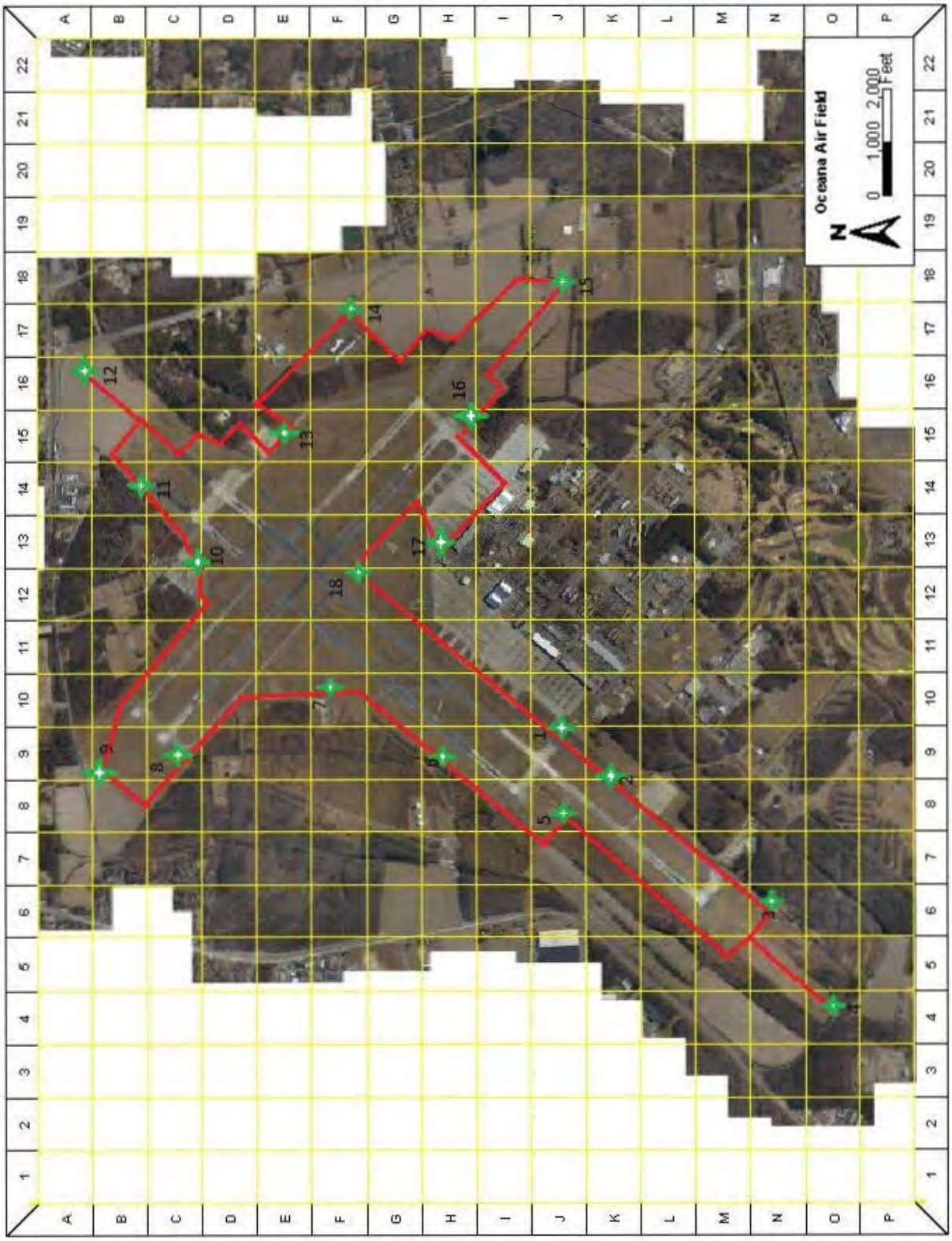


Figure 2: NAS Oceana Bird Observation Points and Survey Route.

Birds were observed from a vehicle for 3 minutes at each point, with approximately ¼ mile distance between points. At each observation point, the following data were recorded: weather, temperature, time, location, species, number observed, activity (behavior), habitat type, direction of flight, and comments on any other significant information (i.e., freshly mowed grass, approaching weather, change in flight activity, agricultural crop on fields, etc.). A map overlain with a 1000-foot grid system was used to record location. Bird species were located without the aid of binoculars, though binoculars were used to identify species that could not be readily identified with the naked eye or in low light conditions. Alpha species codes from the North American Bird Banding Manual were used to record birds observed during surveys.

In addition to bird surveys, 22 night-time deer surveys were conducted in the airfield over the course of the study period. Beginning 1 hour after sunset, night surveys were conducted by driving an established route 15.5 miles long around the airfield (Figure 3). Observations were made using spotlights and forward looking infra-red (FLIR) equipment to determine primarily deer, and other mammal use of the airfield. Information recorded included: weather, temperature, time, location, species, number observed, activity, and habitat type.

Data were analyzed with descriptive statistics and frequency distributions per month using the Wildlife Hazard Management Information System (WHMIS) software developed by WS to determine trends in species abundance, habitat use, and behavior. For analysis purposes, common species were categorized into groups or guilds. Species were placed into their respective guilds based on similar behavioral characteristics, not taxonomic relationships (although guilds often parallel taxonomic lines). This approach was selected because behavioral attributes play a significant role in predisposing some species of wildlife to collisions with aircraft. In addition, wildlife control strategies are often selected based on their ability to exploit an animal's specific behavior(s), therefore species that exhibit similar behaviors and life history attributes generally require similar control methods.

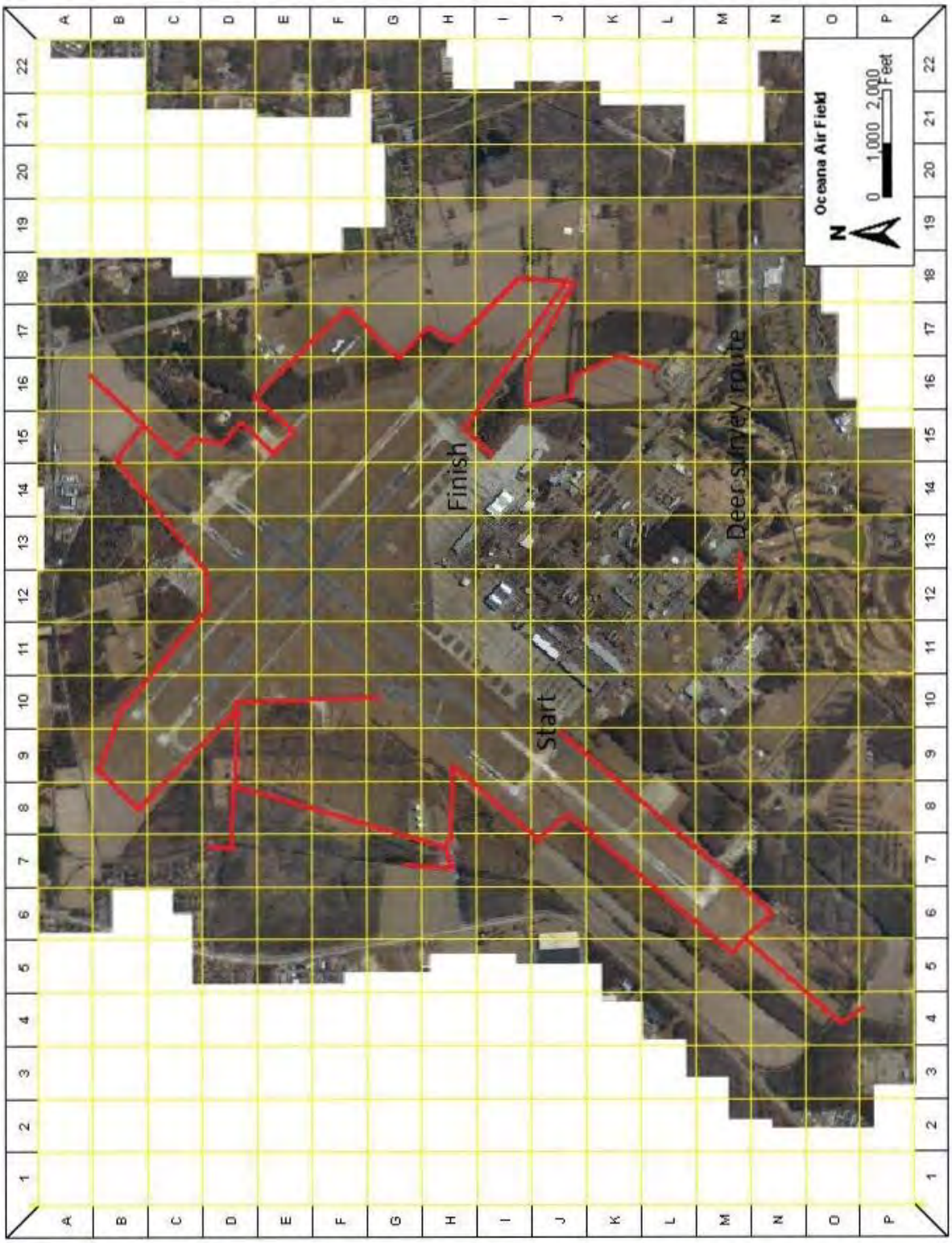


Figure 3: NAS Oceana Deer Survey Route.

5.0 RESULTS

5.1 Wildlife/Aircraft Strikes

According to criteria outlined in FAA Advisory Circular 150/5200-32A, a wildlife strike has occurred when:

1. A pilot reports striking 1 or more birds or other wildlife;
2. Aircraft maintenance personnel report aircraft damage as having been caused by a wildlife strike;
3. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;
4. Bird or other wildlife remains, whether in whole or in part, are found within 250 feet of a runway centerline, unless another reason for the animal's death is identified; and
5. An animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high speed emergency stop, aircraft left pavement area to avoid collision with an animal, etc.).

Wildlife strike data provides valuable information about wildlife hazards on or near airfields, including the species that are struck, seasonal trends, and time of day when strikes occur. Nationwide, the number of reported wildlife strikes has shown a five-fold increase from 1990 through 2009 (Dolbeer et al. 2011). Despite the increase in reported strikes, the number of strikes resulting in damage during this same time period has declined by 21% (Dolbeer et al. 2011). This important fact is attributed to successful wildlife hazard management programs and improved reporting at many certificated airports (Dolbeer et al. 2011).

Data obtained from the Navy Safety Center WESS and Smithsonian Feather ID Lab revealed that there have been 327 reported wildlife strikes at NASO from 1981 through 2010 (Figure 4). Wildlife strikes peaked in 2010 with 45 reported strikes (Figure 4). The upward trend in wildlife strikes at NASO may be attributed to factors such as increases in wildlife populations, changing land uses on and adjacent to the airbase, and an increase in reporting. The Navy Safety Center estimates that only 25% of all strikes are reported. Much of the increase may be attributed to better reporting of wildlife strikes due to greater awareness of the wildlife strike issue and greater cooperation within the aviation industry to report strikes (Dolbeer et al. 2011).

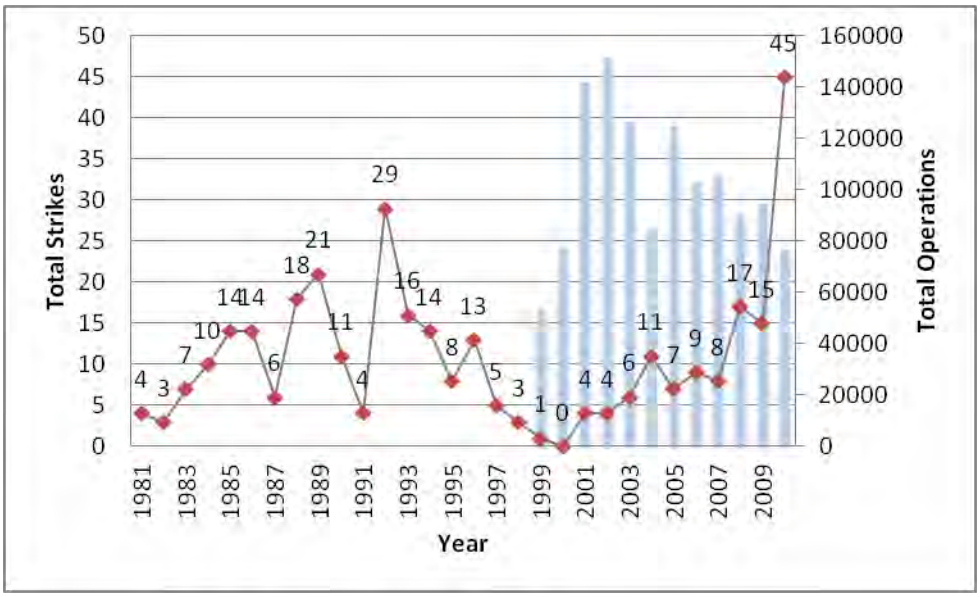


Figure 4: Reported wildlife strikes (1981-2010) and aircraft operations (1999-2010) at NASO.

Of the 327 reported strikes at NASO from 1981 through 2010, over 80% were unknown species (263), 11.9% involved birds (39), 7.3% were white-tailed deer (24), and less than 1% involved bats (1). Most of the unknown strike reports were bird species (270, or 82.5%). Of the strikes where the species was identified, white-tailed deer (24), and gulls (5) were the most frequently reported species. Consistent with national trends (Dolbeer et al. 2011), most strikes at NASO occur in the late summer through early fall (Figure 5). Strikes during these periods coincide with the dispersal of naïve juveniles and fall migration.

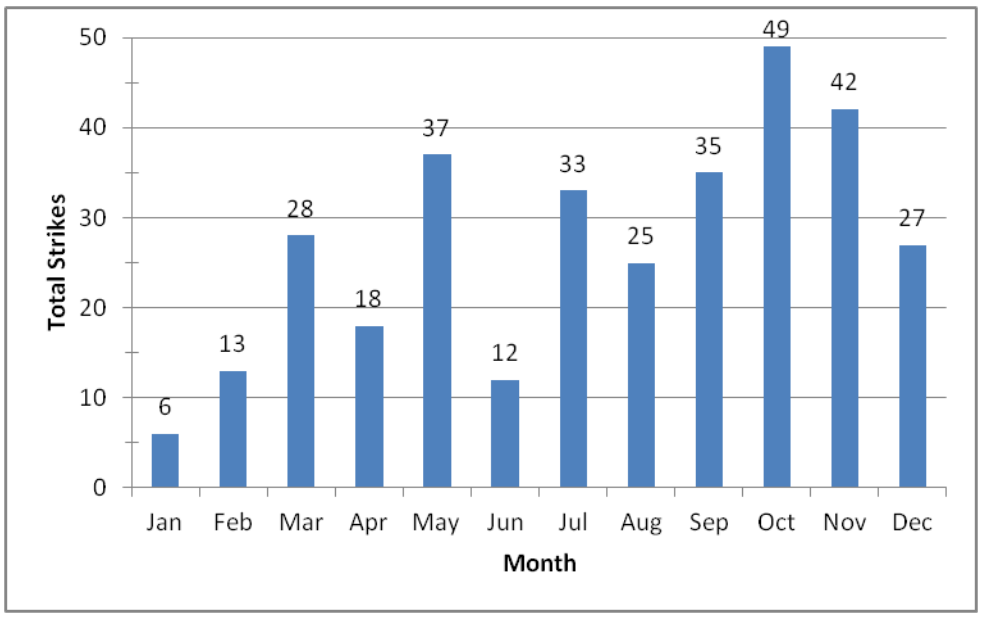


Figure 5: Number of strikes reported by month at NASO, 1981-2010.

For all strikes reported at NASO only 0.9% (3 of 327) reported damage >$10,000 (Table 1). All 3 strikes were * Class C Mishaps (1 deer $15,000, 1 deer $12,258, and 1 unknown gull $19,999).

Table 1: Strikes with reported damage at NASO, 1981-2010.

Species	N	A	B	C	Total
Unknown	263				263
White-tailed Deer	22			2	24
Passerine Species	5				5
Ring-billed Gull	3				3
Herring Gull	3				3
Blackpoll Warbler	3				3
Eastern Meadowlark	2				2
Red-tailed Hawk	2				2
American Kestrel	2				2
Barn Swallow	2				2
Chimney Swift	2				2
Tree Swallow	1				1
Upland Sandpiper	1				1
Horned Lark	1				1
Baltimore Oriole	1				1
Fox Sparrow	1				1
Unknown Seabird	1				1
Unknown Gull				1	1
Broad-winged Hawk	1				1
Morning Dove	1				1
Northern Parula	1				1
Black-throated Blue Warbler	1				1
Yellow-rumped Warbler	1				1
Common Yellowthroat	1				1
Swainson's Thrush	1				1
Pectoral Sandpiper	1				1
Bat	1				1
Total	**322**	**0**	**0**	**3**	**327**

Damage Classes: N = No damage Reported or <$10,000
A = >$1,000,000
B = $200,000 to <$1,000,000
C = $10,000 to <$200,000

5.2 Wildlife Surveys

Birds

From June 2010 through May 2011, WS recorded 32,037 bird observations at NASO during bird surveys. Sixty-nine bird species representing 29 different bird guilds were observed throughout the study year (a complete table listing each guild and species observed throughout the study year may be found in Appendix F). The 6 most abundant guilds were Blackbirds/Orioles (15,454), Starlings (6,046), Waterfowl (1,701), Pigeons/Doves (1,571), Crows/Ravens (1,472), Meadowlarks (1,244), and Gulls (1,139. The 10 most abundant species observed are listed below[1]:

1.) European Starling (*Sturnus vulgaris*) = 6,046
2.) Canada Geese (*Branta canadensis*) = 1,618
3.) American Crow (*Corvus Brachyrincos*) = 1,472
4.) Eastern Meadowlark (*Sturnella magna*) = 1,244
5.) Mourning Dove (*Zenaida macroura*) = 952
6.) Laughing Gull (*Larus atricilla*) = 766
7.) Rock Pigeon (*Columba liva*) = 619
8.) Tree Swallow (*Tachycineta bicolor*) = 510
9.) Red-winged Blackbird (*Agelaius phoeniceus*) = 441
10.) Killdeer (*Charadrius vociferous*) = 432

Birds were observed in 14 different habitat types during surveys at NASO. Birds were most commonly observed utilizing the large, open areas of short grass (32%) that makeup the dominant habitat feature on the active airfield (Figure 6). Woodland areas were the next most commonly used habitat (21%), followed by structures (13%) such as towers, fences, and buildings where birds were often observed loafing.

Bird activity was classified into 12 categories: flying locally (short, random flights); perched (loafing on a structure); vocalizing; feeding (actively consuming food); standing; flying passing (flying in a continuous path beyond the survey area); loafing (staying in one area, on a structure for a length of time without engaging in another activity); towering (flying in a circular pattern, often while utilizing thermal currents); hawking insects (flying erratically while attempting to catch insects); walking; roosting (perched in a single location for the night); and swimming. Sixty-three percent of all observations fell into three activities: flying locally (31%), perched (19%) and vocalizing (13%) for all species during the study year (Figure 7).

[1] Total abundance is derived by summing all bird observations throughout the study year. Therefore, the total number of bird observations includes individuals that may have been present on the airfield day after day and were recorded on multiple occasions.

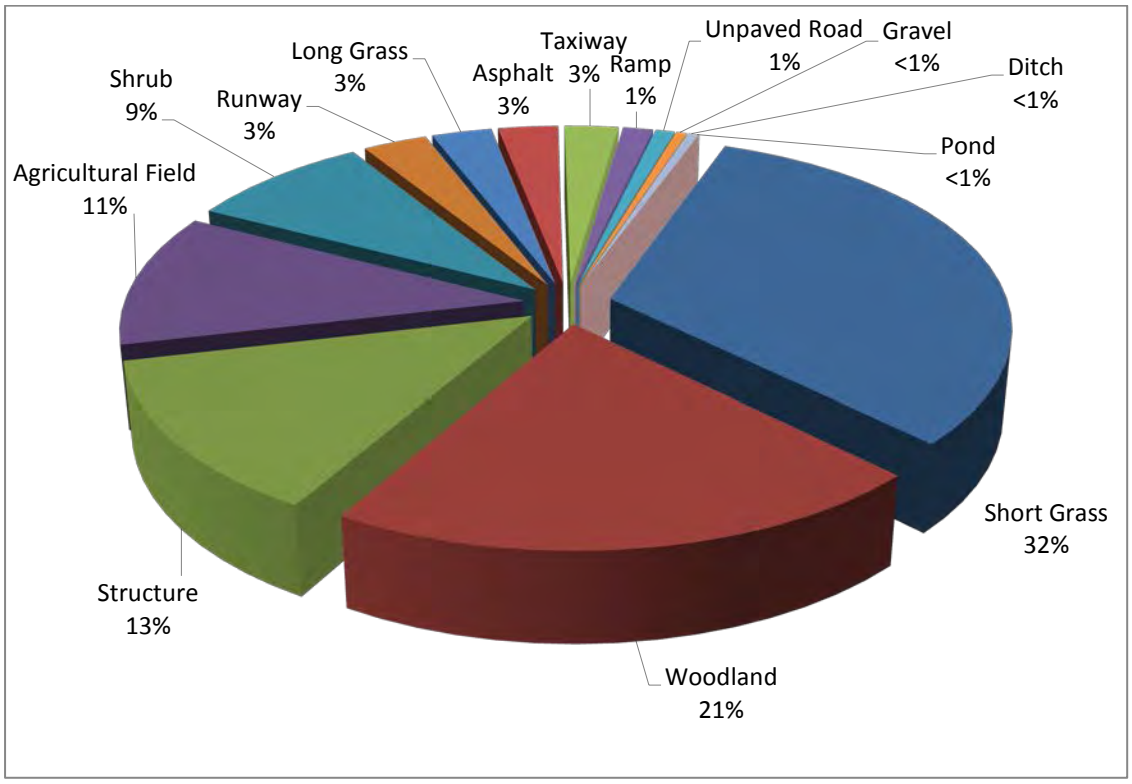


Figure 6: Habitat use by birds at NASO, June 2010 through May 2011.

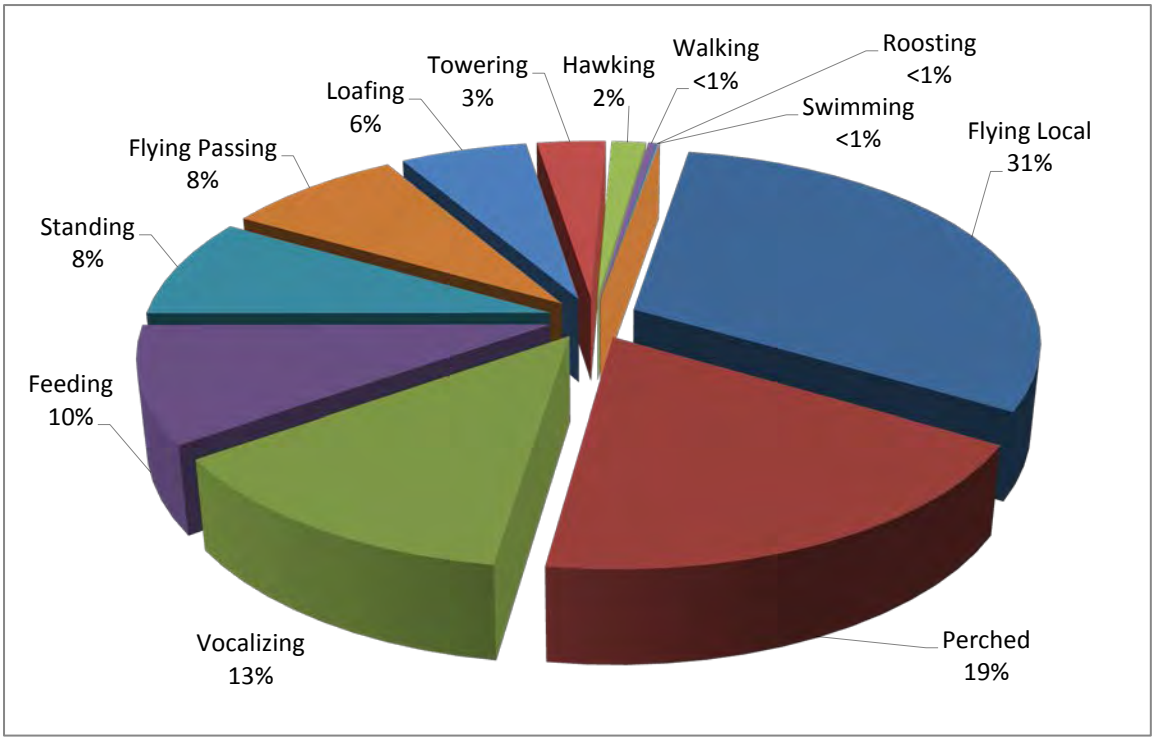


Figure 7: Bird activity at NASO, June 2010 through May 2011.

Mammals

WS completed 22 night surveys of the NASO airfield during the study year. Three hundred and seventy-nine medium to large mammals were observed during night surveys through the study year, with white-tailed deer (*Odocoileus virginianus*) being the most frequently observed species (Table 2). Observations recorded during night surveys may have been multiple observations of the same individuals throughout the survey year. Most mammal species were observed in the agricultural fields or in short grass (Table 2).

Table 2: Mammal species and cover type observed during night surveys at NASO.

Species	Ag. Fields	Grass, Short	Grass, long	Woodland	Shrub	Asphalt/Unpaved Road	Total
White-tailed Deer	143	134	31	28	29		**365**
Coyote	1	3				1	**5**
Red Fox			1	1		1	**3**
Gray Fox	2						**2**
Bobcat	1				1	1	**3**
Total	**147**	**137**	**32**	**29**	**30**	**3**	**378**

Small mammal surveys were not included in this WHA. Small mammal surveys are conducted bi-annually in the fall and spring to determine abundance and preferred habitat for species such as voles and mice inhabiting the airfield. The data is beneficial for evaluating predator-prey relationships on the airfield by comparing relative rodent abundance to wildlife activity and strike information. Small mammal surveys were conducted in the fall of 2011 and spring of 2012. The data collected from these surveys will be evaluated and included in the first annual update to this WHA.

6.0 DISCUSSION

Although almost all wildlife species commonly found at airports can pose some hazard to aircraft safety, not all species are equally hazardous to aviation (Dolbeer and Wright 2009). For example, bird species such as Canada Geese (*Branta canadensis*) are more likely to cause damage if struck by aircraft than species the size of a sparrow. Utilizing the FAA wildlife strike database, Dolbeer and Wright (2009) developed a ranking of 89 wildlife species that pose the greatest threats to aircraft safety. The ranking was based on the percentage of strikes causing damage to aircraft from 1990 through 2007, and species were classified into 6 hazard severity levels ranging from extremely high (>40% of strikes causing damage) to very low (<1% of strikes causing damage). Combined with wildlife surveys conducted locally at an airbase, this hazard ranking list can be used to prioritize management actions to species posing the greatest risk to aircraft safety (Dolbeer and Wright 2009).

Though there were 76 species observed from 29 different guilds and 4 mammal groups through the study year (Appendix F), for this discussion emphasis will be placed on those guilds/groups

that pose the greatest threats to aviation safety at NASO. For this analysis the following criteria was used:

Primary Consideration:

1. Number of individuals observed during surveys.
2. The individuals' associated hazard ranking according to Dolbeer and Wright.
3. Evaluation of NAS Oceana's strike record.

Secondary consideration was given for the following conditions:

- Location and behavior of individuals within each guild/group.
- Amount of control effort attributed to remove the specific hazard from the airfield (i.e. did the species easily disperse or not).

Using this information, guilds/groups were ranked in order of the threat level that they pose to aviation safety at NASO from the most severe to the least. This comparison helps to show that the most abundant species at an airfield (Blackbirds/Orioles, in this case) are not necessarily the most hazardous to aircraft safety due to abundance alone. The 8 guilds/group identified as most hazardous to aircraft safety at NASO from June 2010 through May 2011 were deer, Gulls, Raptors, Waterfowl, Pigeons/Dove, Crows/Ravens, Starlings, and Blackbirds/Orioles (Table 3), respectively. There were four species observed at NASO that rank as an extremely high hazard to aviation safety, one as very high, and six as a high hazard (Table 3). The following discussion and management recommendations will focus on the 8 most hazardous guilds/groups listed in Table 3. However, most if not all of the management recommendations (habitat modification, dispersal methods, etc.) will be effective for managing the majority of species observed at NASO.

Table 3: Guild hazard ranking and total observations at NASO, June 2010 through May 2011.

Guild/Group	Species	Hazard Level and percentage of strikes causing damage in the U.S.[1]	Total Observed at NASO[2]	Reported Strikes at NASO, 1981-2010	Strikes at NASO with reported damage, 1981-2010[3]
Artiodactyls	White-tailed Deer	Extremely High (82%)	365	24	2
Gulls	Laughing Gull	Moderate (7%)	766	0	0
	Ring-billed Gull	High (10%)	346	3	0
	Herring Gull	High (12%)	23	3	0
	Unknown Gull	n/a	4	1	1
	Totals		**1139**	**7**	**1**

Raptors	Red-tailed Hawk	High (17%)	279	2	0
	American Kestrel	Very Low (1%)	171	2	0
	Northern Harrier	Low (2%)	171	0	0
	Turkey Vulture	Extremely High (52%)	99	0	0
	Osprey	Very High (22%)	11	0	0
	Cooper's Hawk	n/a	8	0	0
	Bald Eagle	Extremely High (42%)	4	0	0
	Sharp-shinned Hawk	n/a	1	0	0
	Broad-winged Hawk	n/a	0	1	0
	Totals		**744**	**5**	**0**

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Table 3 (Cont.): Guild hazard ranking and total observations at NASO, June 2010 through May 2011.

Guild/Group	Species	Hazard Level and percentage of strikes causing damage in the U.S.[1]	Total Observed at NASO[2]	Reported Strikes at NASO, 1981-2010	Strikes at NASO with reported damage, 1981-2010[3]
Waterfowl	Canada Geese	Extremely High (51%)	1618	0	0
	American Brant	n/a	67	0	0
	Tundra Swan	n/a	12	0	0
	Hooded Merganser	n/a	3	0	0
	Mallard	Very High (26%)	1	0	0

	Totals		**1701**	**0**	**0**
Pigeon/Doves	Mourning Dove	Moderate (4%)	952	1	0
	Rock Pigeon	High (12%)	619	0	0
	Totals		**1571**	**1**	**0**
Crows/ Ravens	American Crow	High (10%)	1472	0	0
Starlings	European Starling	Moderate (4%)	6046	0	0
Blackbirds/ Orioles	Mixed Flock	n/a	14925	0	0
	Red-winged Blackbird	Low (3%)	441	0	0
	Common Grackle	Moderate (9%)	84	0	0
	Brown-headed Cowbird	Low (2%)	4	0	0
	Baltimore Oriole	n/a	0	1	0
	Totals		**15454**	**1**	**0**

1. Ranking based on strike reports from 1990-2007 (Dolbeer and Wright 2009); "n/a" indicates that species was not individually ranked.
2. Total observations obtained by summing all observations during surveys (day and night) from June 2010-July 2011. Total may include individuals that were present day after day and were recorded on multiple occasions.
3. Reported damage >$10,000.

6.1 Artiodactyls

Artiodactyls (i.e., deer) rank as the most hazardous mammal species to aviation safety in the United States, with 82% of strikes resulting in damage from 1990 through 2007 (Dolbeer and Wright 2009). The large size of species such as White-tailed Deer and the percentage of strikes involving multiple animals make them especially hazardous to aircraft during the takeoff and landing phases of flight. From 1990 through 2009, Artiodactyls, primarily white-tailed deer, have been involved in 847 damaging strikes in the U.S., resulting in over $36 million in reported costs (Dolbeer et al. 2011).

General Abundance

Deer were the twelfth most abundant group observed at NASO from June 2010 through May 2011 (Appendix F). White-tailed deer (*Odocoileus virginianus*), the only species observed in this group, rank as an extremely high hazard to aviation safety, with 82% of strikes causing damage from 1990 through 2007 on civil airfields (Table 3, Dolbeer and Wright 2009). From 1981 through 2010 twenty-four deer were struck by aircraft at NASO, and account for two out of only three reported Class C mishaps (WESS Database) on base. A total of 365 deer were observed during 22 night surveys. Night surveys were conducted by driving a predetermined 15.5 mile route around the airfield, using spotlights and/or FLIR to locate deer. The initial two surveys in June of 2010 surveyed 61 and 66 deer. While the deer surveys in May of 2011 surveyed only five and seven deer, respectively. Large numbers of deer are routinely observed in areas surrounding the base property located outside the perimeter fence, on both Navy and private property.

Attractants

The NASO active airfield contains ideal habitat for deer, including agricultural fields, mature timber (especially white oak, a preferred food source), edge/shrub areas, emergent vegetation, and open grassland.

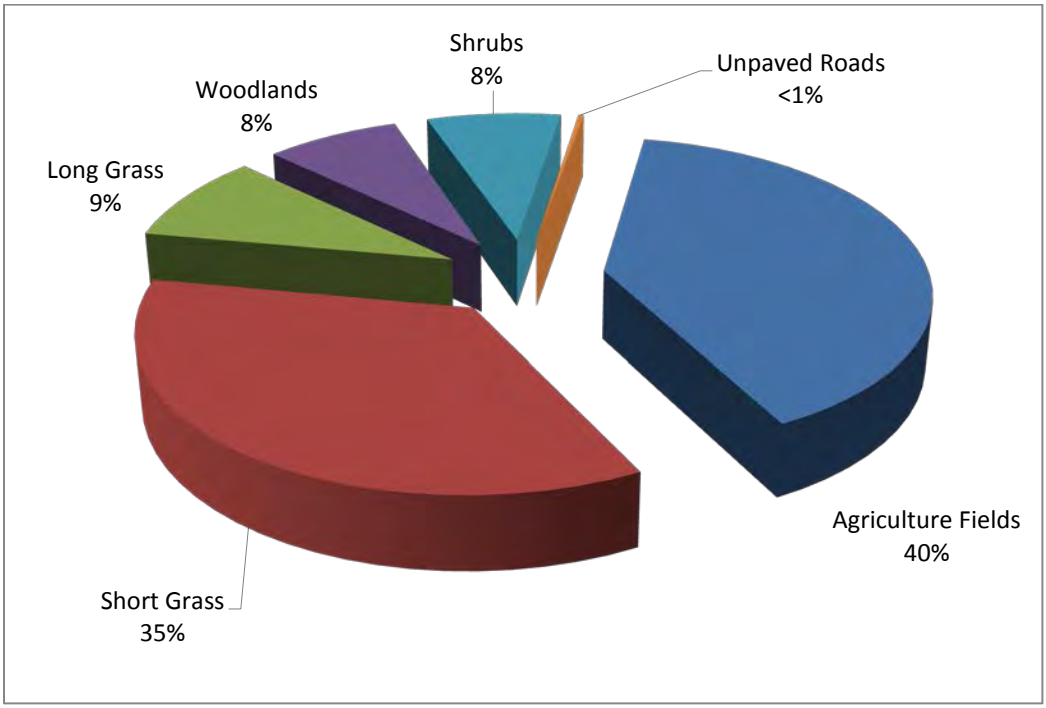

Figure 8: Deer habitat use at NASO, June 2010 through May 2011.

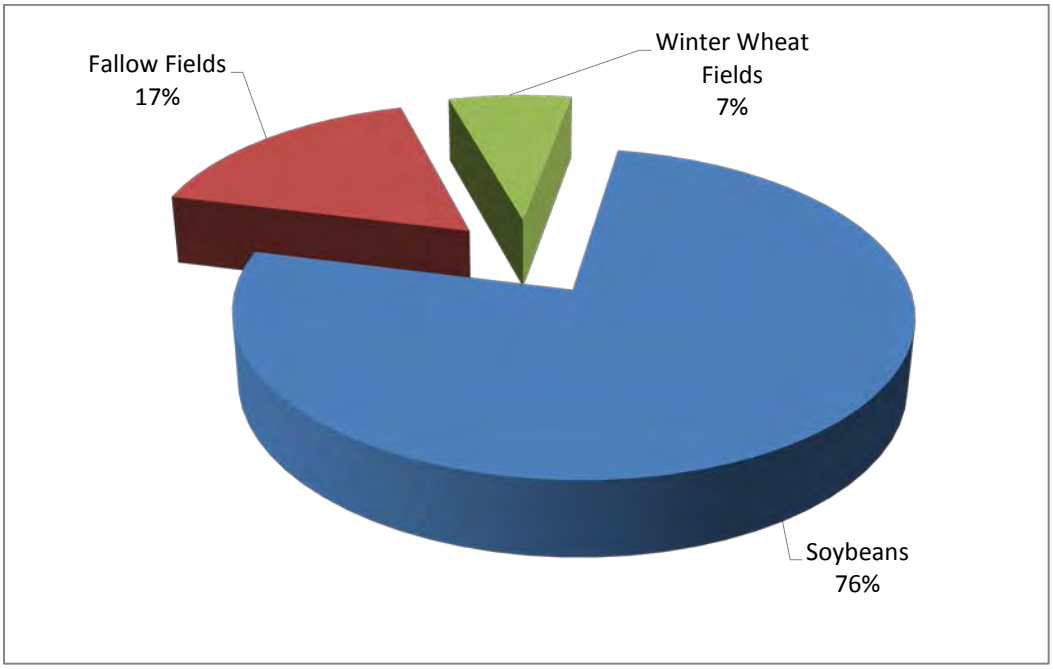

Figure 9: Deer agricultural field use at NASO, June 2010 through May 2011.

Deer were most often observed utilizing two habitat features at NASO: agricultural fields (40%) and short grass (35%, Figure 8). Soybeans accounted for 76% of all deer surveyed in agricultural fields (Figure 9).

NASO contains areas outside of the airfield within the base perimeter fence that contain ideal habitat for deer including: agricultural fields, mature timber, edge/shrub areas, emergent vegetation, wetland mitigation site, two 18-hole golf courses, and open grassland. Deer are often seen utilizing these habitat features by WS and base personnel. These areas outside of the airfield are not fenced off from the airfield. WS personnel have identified several travel corridors utilized by deer to gain access to the airfield (Figure 10). Travel corridors were identified by direct and indirect observations. The travel corridors are identified in yellow below.

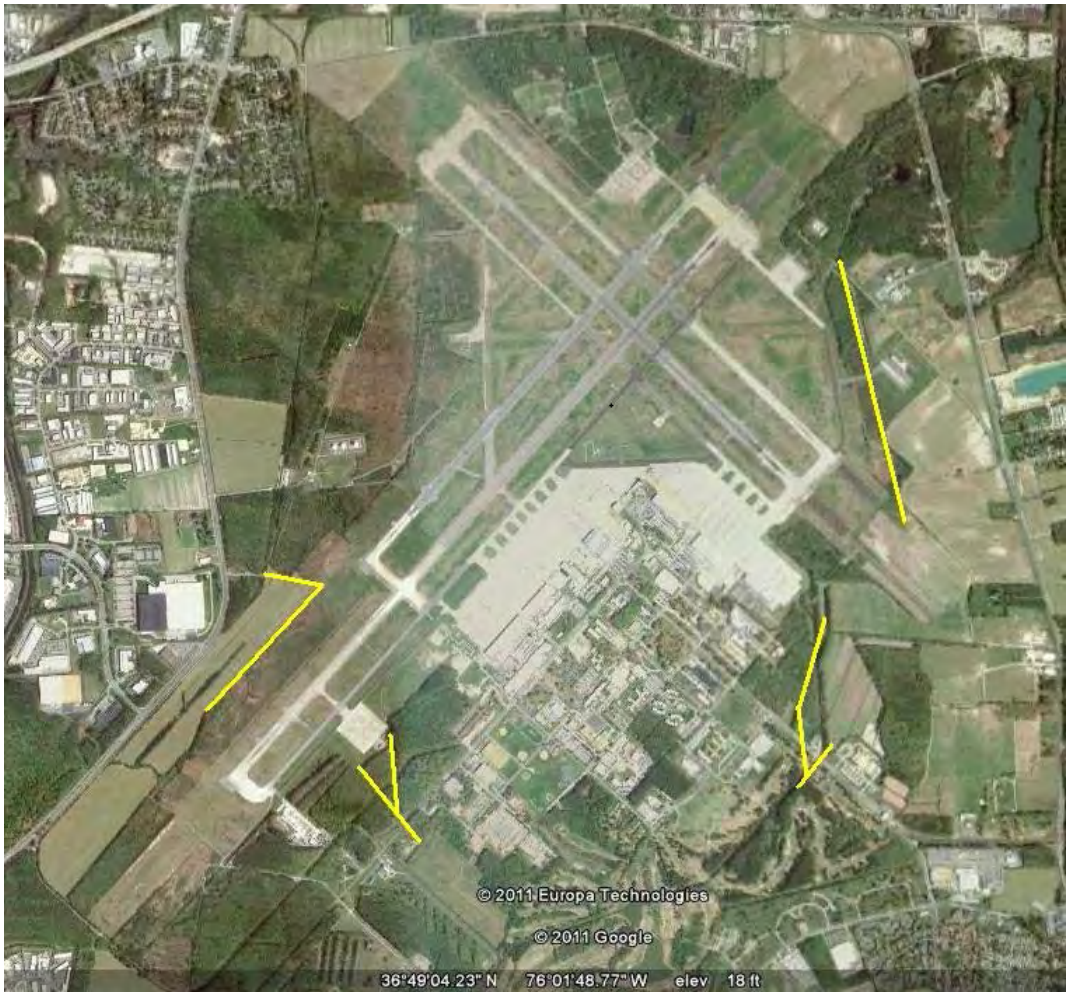

Figure 10: White-tailed deer travel corridors aerial view (photo from GoogleEarth, 2011).

Management Recommendations

Habitat management, installation of an airfield fence, maintenance of the perimeter fence, and removal of deer within the perimeter fence are the most important methods for reducing the threat of deer strikes at NASO. Airfield management is currently converting areas of optimal deer habitat (i.e. secondary growth and security cover) adjacent to the runways to maintained open grassland. After these areas have been cleared it is important that they are properly maintained (regular mowing) to prevent them from reverting back to woody habitat. This site conversion has decreased the number of deer observed in close proximity to runways. Airfield Operations is currently pursuing a Clear Zone Management Plan that will continue to reduce optimal deer habitat adjacent to runways.

The entire base perimeter fence should be inspected frequently. Any gaps large enough to allow deer and any medium sized mammals access to the base should be repaired immediately by installing bars, wire, stone, or patching with sections of fence. Gates should be inspected regularly and personnel should ensure that gates are secured tightly so that there are no spaces between or under gates, large enough to allow deer to pass

between or through them. Sections of fence that cross water drainage ditches/culverts should be inspected for possible deer access points. If these areas are large enough to allow deer access to the base they should be affixed with a swing gate or other similar devices that would allow high water to flow from the base while excluding deer to access.

NASO should continue to actively remove deer from the base. Removal is currently being accomplished through WS personnel and a base hunting program utilizing VDGIF Deer Population Reduction Program (DPOP). Currently, there are additional base properties that could utilize the DPOP program to reduce the deer threat to aviation safety and provide recreational opportunities for Navy personnel. These areas include old base housing, Boy Scout area, base property behind Natural Resource building located on Oceana Boulevard, and all other areas that could be hunted safely.

WS recommends that any deer present in the airfield be removed immediately via shooting or trapping. While not an immediate threat to aircraft safety, deer present on base property can and do gain access to the airfield. Deer on base, off of the airfield also serve as a source population for deer to annually disperse to the airfield. Lethal removal of deer requires a permit from the VDGIF, and it is recommended that NASO keep its permit current.

6.2 Gulls

From 1990 through 2009, gulls were the most frequently struck bird group in the United States (for strikes where the species was identified), with 24% of the 7,894 reported civil strikes resulting in damage (Dolbeer et al. 2011). Gulls threaten aircraft safety due to their tendency to form large flocks, size, flight characteristics, and their foraging and loafing behaviors.

General Abundance

While gulls were the seventh most abundant guild observed at NASO from June 2010 through May 2011 with 1,160 observations (Appendix F), 2 species observed at NASO in the gull guild pose a high risk to aviation safety (Table 3), making gulls the second most hazardous guild to aircraft safety at NASO (Table 3). As shown in Table 3, Laughing Gulls (*Larus atricilla*) were the most commonly observed species in the Gull guild, followed by Ring-billed Gulls (*Larus delawarensis*), Herring Gulls (*Larus argentatus*), and unknown gulls (i.e. gull species that could not be identified during the survey). Gulls were most often observed in or over agricultural and long grass areas of the airfield (Figure 11).

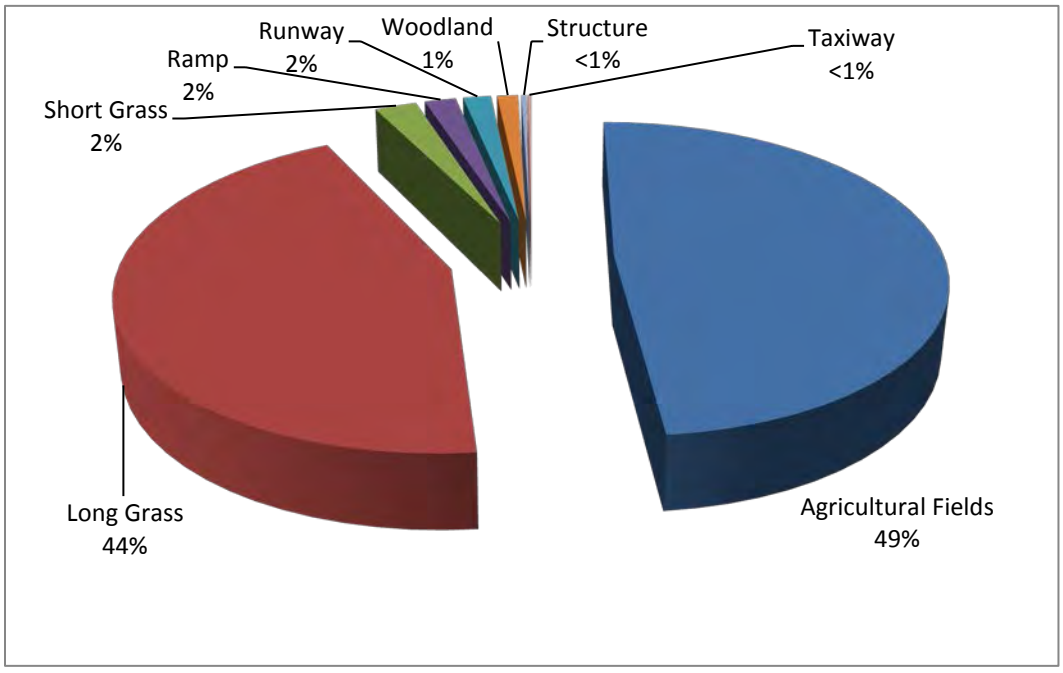

Figure 11: Gull habitat use at NASO, June 2010 through May 2011.

Gull use of agricultural fields occurred most frequently on or over winter wheat and fallow fields (Figure 12).

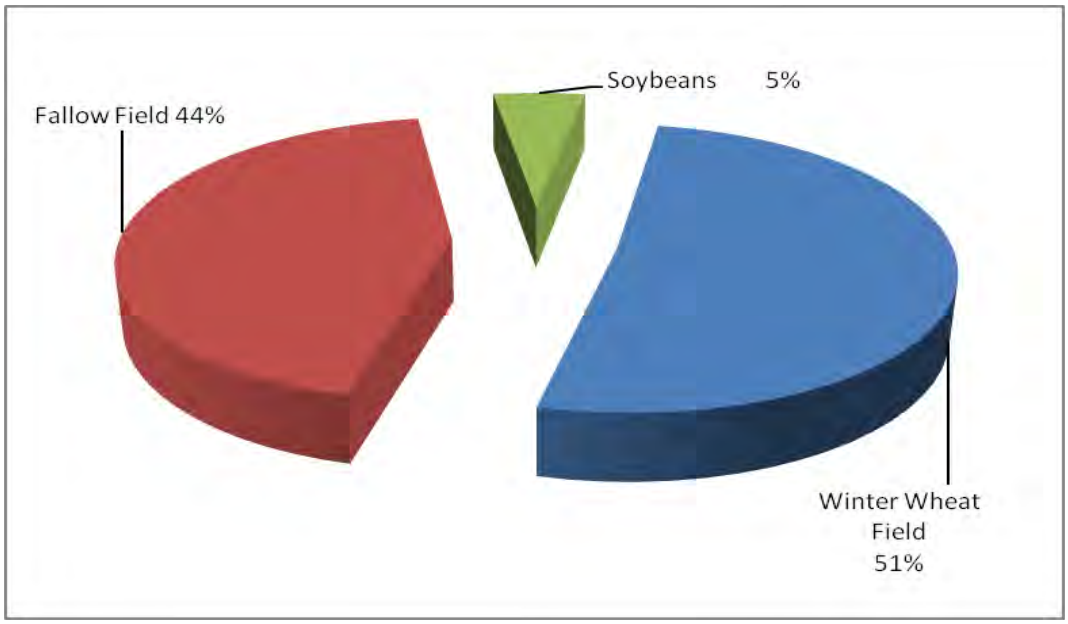

Figure 12: Gull agricultural habitat use at NASO, June 2010 through May 2011.
Flying locally, loafing and feeding accounting for 88% of all gull activity observed (Figure 13).

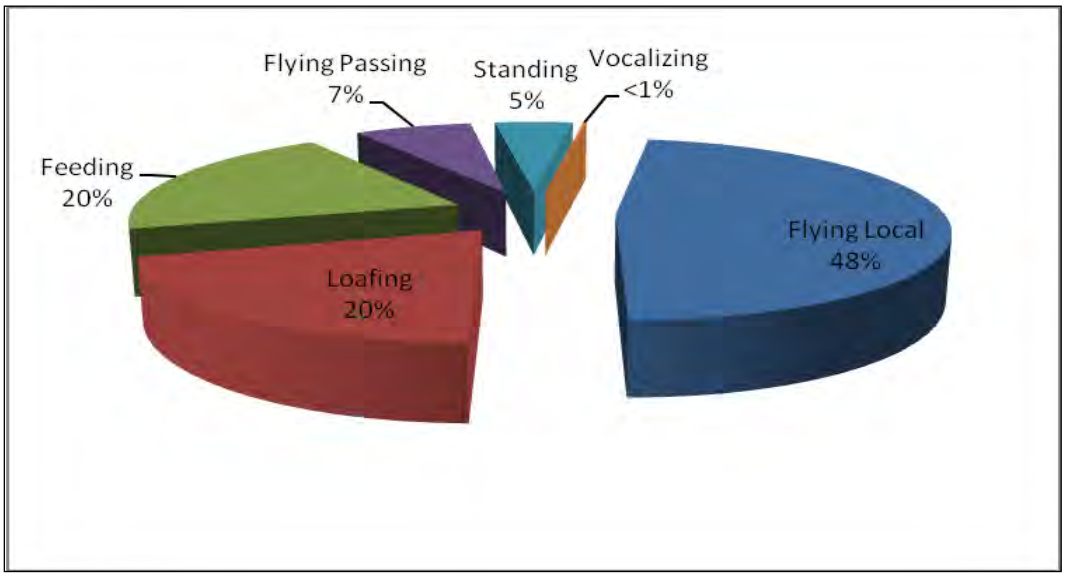

Figure 13: Gull activity at NASO, June 2010 through May 2011.

Attractants

Gulls are most commonly attracted to NASO during periods of inclement weather where they fly locally, loaf and forage throughout the airfield. During surveys gulls were observed over agricultural and long grass areas. Outside of these survey periods, WS personnel observed gulls using paved areas of the airfield. Gulls may find an abundance of food such as earthworms on and adjacent to taxiways and runways after rain events when the ground becomes saturated. This ground saturation forces earthworms to the surface. Thousands of gulls are also observed loafing and flying locally at a waste transfer station located on Virginia Beach Boulevard. This transfer station is located within one mile of the departure end of runway 32.

Management Recommendations

Although gulls were only the seventh most observed guild, gulls rank as the second most hazardous guild to aircraft safety at NASO for several reasons. From June 2010 through May 2011 WS personnel dispersed 6,565 gulls from the airfield (Table 4, Appendix G). Gulls are sporadically present on the airfield, but when present their numbers can be very high, and their habits during inclement weather (i.e. loafing/foraging on runways) make them very hazardous to aviation. Once dispersed gulls tend to tower over the area they were dispersed from, or move to other parts of the airfield increasing the time, effort and geographical area required to alleviate this threat.

As with many species, removing sources of water is an important component of gull management. Since large flocks of gulls are mostly observed at NASO during (and immediately following) periods of rain, improving drainage can help reduce pooling of water in low lying areas. Using sweepers to remove earthworms from paved areas after rainfall may help to reduce the number of gulls foraging in the airfield. Care should be taken to ensure that dumpsters and other waste disposal areas are covered to prevent

attracting gulls and any feeding of gulls by airport tenants or customers should be stopped immediately.

Gulls may be harassed from the airfield by a variety of methods, including vehicles, sirens, pyrotechnics, and propane cannons. Lethal removal of gulls should be implemented when dispersal efforts are insufficient, and as such the airfields migratory bird depredation permit should be kept current.

6.3 Raptors

Raptors (birds of prey) pose serious threats to aviation safety due to the larger size of many species and their flight behaviors. Some raptors may soar high over the airfield (eagles, vultures), other actively perch on structures in the airfield (Red-tailed Hawks and American Kestrels), while others may fly slowly close to the ground while hunting (harriers). From 1990 through 2009, raptors have been involved in 925 damaging wildlife strikes in the United States, resulting in almost $56 million in damages (Dolbeer et al. 2011). Since 1981, there have been 5 reported strikes involving raptors at NASO (Table 3).

General Abundance
Whereas raptors were the ninth most abundant guild observed at NASO from June 2010 through May 2011 with 744 observations (Appendix F), 2 species observed at NASO in the raptor guild pose an extremely high risk to aviation safety (Table 3), making raptors the third most hazardous guild to aviation safety (Table 3). As shown in Table 3, Red-tailed Hawks (*Buteo jamaicensis*) were the most commonly observed species in the raptor guild, followed by American Kestrels (*Falco sparverius*), Northern Harriers (*Circus cyaneus*), Turkey Vultures (*Cathartes aura*), Osprey (*Pandion haliaetus*), Cooper's Hawks (*Accipiter cooperii*), Bald Eagles (*Haliaeetus leucocephalus*), and Sharp-shinned Hawks (*Accipiter striatus*). Raptors were most often observed in or over short grass areas of the airfield (Figure 14).

Attractants
Raptors are attracted to the airfield at NASO by several features. Raptors find abundant prey (i.e., meadow voles, field mice, Eastern cottontails, etc.) in the grassland and woodland areas of the airfield. There are numerous perching sites such as navigation aids, lights, communication towers, trees, and radar facilities that may be utilized by raptors. Vultures are often observed towering on thermal updrafts high above the airfield. Mowing operations, road-killed animals, and deer shot but not retrieved provide abundant food sources for vultures in the area.

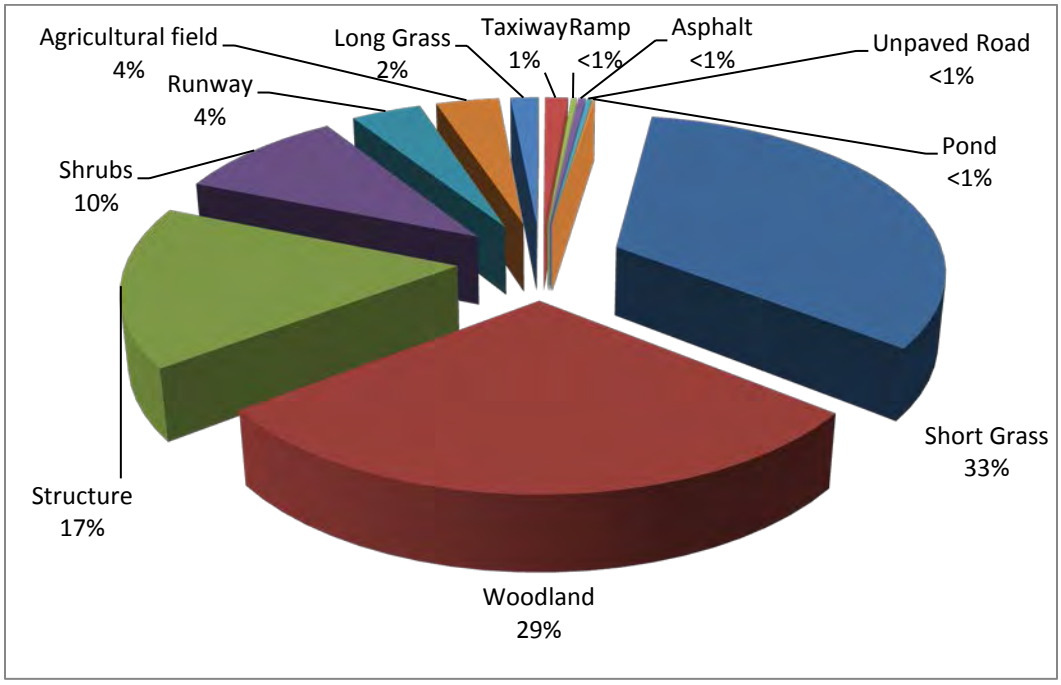

Figure 14: Raptor habitat use at NASO, June 2010 – May 2011.

Management Recommendations

To reduce the likelihood of strikes involving raptors, Blackwell and Wright (2006) suggest that management efforts in the airfield should be directed towards the availability of food and alteration of habitat used by raptors. The reduction of food sources such as rodents and carrion in the airfield is critical in controlling foraging by Red-tailed Hawks and vultures (Blackwell and Wright 2006). Reducing the number of small mammals in the airfield may be accomplished by a variety of methods, including trapping, shooting, or the use of rodenticides. Any animal carcasses found in or around the airfield should be removed and disposed of promptly to avoid attracting vultures. Turkey Vultures were noticeably more abundant following airfield mowing operations. During mowing, small mammals and snakes are often hit by the mower, leaving carcasses on the airfield.

Research has shown that small mammals use unmanaged areas of tall vegetation far more than disturbed areas (Barras and Seamans 2002, Blackwell and Wright 2006, Washburn and Seamans 2007), so frequent mowing can help to reduce small mammal abundance at airports (Barras and Seamans 2002), thereby reducing the availability of food for raptors. When possible, reducing the availability of locations where raptors may perch, roost, loaf, or nest is recommended. As such, NASO should consider the removal of trees and unused structures in the airfield (such as old utility poles). For structures that cannot be removed (i.e., signs, lights, towers, etc.), devices that exclude birds or make it difficult for their perching should be considered (such as spider wires, bird spikes, coil wire, etc.).

Raptor species must be harassed from the airfield whenever present using methods such as vehicles, horns, and pyrotechnics. Vultures commonly soar high above the airfield, making them difficult to disperse using 15mm pyrotechnics, given their limited range.

Devices with much greater range (such as CAPA rounds or 12-gauge shellcrackers) may be more useful for dispersing vultures. Lethal removal of some raptors may be necessary for persistent individuals, and as such NASO's depredation permit must be kept current to allow take of raptors. Lethal removal may include methods such as shooting or trapping. Though recently removed from the endangered species list, Bald Eagles are protected under the Bald and Golden Eagle Protection Act and are state threatened species, and a permit is required to simply harass eagles from the airfield. Eagles are becoming more abundant in the area around NASO and observations by base and WS personnel have increased in the past few years. NASO received a U.S. Fish and Wildlife Service Bald Eagle Depredation Permit in March of 2012 (Appendix C). The current permit is active for five years or until 2017, at this time it is recommended that the permit be renewed. All eagle dispersals conducted under this permit are required by the U.S. Fish and Wildlife Service to be documented and submitted at the end of each calendar year for the duration of the permit. Eagle activity is great in the areas immediately surrounding nests and any nesting attempts should be discouraged, and established nests should be removed promptly.

6.4 Waterfowl

Waterfowl can be particularly hazardous to aircraft safety due to their larger size and flocking behavior. In particular, Canada Geese have been responsible for some of the more serious wildlife strikes. In addition to the more recent "Miracle on the Hudson" event (see Section 1.1), 24 airmen were killed in 1995 when an Air Force AWACS aircraft crashed at Elmendorf Air Force Base in Alaska after striking a flock of Canada Geese (Wright 2011). From 1990 through 2009, waterfowl have been responsible for the greatest number of damaging strikes in the United States (1,503), resulting in over $144 million in losses (Dolbeer et al. 2011).

General Abundance

Waterfowl were the forth most abundant guild observed at NASO from June 2010 through May 2011 (Appendix F). Waterfowl rank as the forth most hazardous guild to aircraft safety at NASO (Table 3). Canada Geese (*Branta canadensis*) were the most commonly observed species in the waterfowl guild. Canada Geese are ranked as an extremely high hazard threat to aviation safety (Table 3). Canada Geese accounted for 95% of all observations in the Waterfowl guild. Canada Geese were observed year-round at NASO and were most abundant during the winter months when migrating birds wintered in the area. The number of Canada Goose observations during summer months supports a substantial resident (non-migratory) population. Other waterfowl species observed at NASO included American Brant (*Branta bernicla*), Tundra Swan (*Cygnus* columbianus), Hooded Merganser (*Lophodytes cucullatus*) and a single Mallard (*Anas platyrhynchos*). Although only a single Mallard was observed during surveys, WS personnel observed numerous Mallards during routine field activities, removing 21, and dispersing 54 individuals from the airfield (Appendix G). All Mallards were removed or dispersed from standing water.

Attractants

Utilization of short grass areas adjacent to runways and taxiways by Canada Geese occurred predominantly during May through July, coinciding with populations of resident geese. Tundra Swans were observed during migratory periods flying high over the airfield. Canada Geese were often observed by WS and NASO personnel feeding in grassy areas outside of the airfield on and off base. Resident Canada Geese were observed frequently utilizing ponds located on the Aero Pines Golf Course and the agricultural field located outside of the back gate.

Waterfowl are attracted to NASO and the surrounding area by several habitat features. There are many small bodies of water on and around the airport that provide a source of food and cover for waterfowl. Most of these bodies of water are small retention ponds and wetland mitigation sites that are the result of required Best Management Practices (BMP) for construction projects. These BMPs are found throughout the base and on the Aero Pines Golf Course. Three barrow pits are located along Oceana Boulevard just outside of the base. The barrow pits contain standing water, and are attractive to waterfowl. Agricultural fields on and off base outside of the active airfield are known to attract large numbers of foraging Canada Geese during the winter months.

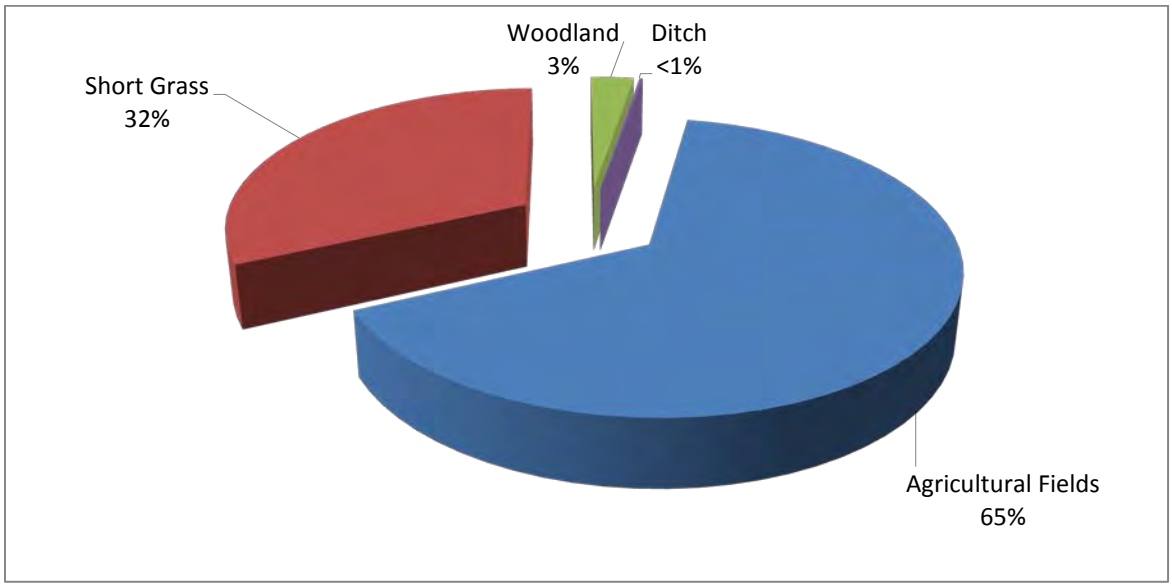

Figure 15: Waterfowl habitat use at NASO, June 2010 – May 2011.

Waterfowl were most often observed utilizing two habitat features at NASO: agricultural fields and short grass (Figure 15). Agricultural fields were utilized the most with winter wheat accounting for 85% of the utilization (Figure 16). Utilization of winter wheat occurred predominantly by Canada Geese and American Brant during December through March.

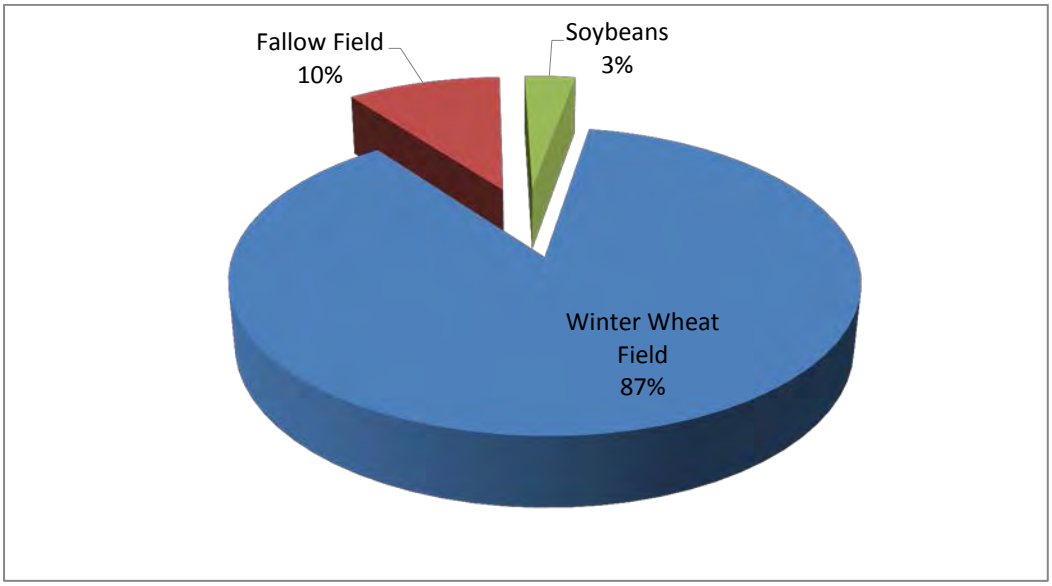

Figure 16: Waterfowl agricultural habitat use at NASO, June 2010 through May 2011.

Management Recommendations

Canada Geese should be considered the second greatest wildlife species threat to aviation safety at NASO. Nationally, Canada Geese are ranked as an extremely high hazard to civil aviation safety, as 51% of aircraft strikes with geese resulted in damage from 1990 through 2007 (Dolbeer and Wright 2009). By comparison, Mallards are ranked as a very high hazard to aviation safety, but the damaging strike rate for Mallards is about half that of Canada Geese (Dolbeer and Wright 2009). Resident Canada Geese find many areas of suitable habitat all around NASO and regularly fly through critical airspace when traveling from roosting/loafing areas to feeding areas. There are several control methods that should be considered to reduce hazards from Canada Geese (and waterfowl in general).

Winter wheat was the largest single attractant for geese during winter months on base property. Consideration should be given to eliminate the production of winter wheat on NASO agricultural fields. Whenever and wherever possible, areas of standing water in the airfield should be eliminated by improving drainage, grading, or filling in low areas. In the airfield, the wet areas of most concern are located at the approach and departure ends of runways 32R and 32L. Other areas of concern that contain standing water adjacent to the airfield include the barrow pits located along Oceana Boulevard, ponds located on the Aero Pines Golf Course, and Aero Pines wetland mitigation site. A permit may be required prior to disturbing/altering some wet areas, so coordination with the U.S. Army Corps of Engineers (ACOE) may be necessary. For areas that cannot be drained (such as BMPs), it may be useful to suspend a wire grid over ponds that may act as both a physical and visual barrier to prevent waterfowl from landing on the water. Installing stone rip-rap along the banks of BMPs or drainage ditches may help to reduce waterfowl use of these areas, as well.

Drainage ditches should be properly maintained, allowing water to effectively drain from the airfield and the ditches. Ditches can be maintained by: removal of vegetation slowing the flow, proper grading, removal of excess sediment, and use of herbicides to limit vegetation growth.

Vegetation management can be an important component for managing Canada Geese. Generally, it is recommended that airfields maintain grass at an intermediate height in the airfield (between 6 and 10 inches). It has long been thought that tall vegetation management in the airfield would deter Canada Geese since they often prefer to forage in areas of short grass, though there is limited scientific data on how Canada Geese react to tall vegetation management and studies have often produced conflicting results (Seamans et al. 2007, Barras and Seamans 2002, Washburn et al. 2007). Though more research is needed, studies suggests that a promising method of reducing Canada Goose use of airfields is to use an endophyte-infected variety of tall fescue when re-seeding areas of an airport disturbed by tree removal, construction or renovation (Washburn et al. 2007). Research suggests that when consumed by wildlife, tall fescue produces a variety of adverse effects (taste aversion, physical distress) and is generally avoided (Washburn et al. 2007). When re-seeding areas of the airfield, NASO should consider planting tall fescue and avoid grass mixtures containing millet or ryegrass so as not to provide a preferred food source for geese and other hazardous bird species.

NASO should adopt and maintain a "zero tolerance" policy towards waterfowl in and adjacent to the airfield, especially Canada Geese. Waterfowl species should be aggressively harassed to disperse them from the area. Harassment methods may include the use of pyrotechnics, horns, sirens, paintballs, and chasing with vehicles. NASO should maintain its current migratory bird depredation permit from the USFWS to allow lethal take of waterfowl species that do not respond to harassment. Canada Geese may also be taken under the Control Order at Airports and Military Airfields (50 CFR §21.49), which allows take of Canada Geese on base property and other properties within a 3-mile radius of the airfield (with written permission of the landowner) from April 1 to September 15.

In order to further reduce threats from Canada Geese, NASO has expanded control efforts beyond the airfield to base properties that provide attractive sources of food and cover. This control should be expanded to off base locations within 3 miles of the base. A study conducted in New York by Seamans et al. (2009) indicated that resident Canada Geese remained within 3 miles (5 km) of their primary feeding and loafing areas around JFK International Airport, and this trend seems to be reflected in the areas around NASO. The WS program in NY reported that goose numbers at Rikers Island decreased yearly after removal efforts from 2004 through 2007, and subsequently goose strikes at nearby LaGuardia Airport decreased by 80% (Seamans et al. 2009).

6.5 Pigeons/Doves,

Pigeons/Doves were the fifth most hazardous guild identified at NASO from June 2010 through July 2011 (Table 3). Although Rock or feral Pigeons (*Columba livia*) rank as only a high hazard to aircraft, Pigeons are also a hazard to aircraft located in hangars due to fecal contamination. Fecal contamination of aircraft has been reported to cause corrosion of critical aircraft instruments. Rock Pigeons and Mourning Doves (*Zenaida macroura*) are the only two species observed at NASO in this guild.

From June 2010 through May 2011 Pigeons/Doves were the third most abundant guild observed at NASO (Appendix F). Pigeons were usually observed perched on hangars, while Morning Doves were usually observed perched on the perimeter fences to the blue ramp area and VACAPS. From 1981-2010 the only reported strike occurring at NASO involving this guild was one Morning Dove.

Attractants

Pigeons/Doves were observed most frequently utilizing structures followed by agricultural fields (Figure 17). Pigeons are attracted to the airfield to roost and nest on structures, while Mourning Doves prefer to feed in agricultural fields or perch/loaf on fences.

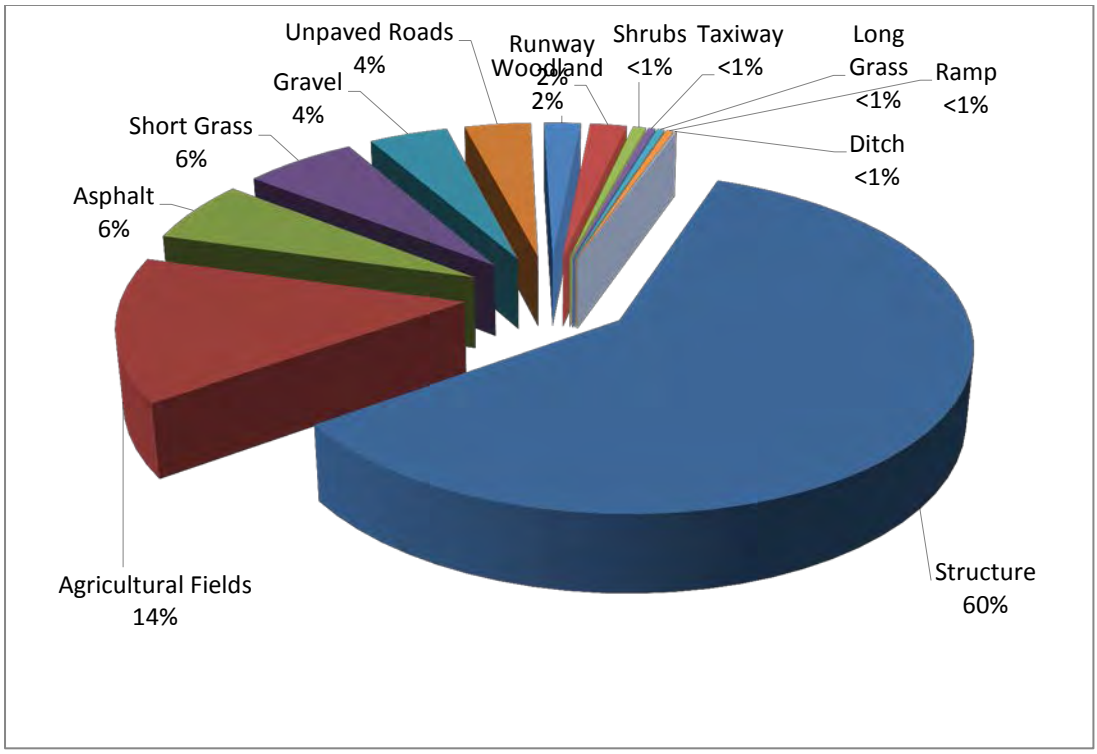

Figure 17: Pigeons/Doves habitat use at NASO, June 2010 – May 2011.

Management Recommendations

Flocks of birds in these guilds may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse should be removed lethally by shooting or trapping. The most effective means to remove pigeons from

hangars is through trapping. Shooting should not be conducted in any hangars containing aircraft. Control of pigeons does not require a permit, though control of Mourning Doves does require a Federal Migratory Bird Depredation Permit. Mourning Doves are especially attracted to areas of bare ground and old pavement. These areas provide ideal areas for foraging and obtaining grit. Bare ground areas that have been graded or re-seeded should be monitored for Mourning Dove activity. WS noticed large numbers of doves utilizing the old ramp area north of runway 32L and 5R intersection. WS recommends that areas of old pavement no longer needed for airfield operations are removed and all areas of bare ground be re-seeded. Activities at the stables should be evaluated for accidental feeding of pigeons and other wildlife. All feed should be maintained in closed containers and any spilled feed cleaned up. Even with all these measures in place the birds (pigeons and blackbirds) will always be attracted to this area due to the availability of undigested grains present in the horse manure. Other places of concern are any areas where the manure is spread mechanically.

6.6 Crows/Ravens, Starlings, and Blackbirds/Orioles

Crows/Ravens, Starlings, and Blackbirds/Orioles were the sixth, seventh, and eighth most hazardous guilds identified at NASO from June 2010 through May 2011 (Table 3). One species within these guilds, the American Crow is ranked as high, while two other species the European Starling and Common Grackle were ranked as moderate and a low ranking was given to the red-winged Blackbird and Brown-headed Cowbird. While these guilds do not contain any species that rank as an extremely high or very high hazard and control efforts are often required, due to the large number of individuals observed on the airfield.

From June 2010 through May 2011, Blackbirds/Orioles were the most abundant guild observed at NASO, starlings were second, and Crows/Ravens were the fifth most abundant (Appendix F). These species were mostly observed flying locally over short grass and agricultural areas, though European Starlings (*Sturnis vulgaris*) were commonly observed perched on structures throughout the airfield. None of these guilds have been involved in reported damaging strikes at NASO since 1981 (Table 3). The greatest hazard these species pose to aviation is through their tendency to form large dense flocks that stay in almost continuous motion over short grass habitat near runways.

Attractants
Species in these guilds are attracted to the airfield to feed in the large areas of open grassland agricultural fields where they find abundant forage such as seeds, earthworms, and insects. There are many perching roosting locations utilized by these guilds such as hangars, buildings, communication equipment, fences, and radar facilities.

Management Recommendations
Flocks of birds in these guilds may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse should be removed lethally by shooting and/or trapping. The control of crows, starlings, and blackbirds does not require a Federal permit. Grass management can be important for controlling these

species. Grass that is tall enough to produce a seed head provides a food source and effective cover for species such as starlings and blackbirds, so grass in the airfield should be maintained at the recommended height of 6 to 10 inches (Dolbeer et al. 2011). Starlings using structures such as hangars for roosting locations can be excluded by keeping doors/windows closed and repairing any holes in the structure that allow birds to access the building. Nest traps, mist nets and toxicants may also be used to reduce the population of starlings utilizing these structures.

6.7 All Other Guilds

Appendix F lists all guilds and species observed at NASO during wildlife surveys from June 2010 through May 2011. For all other guilds observed during wildlife surveys, many if not all of the management recommendations listed for waterfowl, raptors, artiodactyls, and gulls are applicable in reducing their threats to aviation safety. Many species utilize the same habitats, so management for one species will likely affect another. As discussed earlier in this section, habitat management and exclusion are the two most important components for reducing the threat of wildlife strikes at NASO. Vegetation and water management will likely have the greatest impact for most bird species, while maintaining the perimeter fence will be most effective in reducing the presence of larger mammal species (such as deer and coyotes).

6.8 Threatened and Endangered Species

Appendix E lists species that are considered endangered, threatened, or of concern in the Commonwealth of Virginia. Of the species observed at NASO during the survey period, Bald Eagles and Upland Sandpiper are the only species appearing on the list, classified as State Threatened and a Federal Species of Concern. Strike records report one Upland Sandpiper has been struck at NASO. Six Upland Sandpipers were observed during wildlife surveys, and WS personnel have observed others during periods of migration.

7.0 CONTROL ACTIVITIES

In addition to conducting a wildlife hazard assessment, WS also provided direct control services to NASO from June 2010 through May 2011. Table 4 lists species within guilds that were removed or dispersed to protect aviation safety at NASO by WS.

Table 4: Species or Guilds removed or dispersed by WS at NASO, June 2010 – May 2011.

Guild/Group	Guild Hazard Ranking at NASO	# Removed[1]	# Dispersed[1]
Artiodactyls (i.e. White-tailed Deer)	1	138	0[2]
Gulls	2	11	7,643
Raptors	3	13	87
Waterfowl	4	51	5,399
Pigeons/Doves	5	310	276
Crows/Ravens	6	3	45
Starlings	7	99	382
Blackbirds/Orioles	8	61	5,450
All other Birds	N/A[3]	9	20
All other Mammals	N/A[3]	68	2
Totals	**-**	**763**	**19,304**

1. Total species removed and dispersed obtained by summing all activities conducted by WS personnel from June 2010-May 2011.
2. Deer were not considered dispersed from the airfield.
3. All other bird and mammal guilds were not ranked and are combined.

Artiodactyls

WS personnel removed 138 deer from NASO base property from June 2010 through May 2011 including 15 deer from Aeropines Golf Course. The other 123 deer were removed from the airfield. The initial two deer surveys conducted in June of 2010 surveyed 61 and 66 deer, while the two surveys in May 2011 surveyed 5 and 7 deer. Figure 18 below shows all deer survey numbers and cumulative deer removal.

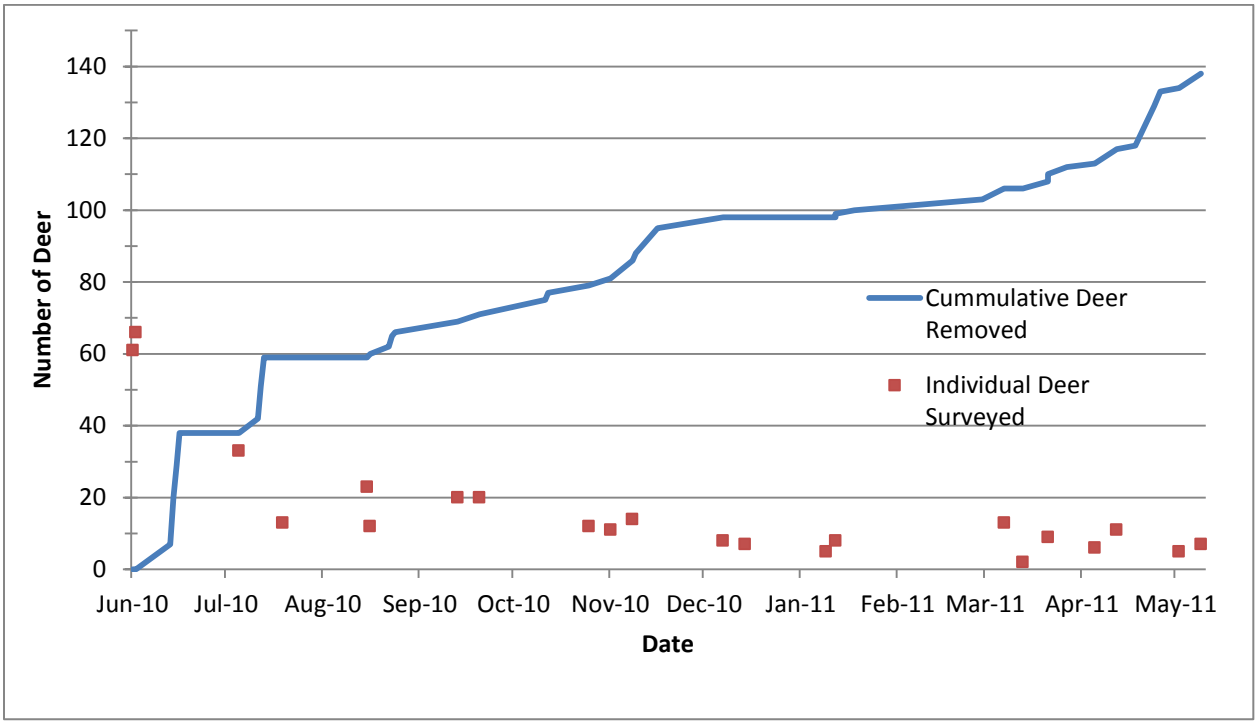

Figure 18: Deer surveyed and removed from NASO by WS personnel from June 2010 – May 2011.

Birds

WS dispersed 19,302 and removed 557 individual birds from the airfield (Table 4). The top 8 species dispersed from the airfield are listed below and Appendix G contains all species removed and dispersed from the airfield that fall in the eight most hazardous guilds/groups identified at NASO.

WS personnel responded to complaints of pigeons in hangars causing corrosion damage to aircraft by trapping and removing 276 pigeons from September 2010 through November 2011. Pigeons were not surveyed utilizing the hangars again after trapping.

8.0 RECOMMENDATIONS

In addition to placing an emphasis on the management of the species discuss in Section 6, WS recommends that the following actions are implemented at NASO to improve wildlife hazard management at NASO and further reduce the threat of wildlife/aircraft strikes:

Install a Security/Wildlife fence around the perimeter of the entire airfield

The Federal Aviation Administration (FAA) recommends that civil airports in areas of high deer populations install a 10 to 12 foot chain link fence with outriggers supporting three strands of barbwire projecting away from the airfield. FAA also supports a 4 foot skirt of chain link fence attached at the bottom of the fence and buried at a 45 degree

angle away from the airfield to exclude wildlife from digging of slipping under the fence. A properly installed wildlife fence will greatly improve safety and security of the airfield.

Update the NASO BASH Plan (WHMP) Based on the WHA

NASO's current BASH plan (NASOCEANAINST 3750.2B) was developed in 2008 by Geo-Marine, Inc. and was not based on a WHA. The plan provides the framework for the base to address wildlife hazards. The BASH plan lacks base specific details of wildlife hazards, and who, how and when the programs outlined in the plan will be conducted. It is recommended that the BASH plan be updated to reflect the information contained in this WHA.

Training of Airfield Personnel in Wildlife Hazard Management

FAA regulations require that civilian airport personnel who are responsible for implementing wildlife control measures are properly trained in wildlife hazard management by a qualified wildlife biologist [14 CFR Part 139.303 (c) and (e)]. NASO currently does not have a formalized training. Formalized training topics should include: USN regulations, policies, and procedures; wildlife strike reporting; wildlife attractants; habitat management; species identification; safety; and hands-on demonstrations of wildlife management tools and techniques. It is recommended that NASO develop formalized training for airfield personnel that may encounter wildlife on the airfield. The current BASH plan outlines this in the form of a Bird Detection and Dispersal Team (BDDT).

Establish a Formal BASH Working Group

The current NASO BASH Plan and the Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance (CNICINST 3700, 7 Jul 2011) both outline the functions and personnel to be involved with the BASH Working Group (BWG). WS recommends that NASO establish a BWG in accordance with CNICINST 3700. The formation of this group is important, as it will facilitate greater sharing of information and cooperation among those who have a stake in managing wildlife hazards at NASO.

Continue to Seek Cooperation from Adjacent Property Owners

As discussed in Section 6, wildlife on properties near the airport pose serious threats to aviation safety at NASO. WS recommends that NASO continues to identify areas within 3 miles of the airport that may provide roosting and/or foraging areas for birds that utilize the airspace at NASO, especially Canada Geese. NASO should approach these landowners to seek cooperation for the removal of these hazards.

Utilize the Wildlife Activity Log and Report Bird Strikes

Airfield Operations personnel currently use the airfield wildlife activity database to record occasional instances of wildlife activity on the airfield. It is recommended that operations personnel continue to increase the accuracy of the wildlife activity records.

WS recommends that this log also be extended to other personnel including AFF, GEMD and Tower. WS recommends that the wildlife activity log be modified to include additional information that is currently not recorded, such as the number of birds involved, cover type, and location on the airfield. This information can be useful in determining trends and prioritizing management objectives.

Bird strikes should be reported online via WESS and a sample submitted to the Smithsonian Feather ID Lab for positive identification. Evaluation of the WESS data base has shown a lack in bird strike reporting. WS have seen an increase in strike reporting since June 2010. WS should continue training on proper strike reporting to airfield personnel and squadrons. Damage to aircraft following a strike or wildlife incidence is seldom recorded. WS recommends that NASO formalizes a process for recording damage. Damage should include aircraft structural damage, aircraft down time, repair, cleaning, and all other costs associated with a wildlife incidence. WS recommends that NASO work with the Naval Safety Center to ensure that the WESS data base is being updated with species identification and associated damages. This information is usually not available at the time a WESS report is initially submitted.

Maintain Necessary Permits to Control Wildlife

As stated previously, federal and state permits are necessary for lethal take of migratory bird species and state-managed species such as deer and turkeys. In addition, a federal permit is needed before Bald Eagles may be harassed from the airfield. NASO currently holds a migratory bird depredation permit, a state permit, and a Bald Eagle harassment permit. WS recommends that these permits be maintained to address wildlife species as necessary. If eagle nests are established, an amendment to the existing permit for base property or a new permit for neighboring property will need to be obtained for immediate removal of the nest.

Have Control Supplies on Hand

WS recommends that airfield personnel that are members of the BDDT who are responsible for wildlife hazard management be provided adequate equipment needed to disperse wildlife and adequate storage for this equipment, especially pyrotechnics. Such devices may include pyrotechnics and launchers, propane cannons, and vehicles equipped with sirens and lights. WS recommends that BDDT members are properly trained in the safe use and storage of these devices.

Evaluate Potential Wildlife Hazards When Planning New Construction or Land Use Changes

NASO is constantly undergoing expansion and improvement projects. It is critical to consider wildlife attractants during these planning phases. Several aspects to consider will be the planting of new vegetation, which may provide food to wildlife in the form of seeds and fruits and the creation of water bodies or drainage basins that provide fresh water. NASO's airfield manager currently reviews airfield maintenance projects with

WS for possible BASH concerns. WS recommends that this continue and be expanded to all construction and maintenance projects on base property. In addition, adjacent off-site projects, industrial development, road construction, recreational development, etc. need to be considered as potential wildlife attractant hazards and dealt with accordingly.

Continue to Monitor Wildlife Populations and Habitat Use Patterns in the Active Airfield

The intent of this WHA has been to document general occurrence, land-use patterns, and population characteristics of wildlife at NASO. It must be realized that wildlife abundance and use patterns on airfields are affected by a host of variables that are rarely the same from year-to-year. Hence, conclusions based on wildlife populations and patterns during this study are only meant to be a guide and may or may not be consistent in subsequent years. Survey routes and methods were established in a manner that facilitates continued monitoring. Data from this study will provide a baseline for comparison in subsequent years and NASO should continue to monitor wildlife populations by conducting monthly surveys using the same stations established in this assessment. While surveys conducted in subsequent years may not be conducted with the same frequency or intensity as this initial hazard assessment, they will still provide general insights into wildlife use patterns over time and enable NASO to gauge the effectiveness of its control efforts.

Habitat Modification and Exclusion

As discussed in Section 6, habitat modification and exclusion are two of the most important components of a wildlife hazard management plan. NASO airfield maintenance personnel have been diligent in maintaining grass in the airfield at the recommended height (6 to 10 inches), and WS recommends that regular mowing is continued. Grass management is seasonal, and frequency of mowing may need to be increased during growing season as resources permit. Woody vegetation growing in drainage ditches should be removed and these areas should be maintained to prevent creating thick, shrub-like habitat that can provide cover for small mammals and perching sites for raptors. Most ditches within the airfield have become clogged with woody vegetation. This not only attracts wildlife but prevents water from effectively draining from the airfield compounding the problem with areas of standing water within the airfield. The resulting saturated soils increase the chance of field equipment rutting the airfield when driving across or avoiding the area completely during mowing operations.

Because all species are attracted to water, areas of standing water should be eliminated where possible. Low lying areas should be filled or graded to improve drainage. Underground drainage culverts in the airfield have failed in areas creating extended periods of standing water following heavy rains. WS recommends NASO continue with their plans to repair/replace all non-functioning drainage systems.

The entire perimeter fence should be inspected periodically for any areas that may allow larger mammals to enter the airfield. Any gaps discovered in or under the fence should

be repaired immediately using bars, wire, or sections of fence to patch the area. Where wildlife are crawling under fences, it may be useful to install stone rip-rap along the bottom of the fence to prevent digging. If this is not sufficient, installing an "apron" of woven-wire or chain-link fence on the bottom of the perimeter fence that extends several feet out can help to prevent digging. Specific habitat features that require attention are detailed in Appendix H. A list of habitat management sites should be maintained and progress toward resolving these hazards should be discussed in working group meetings and documented in annual monitoring reports.

Agricultural Practices

Agricultural crops can attract hazardous wildlife to the airfield. All approach/departure corridors on NASO contain agricultural fields. The WHA has shown that these fields attract wildlife (e.g. geese) to the airfield. Consideration should be given to the crops that are planted and the agricultural practices used for their production. Cereal grain products should be avoided. These crops attract large numbers of waterfowl for forage. Agricultural practices should minimize tilling. Tilling exposes large numbers of forage (i.e. insects, worms, etc.) that attract large numbers of gulls. Care should be taken during harvest to ensure excess amounts of grains are not spilled. If spills occur they should be cleaned up.

The FAA recommends a distance of 5 statute miles between the farthest edge of the airfield and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace.

Evaluation of Off Base Aviation Hazards

The FAA recommends a separation distance of 5 statute miles between the farthest edge of the airports AOA and hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace (FAA AC 150/5200-33B). WS has identified several potential areas that attract hazardous wildlife within the approach/departure and circling airspace of NAS Oceana. These areas include: several barrow pits located along Oceana Blvd, Owl's Creek Golf Course, and a waste transfer station located on Virginia Beach Blvd. WS recommends that potential hazards surrounding the airfield be identified. Areas identified as potential hazards should be evaluated and BASH mitigation procedures implemented to reduce hazards.

9.0 SUMMARY

Based on data collected during the WHA, records from the WESS wildlife strike database, and control efforts by WS and NASO personnel, several species were identified that threaten aircraft safety at NASO. The guilds/group that are of most concern to aircraft safety include deer, gulls, raptors, waterfowl, pigeons/doves, crows, starlings, and blackbirds. Several management strategies may be implemented to reduce wildlife hazards at NASO, including habitat modification, exclusion, harassment, and lethal removal of hazardous wildlife species. WS

recommends that NASO continues to take an active approach to wildlife hazard management, utilizing the information contained in this WHA to reduce wildlife hazards and provide a safe environment for aircraft operations.

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WILDLIFE HAZARD ASSESSMENT

For

NAVAL AUXILIARY LANDING FIELD FENTRESS

October 1, 2011 through September 30, 2012

Prepared by

United States Department of Agriculture

Animal and Plant Health Inspection Service

Wildlife Services

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February 19, 2013

Project was monitored by Tim Linder, Wildlife Biologist, Virginia Wildlife Services.

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EXECUTIVE SUMMARY

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program (WS) conducted a 12-month wildlife hazard assessment (WHA) to identify wildlife hazards to aviation safety at Naval Auxiliary Landing Field Fentress (NALFF), an outlying airfield associated with Naval Air Station Oceana (NASO), from October 2011 to September 2012. Airfield bird surveys were conducted twice per month. Twenty-four night-time surveys of the airfield were also conducted to observe deer and other mammals' use of this area. Data collected included species abundance, behavior, and habitat use. Small mammal surveys were conducted in the fall of 2011 and spring of 2012 to determine species abundance in four different habitat types. In addition, WS identified and monitored areas outside of the airfield that may attract hazardous wildlife species to NALFF. Bird species observed were grouped into guilds (species that display similar behavioral characteristics) for analysis. Data collected during surveys were analyzed and compared with records from the Navy Safety Center Web Enabled Safety System (WESS) BASH database, control efforts by NALFF and WS personnel, and a wildlife hazard ranking list (Dolbeer and Wright 2009) to identify the species that are most hazardous to aviation safety at NALFF.

Based on information collected during the WHA, 1 mammal group and 7 bird guilds identified at NALFF from October 2011 through September 2012 presented the greatest threats to aviation safety. These group/guilds included deer, raptors (hawks, vultures, eagles), waterfowl (ducks and geese), pigeons/doves, blackbirds/orioles, starlings and swallows. Though blackbirds/orioles were the most abundant guild, deer were the most hazardous due to their large size, strike record, availability of habitat at or near NALFF, and general abundance in the area. There were 6 species within these group/guilds that were observed during the WHA that ranked as an extremely high hazard to aviation safety, and one species that ranked very high.

WS recommends a variety of methods to reduce or eliminate the threat of wildlife strikes from the group and guilds observed during the WHA. Habitat management can include: eliminating or excluding wildlife from areas of standing water; vegetation management in the airfield; reducing or excluding birds from perching/loafing areas; reducing abundance of prey species (such as small rodents) in the airfield; and installation and maintenance of a perimeter fence to prevent mammals such as deer from entering the airfield. WS also recommends harassment methods such as pyrotechnics, sirens, paintballs, and propane cannons to disperse birds from the airfield. Lethal control of hazardous species should be exercised when necessary utilizing firearms or traps. Permits for lethal control of species protected under federal and state laws should be maintained from the U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries as appropriate.

Additional recommendations include updating the NASO's/NALFF's Bird/Animal Aircraft Strike Hazard (BASH) Plan, establishment of a formal BASH Working Group (BWG), establish a Bird Detection and Dispersal Team (BDDT), establish formal BASH training and evaluating potential wildlife hazards when planning new construction or land use changes. It is recommended that NALFF continue to monitor wildlife abundance and habitat use in order to provide insight into wildlife use of the airfield and to gauge the effectiveness of control efforts.

4.0 INTRODUCTION

4.1 Purpose and Need for Action

Birds and other wildlife in the vicinity of airports are an increasing threat to aviation safety (Dolbeer et al. 2011). Since 1980, the Navy's national wildlife/aircraft strike database accounted for 440 A (> $1,000,000 in damages), B ($200,000 to < $1,000,000), C ($10,000 to < $200,000) and D (<$10,000) Class-rated incidents that included two fatalities to Naval pilots and over $372 million dollars in damages (Naval Safety Center). Based on the Naval Safety Center analysis and statistics, the average damage cost over the last 31 years is one million dollars per month. It is estimated that wildlife/aircraft strikes cost the U.S. civil aviation industry more than $614 million annually, while worldwide the total cost is over $1.2 billion per year (Keirn et al. 2010). In addition to costly aircraft repairs and down time, wildlife strikes sometimes result in serious injury or death. In January 2009, the wildlife/aircraft strike issue was dramatically illustrated when U.S. Airways Flight 1549 crash landed in New York's Hudson River after ingesting Canada Geese into both engines shortly after takeoff from LaGuardia Airport (Dolbeer 2009). This incident has been referred to in the media as "The Miracle on the Hudson" since all 155 passengers and crew survived despite the aircraft being a total loss. Less than two weeks prior to this incident, eight people were killed and one was seriously injured when a helicopter transporting workers to an offshore site in Louisiana struck a Red-tailed Hawk and crashed into a marsh (Wright 2011).

The Commander, Naval Installations Command (CNIC) established the Navy Bird/Animal Strike Hazard Program Implementing Guidance (CNICINST 3700, Appendix A). This instruction establishes the guidance for all installations that conduct or support air operations to conduct a Wildlife Hazard Assessment (WHA). Although the U.S. Navy is not required to follow the regulations set down by the FAA, the Navy does implement the FAA's guidance and expertise whenever practical.

The Federal Aviation Administration (FAA) is responsible for setting and enforcing the Federal Aviation Regulations (FAR) and policies to enhance public safety at civil airports. To ensure compliance with Code of Federal Regulations (CFR) 14 Part 139.337, the FAA requires certificated airports to conduct a wildlife hazard assessment (WHA), and if necessary, establish a wildlife hazard management plan (WHMP) when any of the following triggering events occur on or near an airport:

(1) An air carrier aircraft experiences multiple wildlife strikes;

(2) An air carrier aircraft experiences substantial damage from striking wildlife. As used in this paragraph, substantial damage means damage or structural failure incurred by an aircraft that adversely affects the structural strength, performance or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component;

(3) An air carrier aircraft experiences an engine ingestion of wildlife; or

(4) Wildlife of a size, or in numbers, capable of causing an event described above are observed to have access to any airport flight pattern or aircraft movement area.

The WHA must be conducted by a qualified wildlife biologist (see FAA Advisory Circular 150/5200-33B) and should include the following information:

(1) An analysis of the events or circumstances that prompted the assessment;

(2) Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences;

(3) Identification and location of features on and near the airport that attract wildlife;

(4) A description of wildlife hazards to air carrier operations; and

(5) Recommended actions for reducing identified wildlife hazards to air carrier operations.

Naval Auxiliary Landing Field Fentress

In June 2010, Natural Resources MidAtlantic entered into a cooperative service agreement with the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Program (hereafter referred to as WS) to initiate bird and deer surveys, evaluate the current Wildlife Damage Management (WDM) program, and provide direct control of hazardous wildlife using the airfield. In August 2010, CNIC entered into a cooperative service agreement with WS to conduct a WHA and to establish and continue an Integrated Wildlife Damage Management program (IWDM) at NALFF. Oversight and direction of the IWDM will fall under direct supervision of the NAS Oceana Air Operations Department. In March of 1999, Geo-Marine, Inc. provided NASO/NALFF with a BASH Plan. This BASH Plan did not include a formal evaluation of airfield specific hazards.

Starting in December of 2011, NALFF underwent complete renovation, remaining closed through October 2012. The taxiway and runway were completely reconstructed, lighting and signs were replaced, and buildings were reconstructed.

4.2 Legal Authority of Wildlife Services

The U.S. Navy, Commander Navy Installations Command (CNIC) and the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program (WS) have entered into a Work/ Financial Plan where WS will provide assistance to mitigate potential and realized wildlife hazards at USN air stations in the continental United States (Appendix B). The Plan establishes WS as the appropriate agency to conduct wildlife hazard management at Navy installations.

The primary statutory authority by which WS operates is the Animal Damage Control Act of March 2, 1931, as amended (7 U.S.C. 426-426c; 46 Stat. 1468). WS has the authority to manage migratory bird damage as specified in the CFR. In addition, the Rural Development, Agriculture and Related Agencies Appropriations Act of 1988 authorizes and directs the Secretary of Agriculture to cooperate with States, individuals, public and private agencies, organizations and institutions in the control of nuisance mammals and birds deemed injurious to the public.

The Plan and legislation authorize WS to conduct initial on-site investigations, biological assessments (short-term studies), WHA, and wildlife management techniques to assist USN air stations.

4.3 Legal Status of Wildlife Species

Most species of wildlife are protected by one or more Federal, State, and/or local laws and regulations. As such, several agencies may be responsible for implementation of these regulations and issuance of specific permits may be required prior to taking action to reduce wildlife threats to aviation safety.

Federal laws passed by Congress to protect wildlife include (but are not limited to) the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), and the Endangered Species Act (ESA). Federal wildlife laws are generally administered by the U.S. Fish and Wildlife Service (USFWS), which is the lead agency responsible for migratory birds protected under the MBTA, BGEPA, and ESA. The USFWS may issue depredation permits to take or harass migratory birds when those species are causing damage to various resources or threaten human health and safety (Appendix C).

The Commonwealth of Virginia defers to the Federal depredation permit for take of non-game migratory bird species, though a separate permit is required to take mammals and game bird species managed by the Virginia Department of Game and Inland Fisheries (VDGIF). As detailed in § 29.1-529 of the Code of Virginia, airport operators may obtain authorization from VDGIF to take wildlife (that are not federally protected) as necessary to protect aviation safety (Appendix D).

The Commonwealth of Virginia hosts a number of threatened and endangered (T&E) species that are granted protection under Federal and State regulations (Appendix E). Prior to conducting operational control work such as harassment, shooting, trapping, or habitat manipulation, the list of species of concern should be reviewed to ensure compliance with Federal and State regulations.

5.0 OBJECTIVES

The objectives of this WHA were to:

5. Identify wildlife species, numbers, locations, behavior and habitat use in and around the airfield, with particular emphasis on species most hazardous to aviation safety;

6. Identify and locate features on and in the vicinity of the airfield that attract wildlife;
7. Describe wildlife hazards to aviation safety at NALFF;
8. Provide NALFF with management recommendations to reduce or eliminate wildlife hazards to aviation safety and serve as a basis for updating the current BASH Plan.

6.0 DESCRIPTION OF STUDY AREA

Figure 1: Aerial view of NALFF (photo from Google Earth, 2010).

NALFF is located within Chesapeake, VA. NALFF has one operational runway (5/23), supporting day and night Field Carrier Landing Practice (FCLP) operations by US Navy and US Marine Corps F/A 18 Hornet, F/A 18 Super Hornet and E-2/C-2 Hawkeye, supporting 42,688 day and 50,132 night aircraft operations in calendar year 2010. The runway was closed in December 2011 for complete reconstruction and became fully operational in October 2012. The airfield also includes 8 Landing Zones (LZ's), primarily supporting H-60 and H-53 helicopters. For calendar year 2010, 496 LZ operations were conducted. The NALFF property incorporates approximately 3,000 acres, comprised of open, mowed grassland (296 acres), agricultural leases (~860 acres), woodlots and areas of secondary growth (~1850 acres). The woodlots are primarily comprised of mixed hardwoods, forested swamps and evergreens. A 7-foot fence with a three strand barbed-wire outrigger surrounds the buildings on base, though there is no perimeter or aircraft operating area (AOA) fence present. NALFF is surrounded by agricultural and residential property. To the North and East of the airfield lies the Intracoastal Waterway, connecting the Atlantic Ocean and James River.

7.0 METHODS

Data collection for the WHA began October 1, 2011 and continued through September 30, 2012.

Bird Surveys

Bird survey procedures were based on the North American Breeding Bird Survey methodology. Surveys were conducted twice per month for 12 months at 11 observation points on the airfield (Figure 2). The beginning observation point for each survey was randomly selected, with 2 repetitions of the survey route per day (1/2 hour after sunrise and 2-3 hours prior to dusk).

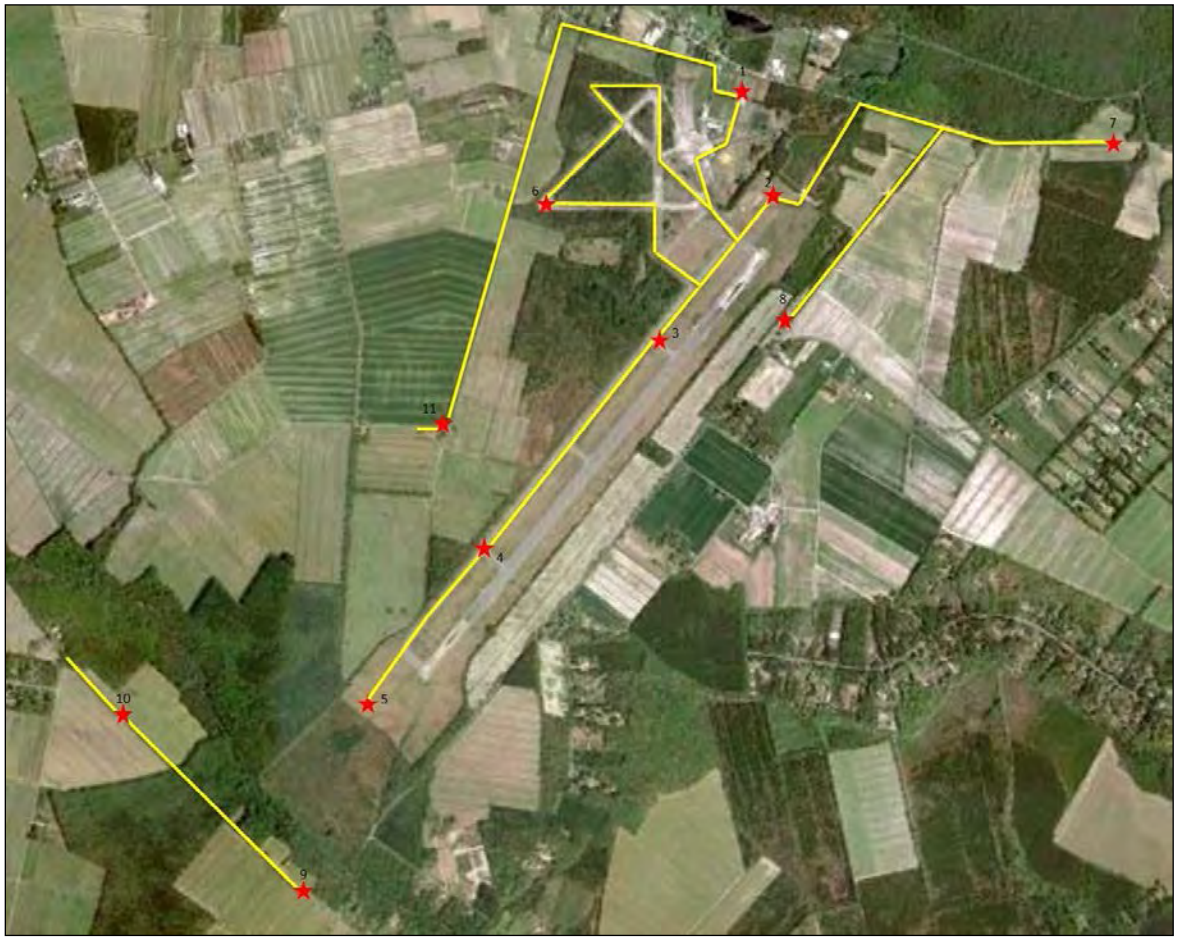

Figure 2: NALFF Bird Observation Points and Survey Route.

Birds were observed from a vehicle for 3 minutes at each point, with approximately ¼ mile distance between points. Between each observation point and at each point, the following data were recorded: weather, temperature, time, location, species, number observed, activity (behavior), habitat type, direction of flight, and comments on any other significant information (e.g., freshly mowed grass, approaching weather, change in flight activity, agricultural crop on fields, etc.). A map overlain with a 1,000-foot grid system was used to record location. Bird species were located without the aid of binoculars, though binoculars were used to identify

species that could not be readily identified with the naked eye or in low light conditions. Alpha species codes from the North American Bird Banding Manual were used to record birds observed during surveys.

Spotlight Surveys

In addition to bird surveys, 24 night-time spotlight surveys were conducted on the airfield over the course of the study period. Beginning 1 hour after sunset, night surveys were conducted by driving an established route approximately 8 miles long around the airfield (Figure 3). Observations were made using spotlights and forward looking infra-red (FLIR) equipment to determine primarily deer and other mammal use of the airfield. Information recorded included: weather, temperature, time, location, species, number observed, activity, and habitat type.

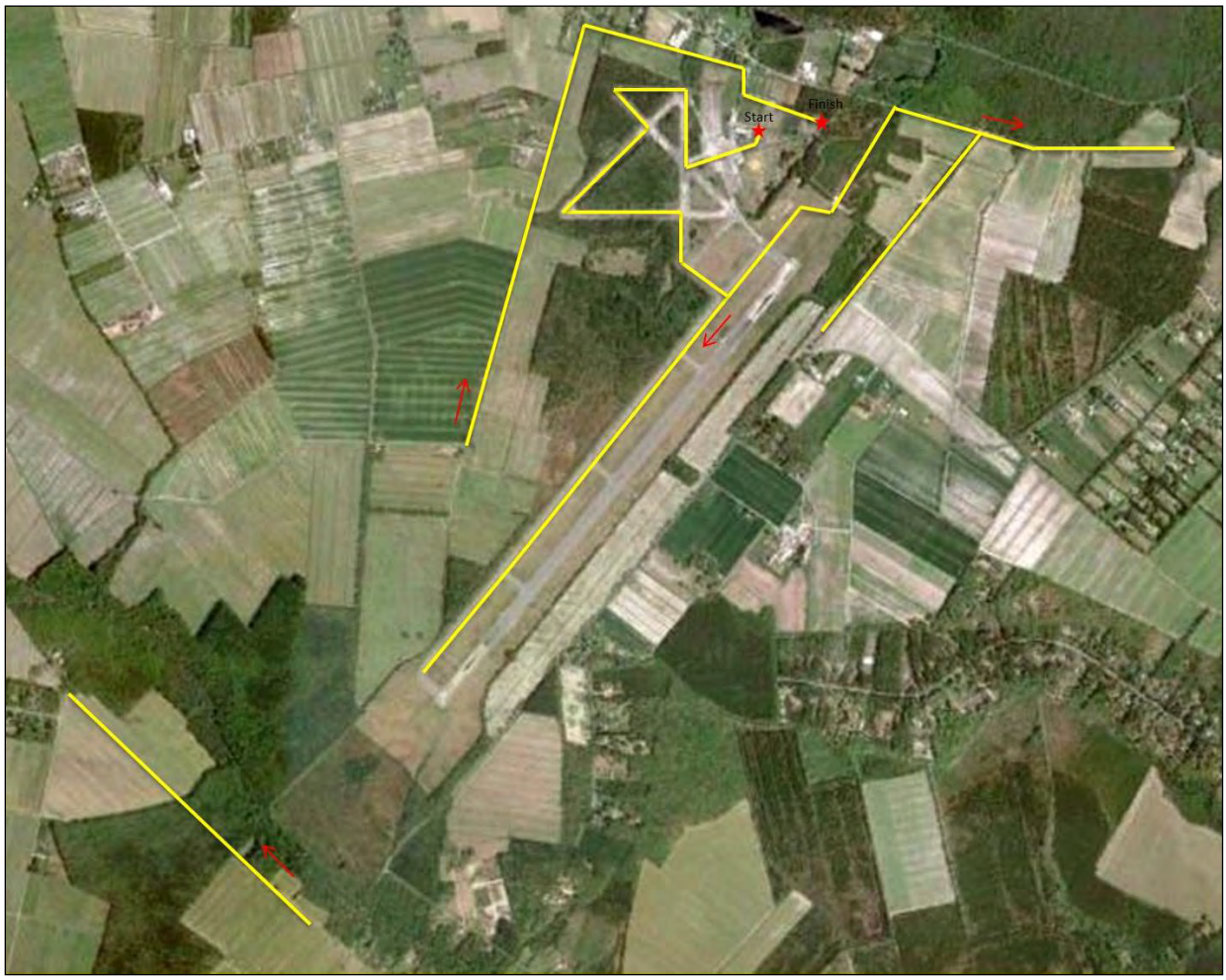

Figure 3: NALFF Spotlight Survey Route.

Small Mammal Surveys

Small mammal surveys were conducted in the fall of 2011 and spring of 2012 to determine abundance and habitat associations for species such as voles and mice inhabiting the airfield. Trapping sessions occurred in the spring and fall seasons over a three night period. Eight plot

areas were randomly selected within airfield study areas. Plots consisted of 25 snap-traps in a 5x5 grid spaced ten yards apart within each sample area. Sample areas consisted of 4 different habitat types; short grass, woodland, secondary growth/shrub, and agricultural field. Each trap was checked for three consecutive days and traps were re-baited, if necessary. Data recorded included: date, weather, study plot, number of species captured, number of sprung traps without capture, number of unsprang traps, and the number of missing traps. Capture-per-unit-effort was calculated for each trap session.

Data Analysis

Data were analyzed with descriptive statistics and frequency distributions per month using the Wildlife Hazard Management Information System (WHMIS) software developed by WS to determine trends in species abundance, habitat use, and behavior. For analysis purposes, common species were categorized into groups or guilds. Species were placed into their respective guilds based on similar behavioral characteristics, not taxonomic relationships (although guilds often parallel taxonomic lines). This approach was selected because behavioral attributes play a significant role in predisposing some species of wildlife to collisions with aircraft. In addition, wildlife control strategies are often selected based on their ability to exploit an animal's specific behavior(s), therefore species that exhibit similar behaviors and life history attributes generally require similar control methods.

5.0 RESULTS

5.1 Wildlife/Aircraft Strikes

According to criteria outlined in FAA Advisory Circular 150/5200-33A, a wildlife strike has occurred when:

6. A pilot reports striking 1 or more birds or other wildlife;
7. Aircraft maintenance personnel report aircraft damage as having been caused by a wildlife strike;
8. Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;
9. Bird or other wildlife remains, whether in whole or in part, are found within 250 feet of a runway centerline, unless another reason for the animal's death is identified; and
10. An animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high speed emergency stop, aircraft left pavement area to avoid collision with an animal, etc.).

Wildlife strike data provide valuable information about wildlife hazards on or near airfields, including the species that are struck, seasonal trends, and time of day when strikes occur. Nationwide, the number of reported wildlife strikes has shown a five-fold increase from 1990 through 2009 (Dolbeer et al. 2011). Despite the increase in reported strikes, the number of strikes resulting in damage during this same time period has declined by 21% (Dolbeer et al. 2011). This important fact is attributed to successful wildlife hazard management programs at many FAA certificated airports (Dolbeer et al. 2011).

Data obtained from the Navy Safety Center WESS and Smithsonian Feather ID Lab revealed that there have been 170 reported wildlife strikes at NALFF from 1981 through 2011 (Figure 4). Wildlife strikes peaked in 2010 with 26 reported strikes (Figure 4). The upward trend in wildlife strikes at NALFF may be attributed to factors such as increases in wildlife populations, changing land uses on and adjacent to the airbase, an increase in reporting, as well as more strikes being attributed to NALFF as opposed to NASO in accordance with the number of operations and flight time at that specific airfield. The Navy Safety Center estimates that only 25% of all strikes are reported. Much of the increase may be attributed to better reporting of wildlife strikes due to greater awareness of the wildlife strike issue and greater cooperation within the aviation industry to report strikes (Dolbeer et al. 2011).

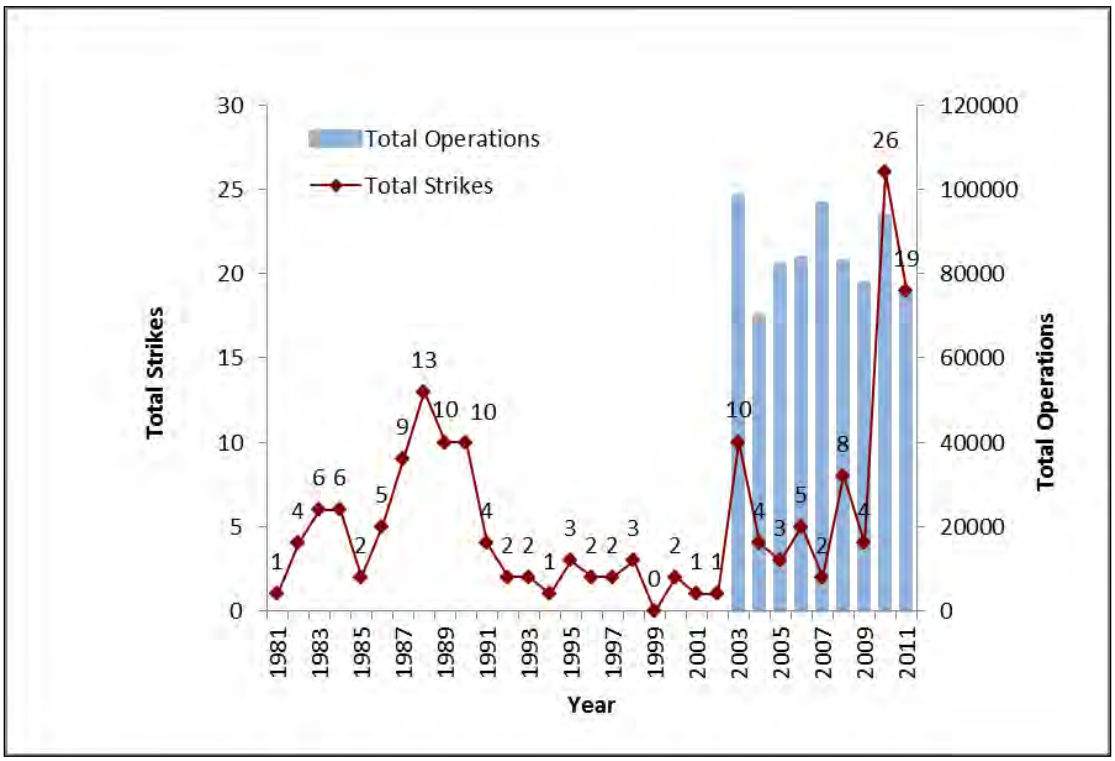

Figure 4: Reported wildlife strikes (1981-2011) and aircraft operations (2003-2011) at NALFF.

Of the 170 reported strikes at NALFF from 1981 through 2011, over 86% were unknown (146), 10% involved birds (17), 2% were white-tailed deer (3), and 2% involved bats (3). Most of the unknown strike reports were bird species (146, or 86%). Of the strikes where the species was identified, Yellow-rumped Warbler (5), Vesper Bats (3) and white-tailed deer (3) were the most frequently reported species. Consistent with national trends (Dolbeer et al. 2011), most strikes at NALFF occur in the late summer through early fall (Figure 5). Strikes during these periods coincide with the dispersal of naïve juveniles and fall migration.

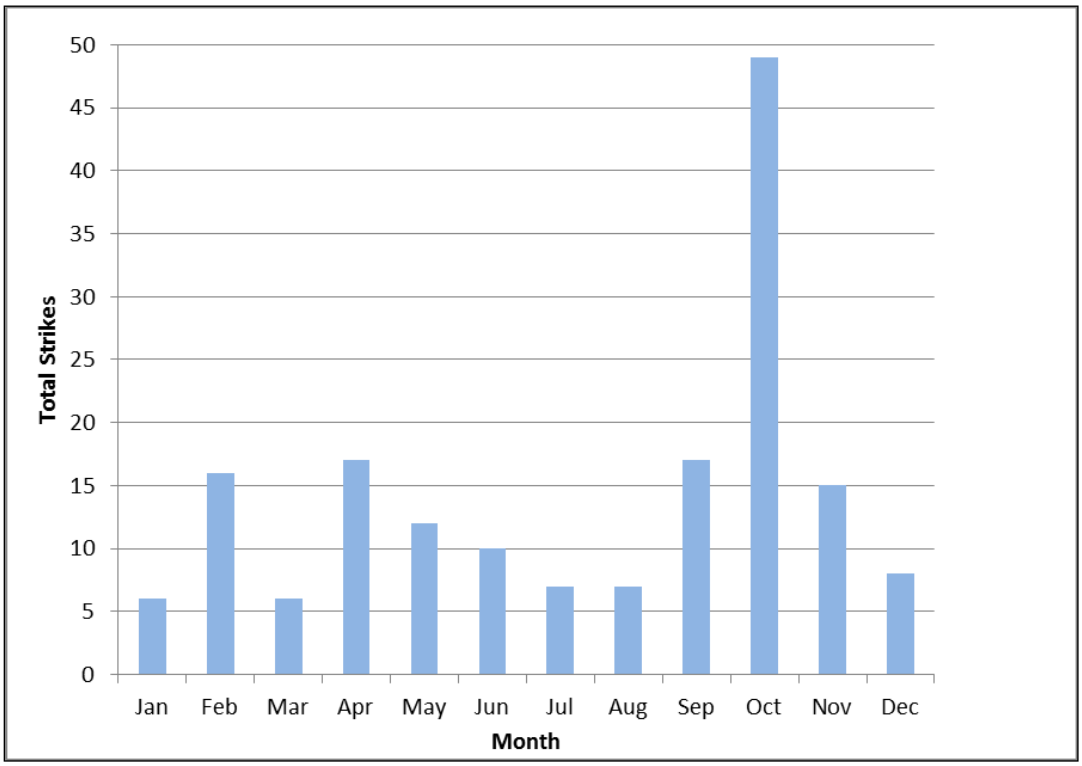

Figure 5: Number of strikes reported by month at NALFF, 1981-2011.

For all strikes reported at NALFF only 3.5% (6 of 170) reported damage >$10,000 (Table 1). All 6 strikes were * Class C Mishaps (1 deer $179,484, 1 Lesser Scaup $125,039 and 4 unknowns which individually totaled $47,842, $34,131, $15,000 and $13,500, respectively).

Table 1: Strikes with reported damage at NALFF, 1981-2011.

Species	N	A	B	C	Total
Unknown	142			4	146
Yellow-rumped Warbler (*Dendroica coronate)*	5				5
White-tailed Deer (*Odocoileus virginianus*)	2			1	3
Vesper Bat (*Vespertilionidae*)	3				
American Redstart (*Setophaga ruticilla*)	1				
American Robin (*Turdus migratorious*)	1				
Blackpoll Warbler (*Dendroica striata)*	1				
Cedar Waxwing (*Bombycilla cedrorum*)	1				
Chimney Swift (*Chaetura pelagica)*	1				
Common Yellowthroat (*Geothlypis trichas*)	1				
Eastern Meadowlark (*Strunella magna*)	1				
Least Sandpiper (*Calidris minutilla*)	1				
Lesser Scaup (*Aythya affinis*)				1	

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Table 1 continued: Strikes with reported damage at NALFF, 1981-2011.

Species	N	A	B	C	Total
Mourning Dove (*Zenaida macroura*)	1				
Ovenbird (*Seiurus aurocapillus*)	1				
Ruby-crowned Kinglet (*Regulus calendula*)	1				
Virginia Opossum (*Didelphis virginiana*)	1				
Total	**164**	**0**	**0**	**6**	**170**

Damage Classes: N = No damage Reported or <$10,000
A = >$1,000,000
B = $200,000 to <$1,000,000
C = $10,000 to <$200,000

5.2 Wildlife Surveys

Bird Surveys

From October 2011 through September 2012, WS recorded 44,448 bird observations at NALFF during bird surveys. Sixty-seven bird species representing 26 different bird guilds were observed throughout the study year (a complete table listing each guild and species observed throughout the study year may be found in Appendix F). The 6 most abundant guilds were Blackbirds/Orioles (27,252), Swallows (8,325), Starlings (3,801), Thrushes (1,075), Pigeons/Doves (880), Waterfowl (715), and Warblers (595). The 10 most abundant species observed are listed below[2]:

10.) Mixed Blackbirds = 25,918
11.) Tree Swallows (*Tachycineta bicolor*) = 7,703
12.) European Starling (*Sturnus vulgaris*) = 3,801
13.) Red-winged Blackbird (*Agelaius phoeniceus*) = 1,074
14.) American Robin (*Turdus migratorious*) = 1,064
15.) Yellow-rumped Warbler (*Dendroica coronata*) = 578
16.) Rock Pigeon (*Columba liva*) = 551
17.) Snow Goose (*Chen caerulescens*) = 530
18.) Eastern Meadowlark (*Strunella magna*) = 474
10.) Purple Martin (*Progne subis*) = 464

Birds were observed in 13 different habitat types during surveys at NALFF. Birds were most commonly observed utilizing the large, agricultural fields (76%) that makeup the dominant habitat feature around the airfield. Short grass areas were the next most commonly used habitat (8%), followed by structure (6%) such as power lines, towers, fences, buildings and old aircraft where birds were often observed perching (Figure 6). Bird activity was classified into 11 categories: flying passing (flying in a continuous path beyond the survey area); flying locally (short, random flights); feeding (actively consuming food); perched (loafing on a structure); vocalizing; standing; towering (flying

[2] Total abundance is derived by summing all bird observations throughout the study year. Therefore, the total number of bird observations includes individuals that may have been present on the airfield day after day and were recorded on multiple occasions.

in a circular pattern, often while utilizing thermal currents); walking; loafing (staying in one area, not on a structure for a length of time without engaging in another activity); hawking insects (flying erratically while attempting to catch insects) and running. Ninety percent of all observations fell into three activities: flying passing (54%), flying locally (24%) and feeding (12%) for all species during the study year (Figure 7).

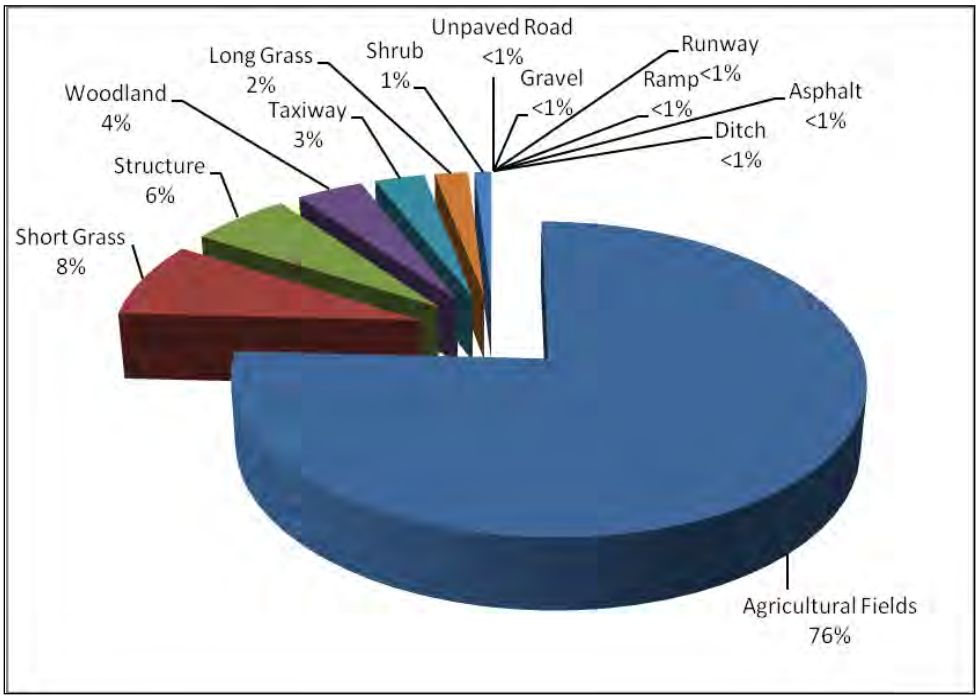

Figure 6: Habitat use by birds at NALFF, October 2011 through September 2012.

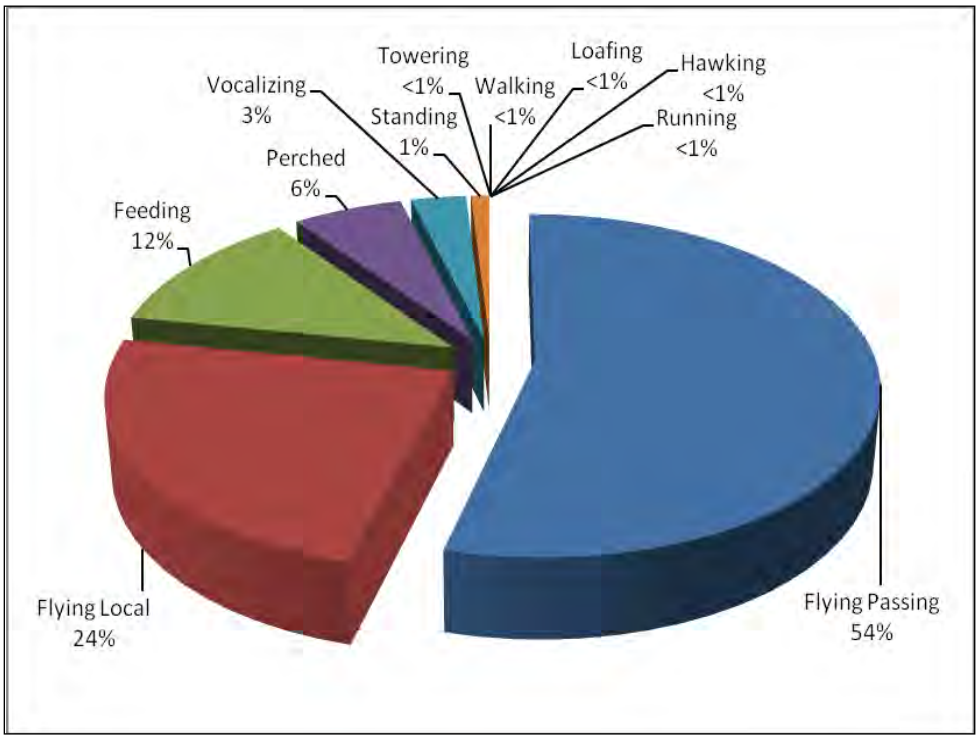

Figure 7: Bird activity at NALFF, October 2011 through September 2012.

Spotlight Surveys

WS completed 24 night spotlight surveys of the NALFF airfield during the study year. Three hundred-forty medium to large-sized mammals were observed during night surveys, with white-tailed deer (*Odocoileus virginianus*) being the most frequently observed species (Table 2). Observations recorded during night surveys may have been multiple observations of the same individuals throughout the survey year. Most mammal species were observed in the agricultural fields or in short grass (Table 2).

Table 2: Mammal species and cover type observed during night surveys at NALFF.

Species	Ag. Fields	Grass, Short	Woodland	Unpaved Road	Grass, Long	Shrub	Ramp/ Ditch	Total
White-tailed Deer	216	51	15	4	6	3	0	**295**
Coyote	3	0	0	0	0	0	0	**3**
Red Fox	1	0	2	0	0	0	1	**4**
Gray Fox	1	3	0	0	0	0	0	**4**
Raccoon	10	0	5	0	0	1	2	**18**
Rabbit	1	0	0	4	0	0	0	**5**
Opossum	7	1	1	2	0	0	0	**11**
Total	**239**	**55**	**23**	**10**	**6**	**4**	**3**	**340**

Small Mammal Surveys

Airfield small mammal surveys were conducted in November 2011 (fall trapping session) and May 2012 (spring trapping session). Species captured during the trapping sessions included: northern short-tailed shrew (*Blarina brevicauda*, 33%), peromyscus species (32%), least shrew (*Cryptotis parva*, 21%), meadow vole (*Microtus pensylvaticus*, 13%) and hispid cotton rat (*Sigmodon hispidus*, 1%). Capture rates were greater during the spring when compared to the fall trapping sessions (Figure 8). Small mammals were most often captured in secondary growth/shrub (49%) and woodland (37%) habitats.

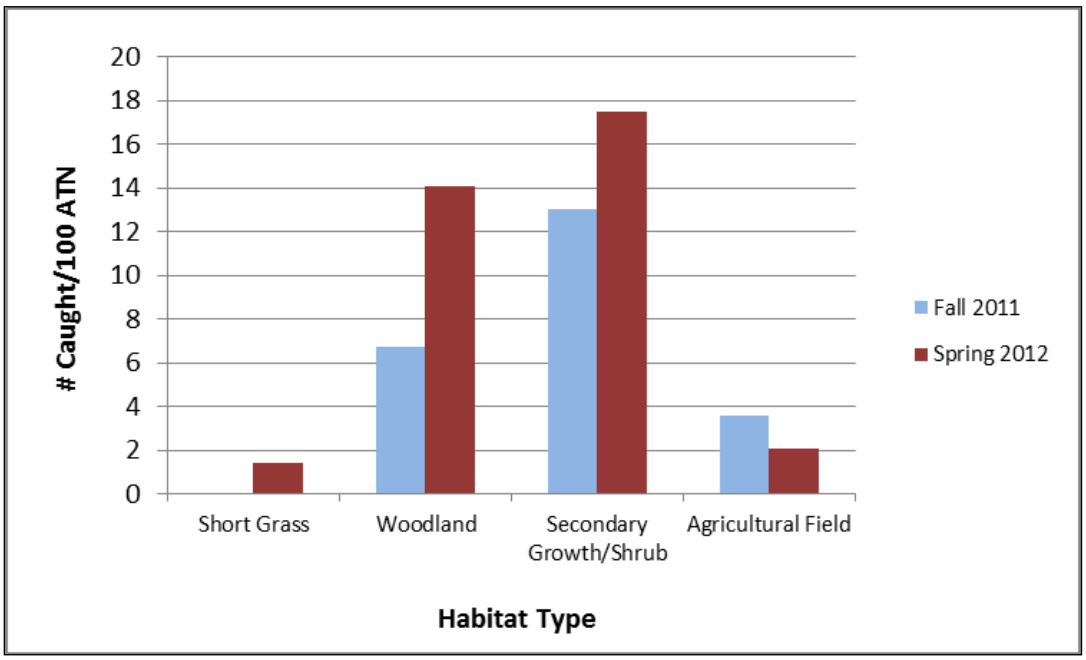

Figure 8: Catch-per-unit-effort of rodents captured for each habitat type at NALFF, fall 2011 and spring 2012.

6.0 DISCUSSION

Although almost all wildlife species commonly found at airports can pose some hazard to aviation safety, not all species are equally hazardous to aviation (Dolbeer and Wright 2009). For example, bird species such as Canada Geese (*Branta canadensis*) are more likely to cause damage if struck by aircraft than species the size of a sparrow. Utilizing the FAA wildlife strike database, Dolbeer and Wright (2009) developed a ranking of 89 wildlife species that pose the greatest threats to aviation safety. The ranking was based on the percentage of strikes causing damage from aircraft from 1990 to 2007, and species were classified into 6 hazard severity levels ranging from extremely high (>40% of strikes causing damage) to very low (<1% of strikes causing damage). Combined with wildlife surveys conducted locally at an airbase, this hazard ranking list can be used to prioritize management actions to species posing the greatest risk to aviation safety (Dolbeer and Wright 2009). As of 2011, DeVault et. al developed a new process

for identifying the hazard level ranking of wildlife if struck as opposed to species that caused the most damage. The effects of avian body mass, body density, and group size on relative hazard scores was assessed, and a ranking was developed (DeVault et al 2011). Even though the process has been updated, the species that pose the greatest risk remained the same.

Though 67 species were observed from 26 different guilds and 7 mammal groups through the study year (Appendix F), for this discussion emphasis will be placed on those guilds/groups that pose the greatest threats to aviation safety at NALFF. For this analysis the following criteria were used:

Primary Consideration:

1. Number of individuals observed during surveys.
2. The individuals' associated hazard ranking according to Dolbeer and Wright.
3. Evaluation of NALF Fentress' strike record.

Additional consideration was given for the following conditions:

- Location and behavior of individuals within each guild/group.
- Amount of control effort required to remove the specific hazard from the airfield (i.e. did the species easily disperse or not).

Using this information, guilds/groups were ranked in order of the threat level that they pose to aviation safety at NALFF from the most severe to the least. This comparison helps to show that the most abundant species on an airfield (Blackbirds/Orioles, in this case) are not necessarily the most hazardous to aviation safety due to abundance alone. The 7 guilds/groups identified as most hazardous to aviation safety at NALFF from October 2011 through September 2012 were deer, Raptors, Waterfowl, Pigeons/Doves, Blackbird/Orioles, Starlings, and Swallows (Table 3). There were six species observed at NALFF that rank as an extremely high hazard to aviation safety, one as very high, and two as a high hazard (Table 3). The following discussion and management recommendations will focus on the 7 most hazardous guilds/groups listed in Table 3. However, most if not all of the management recommendations (habitat modification, dispersal methods, etc.) will be effective for managing the majority of species observed at NALFF.

Table 3: Guild hazard ranking and total observations at NALFF, October 2011 - September 2012.

Guild/Group	Species	Hazard Level and percentage of strikes causing damage in the U.S.[1]	Total Observed at NALFF[2]	Reported Strikes at NALFF, 1981-2010	Strikes at NALFF with reported damage, 1981-2010[3]
Artiodactyls	White-tailed Deer	Extremely High (82%)	295	3	1
Raptors	Turkey Vulture	Extremely High (52%)	126	0	0
	Red-tailed Hawk	High (17%)	49	0	0
	American Kestrel	Very Low (1%)	11	0	0
	Black Vulture	Extremely High (51%)	9	0	0
	Northern Harrier	Low (2%)	7	0	0
	Cooper's Hawk	n/a	7	0	0
	Bald Eagle	Extremely High (42%)	2	0	0
	Sharp-shinned Hawk	n/a	1	0	0
	Totals		**212**	**0**	**0**
Waterfowl	Snow Goose	Extremely High (51%)	530	0	0
	Canada Geese	Extremely High (51%)	141	0	0
	Tundra Swan	n/a	43	0	0
	Mallard	Very High (26%)	1	0	0
	Totals		**715**	**0**	**0**
Pigeons/Doves	Rock Pigeon	High (12%)	551	0	0
	Mourning Dove	Moderate (4%)	329	1	0
	Totals		**880**	**1**	**0**
Blackbird/Orioles	Mixed Blackbirds	n/a	25,918	0	0

	Red-winged Blackbird	Low (3%)	1,074	0	0
	Common Grackle	Moderate (9%)	251	0	0
	Brown-headed Cowbird	Low (2%)	9	0	0
	Totals		**27,252**	**0**	**0**

Cont. next page.

Table 3 continued: Guild hazard ranking and total observations at NALFF, October 2011 - September 2012.

Guild/Group	Species	Hazard Level and percentage of strikes causing damage in the U.S.[1]	Total Observed at NALFF[2]	Reported Strikes at NALFF, 1981-2010	Strikes at NALFF with reported damage, 1981-2010[3]
Starlings	European Starlings	Moderate (4%)	3,801	0	0
Swallows	Tree Swallow	Very Low (0%)	7,703	0	0
	Purple Martin	Low (3%)	464	0	0
	Barn Swallow	Very Low (1%)	158	0	0
	Totals		**8,325**	**0**	**0**

4. Ranking based on strike reports from 1990-2007 (Dolbeer and Wright 2009); "n/a" indicates that species was not individually ranked.
5. Total observations obtained by summing all observations during surveys (day and night) from October 2011-September 2012. Total may include individuals that were present day after day and were recorded on multiple occasions.
6. Reported damage >$10,000.

6.1 Artiodactyls

Artiodactyls (i.e., deer) rank as the most hazardous mammal species to aviation safety in the United States, with 93% of strikes resulting in damage from 1990 through 2009 (Dolbeer et al. 2011). The large size of species such as white-tailed deer and the percentage of strikes involving multiple animals make them especially hazardous to aircraft during the takeoff and landing phases of flight. From 1990 through 2009, Artiodactyls, primarily white-tailed deer, have been involved in 847 damaging strikes in the U.S., resulting in over $36 million in reported costs (Dolbeer et al. 2011).

General Abundance

Deer were the ninth most abundant group observed at NALFF from October 2011 through September 2012 (Appendix F). White-tailed deer (*Odocoileus virginianus*), the

only species observed in this group, rank as an extremely high hazard to aviation safety, with 82% of strikes causing damage from 1990 through 2007 on civil airfields (Table 3, Dolbeer and Wright 2009). From 1981 through 2011, three deer were struck by aircraft at NALFF, and account for one out of 6 reported Class C mishaps (WESS Database) on base. A total of 295 deer were observed during 24 night surveys. Night surveys were conducted by driving a predetermined 8 mile route around the airfield, using spotlights and/or FLIR to locate deer. Deer observations ranged from 3 to 25 animals, with an average of 12 seen per survey. A major contributing factor to the variation in deer surveyed was due to the agricultural practices present on NALFF property. Corn fields throughout the summer drastically decreased visibility of deer present in the agricultural fields. Also, a lack of perimeter fence allows white-tailed deer to move in and out of the airfield and surrounding agricultural areas of NALFF at will.

Attractants

The NALFF airfield and surrounding habitats are ideal for deer, including agricultural fields (corn, soybeans), mature timber (especially white oak, a preferred food source), edge/shrub areas, wetlands, and open grassland.

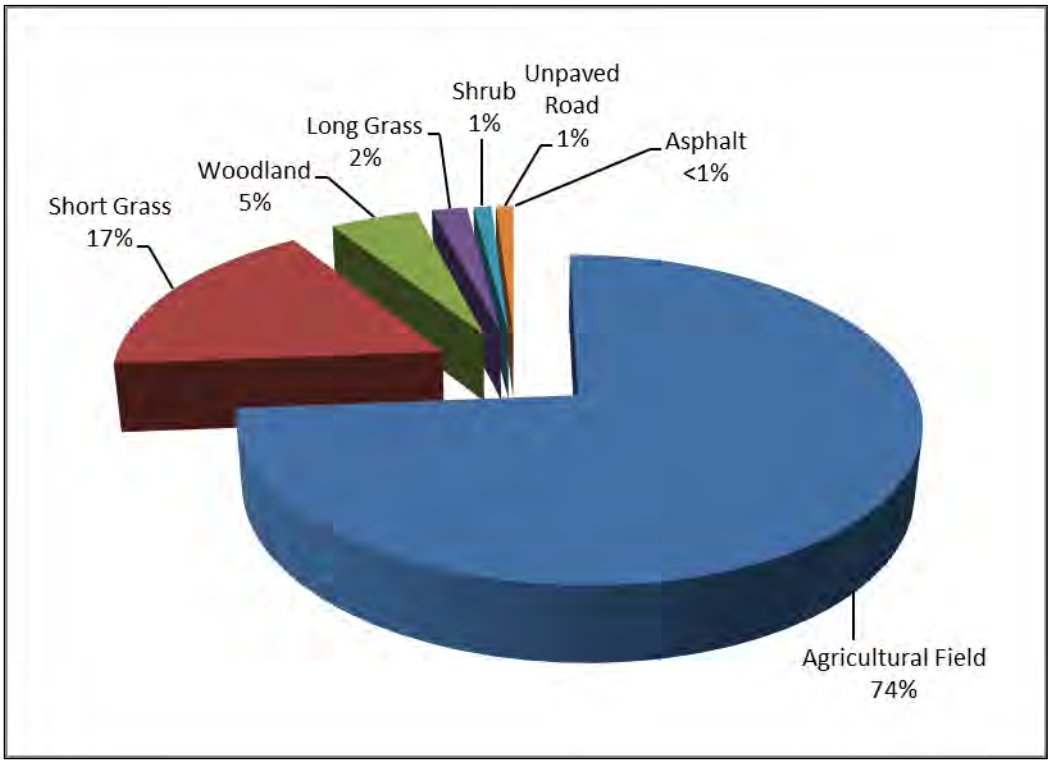

Figure 9: Deer habitat use at NALFF, October 2011 through September 2012.

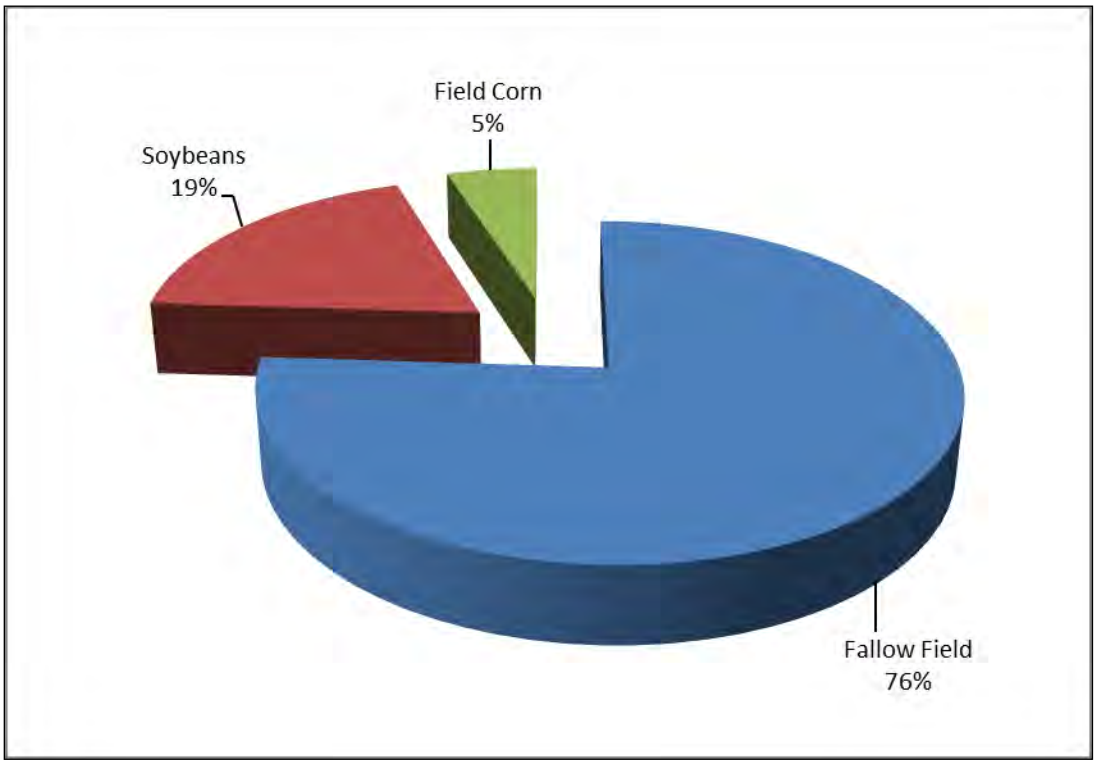

Figure 10: Deer agricultural field use at NALFF, October 2011 - September 2012.

Deer were most often observed utilizing agricultural fields (74%) at NALFF (Figure 9). Fallow fields accounted for 76% of all deer surveyed in agricultural fields (Figure 10). Visibility of fallow fields is much greater in comparison to a field with crops, most likely resulting in a higher percentage of deer observed. Fallow fields are identified as an agricultural field that is not planted with any crops. Agricultural fields were planted in soybeans and corn, both of which were harvested throughout the study period.

NALFF contains areas outside of the airfield on base property that contain ideal habitat for deer including: agricultural fields, mature timber, edge/shrub areas, wetland areas and open grassland. Deer were often seen utilizing these habitat features by WS and base personnel. With no perimeter fence installed, deer are free to roam across the airfield with no restrictions.

Figure 11: White-tailed deer removal focus area at NALFF.

Management Recommendations

The best recommendation for NALFF to decrease and limit deer activity on the airfield involves the installation of a 10-12 foot perimeter fence with three strands of barbed wire attached to outriggers. This is the most effective method for reducing the threat of deer strikes at NALFF. Once installed, it is necessary that the entire fence be inspected frequently for damage and gaps. Habitat management and removal of deer on the airfield and nearby navy property are also major components to reducing the threat. Airfield management is currently converting areas of optimal deer habitat (i.e., secondary growth and security cover) adjacent to the runways to maintained open grassland or agricultural fields. Airfield Operations is currently pursuing a Clear Zone Management Plan that will target travel corridors and continue to reduce optimal deer habitat adjacent to runways and taxiways.

NALFF should continue to actively remove deer from the base. This is currently being accomplished through WS personnel and a base hunting program utilizing VDGIF Deer Population Reduction Program (DPOP). Removal activities should be focused on the area denoted in Figure 11.

WS recommends that any deer present in the airfield be removed immediately via shooting or trapping. While not an immediate threat to aviation safety, deer present on

base property can and do gain access to the airfield. Deer on base, off of the airfield also serve as a source population for deer to annually disperse to the airfield. Lethal removal of deer requires a permit from the VDGIF, and it is recommended that NALFF maintain its permit current.

6.2 Raptors

Raptors (birds of prey) pose serious threats to aviation safety due to the larger size of many species and their flight behaviors. Some raptors may soar high over the airfield (eagles, vultures), others perch on structures in the airfield (Red-tailed Hawks and American Kestrels), while others may fly slowly close to the ground while hunting (harriers). From 1990 through 2009, raptors have been involved in 925 damaging wildlife strikes in the United States, resulting in almost $56 million in damages (Dolbeer et al. 2011).

General Abundance
Although raptors were the ninth most abundant guild observed at NALFF from October 2011 through September 2012 with 212 observations (Appendix F), 3 species observed at NALFF in the raptor guild pose an extremely high risk to aviation safety, making raptors the second most hazardous guild to aviation safety at NALFF (Table 3). As shown in Table 3, Turkey Vultures (*Cathartes aura*) were the most commonly observed species in the raptor guild, followed by Red-tailed Hawk (*Buteo jamaicensis*), American Kestrel, (*Falco sparverius*), Black Vulture (*Coragyps atratus*), Cooper's Hawk (*Accipiter cooperii*), Northern Harrier (*Circus cyaneus*), Bald Eagle (*Haliaeetus leucocephalus*), and Sharp-shinned Hawk (*Accipiter striatus*). Raptors were most often observed flying locally 46% of the time in or over woodland areas and agricultural fields at NALFF (Figure 12).

Attractants
Raptors are attracted to the airfield at NALFF by several features. Raptors find abundant prey (e.g., meadow voles, field mice, Eastern cottontails, etc.) in the grassland, agricultural field and woodland areas of the airfield. There are numerous perching sites such as navigation aids, lights, communication towers, trees, and radar facilities that may be utilized by raptors. Vultures are often observed towering on thermal updrafts high above the airfield. Mowing operations and road-killed animals provide abundant food sources for vultures in the area.

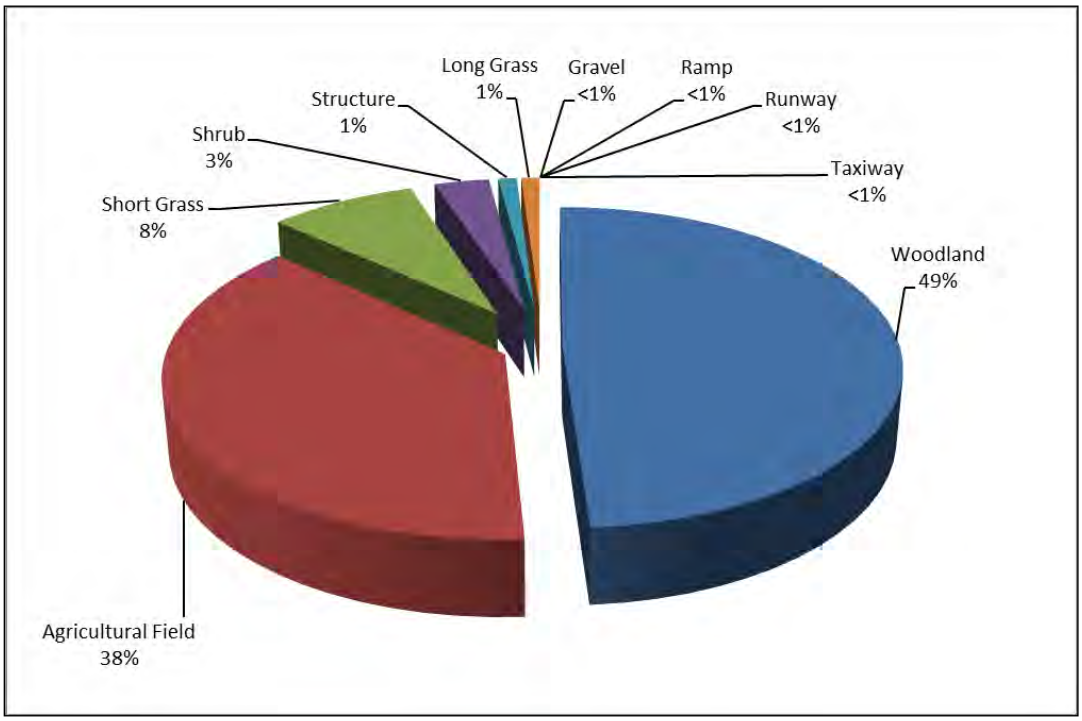

Figure 12: Raptor habitat use at NALFF, October 2011 through September 2012.

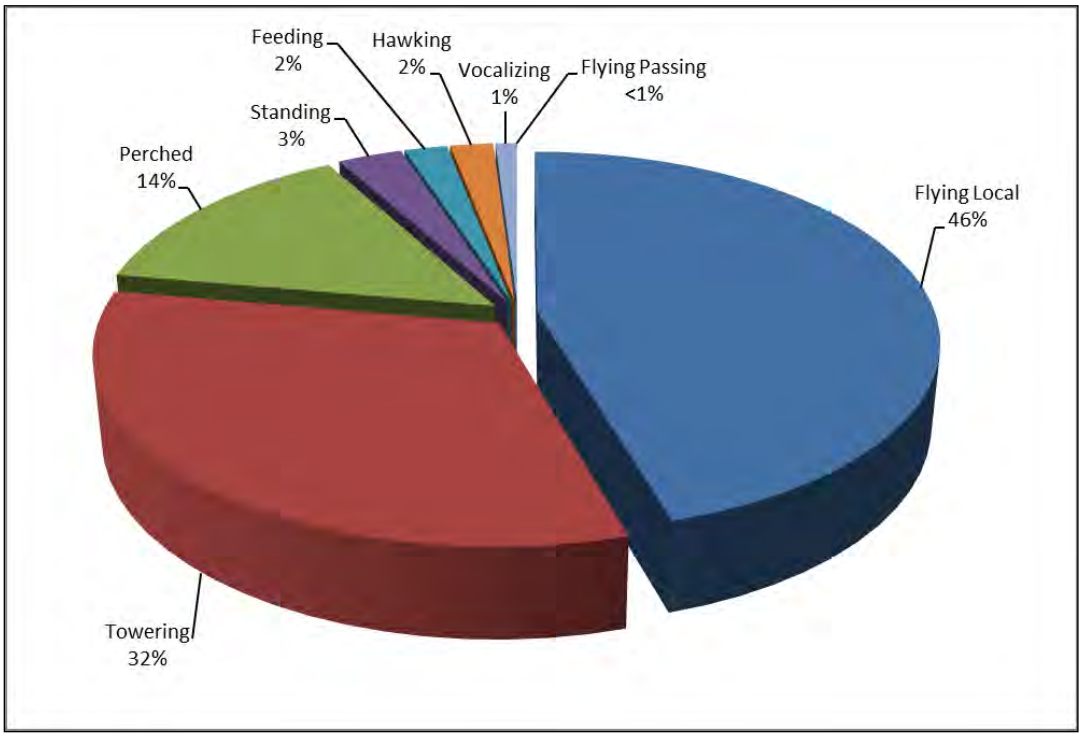

Figure 13: Raptor activity on NALFF, October 2011 through September 2012.

Management Recommendations

To reduce the likelihood of aircraft strikes involving raptors, Blackwell and Wright (2006) suggested that management efforts in the airfield should be directed towards the availability of food and alteration of habitat used by raptors. The reduction of food sources such as rodents and carrion in the airfield is critical in controlling foraging by Red-tailed Hawks and vultures (Blackwell and Wright 2006). Reducing the number of small mammals in the airfield may be accomplished by a variety of methods, including frequent mowing and/or the use of rodenticides. Any animal carcasses found in or around the airfield should be removed and disposed of promptly to avoid attracting vultures. Mowing practices should remain consistent throughout the summer to prevent vegetation from reaching heights attractive to small rodents, decreasing the amount of scavenging by Turkey Vultures and other birds of prey.

Research has shown that small mammals use unmanaged areas of tall vegetation far more than disturbed areas (Barras and Seamans 2002, Blackwell and Wright 2006, Washburn and Seamans 2007), so frequent mowing can help to reduce small mammal abundance at airports (Barras and Seamans 2002), reducing the availability of food for raptors. When possible, reducing the availability of locations where raptors may perch, roost, loaf, or nest is recommended. As such, NALFF should consider the removal of trees and unused structures in the airfield. For structures that cannot be removed (i.e., signs, lights, towers, etc.), devices that exclude birds or make it difficult for their perching should be considered (such as spider wires, bird spikes, coil wire, etc.).

Raptor species must be harassed from the airfield whenever present using methods such as vehicles, horns, and pyrotechnics. Vultures commonly soar high above the airfield, making them difficult to disperse using 15mm pyrotechnics, given their limited range. Devices with much greater range (such as CAPA rounds or 12-gauge shellcrackers) may be more useful for dispersing vultures. Lethal removal of some raptors may be necessary for persistent individuals, and as such NALFF's depredation permit must be kept current to allow take of raptors. Lethal removal may include methods such as shooting or trapping. Though recently removed from the endangered species list, Bald Eagles are protected under the Bald and Golden Eagle Protection Act and a permit is required to simply harass eagles from the airfield. Eagles are periodically observed around the airfield environment. The intracoastal waterway to the North and East of the airfield is a major attractant for eagles, and falls within the 5 mile radius of the airfield. NALFF has submitted an application for this dispersal permit and it is recommended that the permit be kept current once obtained.

6.3 Waterfowl

Waterfowl can be particularly hazardous to aviation safety due to their larger size and flocking behavior. In particular, Canada Geese have been responsible for some of the more serious wildlife strikes. In addition to the more recent "Miracle on the Hudson" event (see Section 1.1), 24 airmen were killed in 1995 when an Air Force AWACS aircraft crashed at Elmendorf Air Force Base in Alaska after striking a flock of Canada Geese (Wright 2011). From 1990 through 2009, waterfowl have been responsible for the

greatest number of damaging strikes in the United States (1,503), resulting in over $144 million in losses (Dolbeer et al. 2011).

General Abundance

Waterfowl were the sixth most abundant guild observed at NALFF from October 2011 through September 2012 (Appendix F). Waterfowl rank as the third most hazardous guild to aviation safety at NALFF (Table 3). Snow Geese (*Chen caerulescens*) are ranked as an extremely high hazard threat to aviation safety (Table 3) and accounted for the majority of waterfowl observed, but only occurred one time in February 2012. Other waterfowl observed at NALFF included Canada Geese (six observations), Tundra Swans (*Cygnus columbianus*) (one observation) and a single Mallard (*Anas platyrhynchos)* making up the rest of the waterfowl guild. Waterfowl observations were not common in terms of number of observations on NALFF property, most likely due to a lack of water, and were seen flying passing above or in the vicinity of the airfield during bird surveys 85% of the time (Figure 14).

Attractants

The Chesapeake/Virginia Beach area is within the Atlantic Flyway and home to a major stopover area for migrating waterfowl in Back Bay National Wildlife Refuge (9,250 acres) to the Southeast of NALFF. Snow Geese and other waterfowl are regularly observed loafing at both of these locations during peak migration. Surveys at NALFF included approximately 530 Snow Geese observed flying in numerous flocks during the migratory period high above the airfield. Canada Geese were observed on several occasions throughout the survey period flying across the airfield or feeding in nearby agricultural fields. There are three golf courses within five miles of NALFF and one (Battlefield Golf Course) within 10,000 feet to the West of NALFF and appears to provide plentiful food and a place for resident geese to molt from May to July (Appendix G and H).

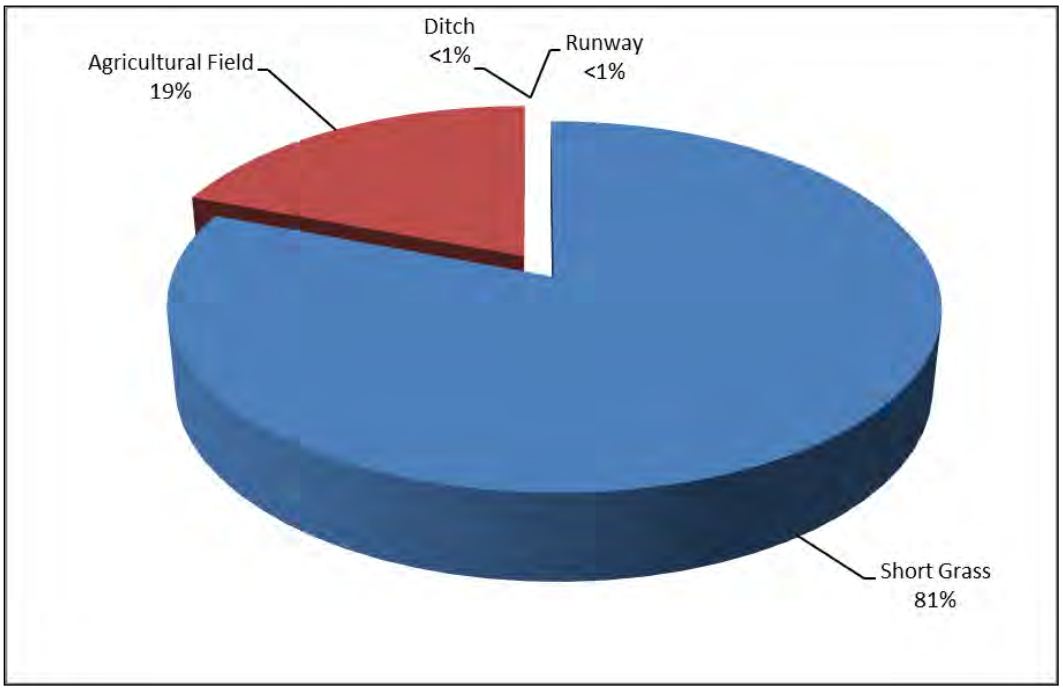

Figure 14: Waterfowl habitat use at NALFF, October 2011 through September 2012.

Management Recommendations

Canada Geese and Snow Geese should be considered the third greatest wildlife species threats to aviation safety at NALFF. Nationally, Canada Geese are ranked as an extremely high hazard to civil aviation safety, as 51% of aircraft strikes with geese resulted in damage from 1990 through 2007 (Dolbeer and Wright 2009). By comparison, Mallards are a very high hazard to aviation safety, but the damaging strike rate for Mallards is about half that of Canada Geese (Dolbeer and Wright 2009). Resident Canada Geese find many areas of suitable habitat around NALFF and have the potential to fly through critical airspace when traveling from roosting/loafing areas to feeding areas, considering the habitat in the area. There are several control methods that should be considered to reduce hazards from Canada Geese (and waterfowl in general).

Agricultural practices within five miles and on NALFF property include the harvest of soybeans, winter wheat, and corn. Winter wheat is a major attractant for waterfowl, in particular Canada Geese, and considerations should be given to eliminate the production of winter wheat on NALFF agricultural fields. Whenever and wherever possible, areas of standing water in the airfield should be eliminated by improving drainage, grading, or filling in low areas.

Recently, a linear ditch was constructed to divert water away from a nearby neighborhood (Appendix G, 3.1). One recommendation would be to suspend a wire grid over any area of water. Wire grids act as both a physical and visual barrier to prevent waterfowl from landing on the water. Installing stone rip-rap along the banks of drainage ditches may help to reduce waterfowl use of these areas, as well.

Drainage ditches should be properly maintained, allowing water to effectively drain from the airfield and the ditches. Ditches can be maintained by: removal of vegetation slowing the flow, proper grading, removal of excess sediment, and use of herbicides to limit vegetation growth.

Vegetation management can be an important component for managing Canada Geese. Generally, it is recommended that airfields maintain grass at an intermediate height in the airfield (between 6 and 10 inches). It has long been thought that tall vegetation management in the airfield would deter Canada Geese since they often prefer to forage in areas of short grass, though there is limited scientific data on how Canada Geese react to tall vegetation management and studies have often produced conflicting results (Seamans et al. 2007, Barras and Seamans 2002, Washburn et al. 2007). Though more research is needed, studies suggests that a promising method of reducing Canada Goose usage of airfields is to use an endophyte-infected variety of tall fescue when re-seeding areas of an airport disturbed by tree removal, construction or renovation (Washburn et al. 2007). Research suggests that when consumed by wildlife, tall fescue produces a variety of adverse effects (taste aversion, physical distress) and is generally avoided (Washburn et al. 2007). When re-seeding disturbed areas of the airfield, NALFF should consider planting tall fescue and avoid grass mixtures containing millet so as not to provide a preferred food source for geese and other threatening bird species.
NALFF should adopt and maintain a "zero tolerance" policy towards waterfowl in and adjacent to the airfield, especially Canada Geese. Waterfowl species should be aggressively harassed to disperse them from the area. Harassment methods may include the use of pyrotechnics, horns, sirens, paintballs, and chasing with vehicles. NALFF should maintain its current migratory bird depredation permit from the USFWS to allow lethal take of waterfowl species that do not respond to harassment. Canada Geese may also be taken under the Control Order at Airports and Military Airfields (50 CFR §21.49), which allows take of Canada Geese on base property and other properties within a 3-mile radius of the airfield (with written permission of the landowner) from April 1 to September 15.

In order to further reduce threats from Canada Geese, NALFF should utilize control efforts beyond the airfield to base properties that provide attractive sources of food and cover. This control should be expanded to off base locations within 5 miles of the base (appendices G and H identify locations of wildlife attractants at 10,000 ft and 5 miles). A study conducted in New York by Seamans et al. (2009) indicated that resident Canada Geese remained within 3 miles (5 km) of their primary feeding and loafing areas around JFK International Airport. The WS program in NY reported that goose numbers at Rikers Island decreased annually after removal efforts from 2004 through 2007, and subsequently goose strikes at nearby LaGuardia Airport decreased by 80% (Seamans et al. 2009).

6.4 Pigeons/Doves

Pigeons/Doves were the fourth most hazardous guild identified at NALFF from October 2011 through September 2012 (Table 3). Rock Pigeons and Mourning Doves (*Zenaida macroura*) are the only two species observed at NALFF in this guild.

From October 2011 through September 2012, Pigeons/Doves were the fifth most abundant guild observed at NALFF (Appendix F). Pigeons were usually observed flying locally and passing, whereas Mourning Doves were usually observed feeding or flying locally around agricultural fields and areas of exposed soil. From 1981-2011, the only reported strike occurring at NALFF involving this guild was one Mourning Dove.

Attractants

Pigeons/Doves were observed most frequently in agricultural fields (Figure 15). Pigeons are attracted to the airfield to roost and nest on structures, while Mourning Doves prefer to feed in agricultural fields and bare ground or perch/loaf on fences. Pigeons and Doves were primarily seen flying locally 64% of the time across agricultural fields and around unpaved roads, looking for seeds and grit. Agricultural fields that were recently cultivated, especially corn fields, attracted greater numbers of both pigeons and doves.

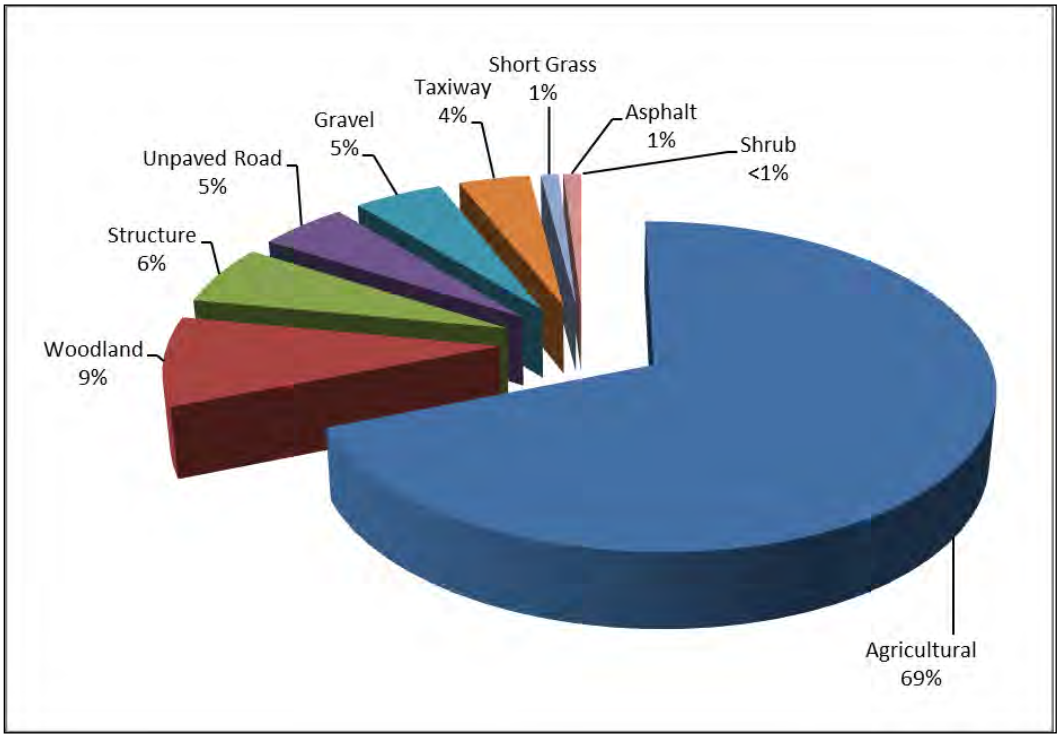

Figure 15: Pigeons/Doves habitat use at NALFF, October 2011 through September 2012.

Management Recommendations

Flocks of birds in this guild may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse should be removed

lethally by shooting or trapping. Areas of bare ground that have been graded or re-seeded should be monitored for Mourning Dove activity. Control of pigeons does not require a permit, though control of Mourning Doves does require a Federal Migratory Bird Depredation Permit.

6.5 Blackbirds/Orioles and Starlings

Blackbirds/Orioles and Starlings were the fifth and sixth most hazardous guilds identified at NALFF from October 2011 through September 2012 (Table 3). European Starling and Common Grackle were ranked as moderate whereas Red-winged Blackbird and Brown-headed Cowbirds were assigned a low ranking. While these guilds do not contain any species that rank as an extremely high or very high hazard and control efforts are not often required, discussion is still warranted due to the number of observations during the study year.

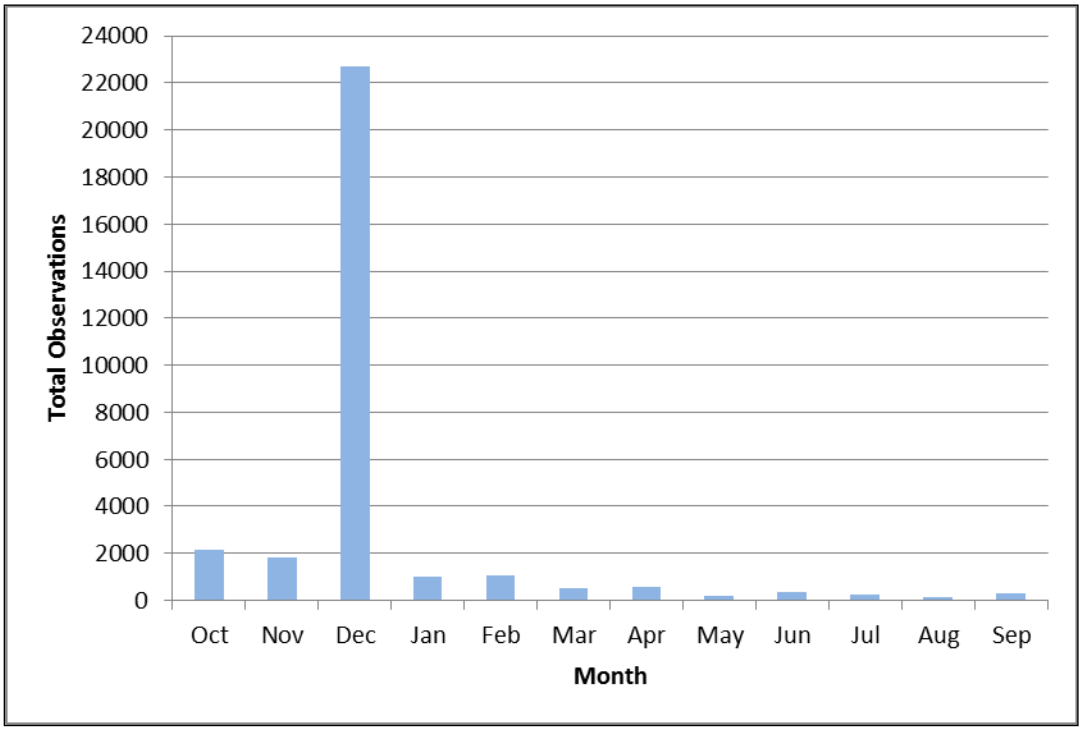

Figure 16: Blackbirds/Orioles and Starling Observations at NALFF, October 2011 through September 2012.

From October 2011 through September 2012, Blackbirds/Orioles were the most abundant guild observed at NALFF and starlings were second among all species (Appendix F). These species were mostly observed flying over short grass and agricultural areas, though European Starlings (*Sturnis vulgaris*) were commonly observed perched on structures throughout the airfield, particularly on the old aircraft and around quarterdeck area. None of these guilds have been involved in reported damaging strikes at NALFF since 1981 (Table 1). The greatest hazard these species pose to aviation is through their tendency to form large dense flocks that stay in almost continuous motion over short

grass habitat near active runways. Figure 16 shows the increase in numbers during the winter months when dense flocks are most often observed as compared to the rest of the year. In June of 1996, a Belgian Hercules C-130 flying into Eindhoven Air Force Base in S. Netherlands struck a flock of European starlings, killing 34 people (Kitowski 2011).

Attractants

Species in these guilds are attracted to the airfield to feed in the large areas of open grassland and agricultural fields where they find abundant forage such as seeds, earthworms, and insects (Figure 17,18). There are many perching roosting locations utilized by these guilds such as buildings, static aircraft, communication equipment, fences, and radar facilities.

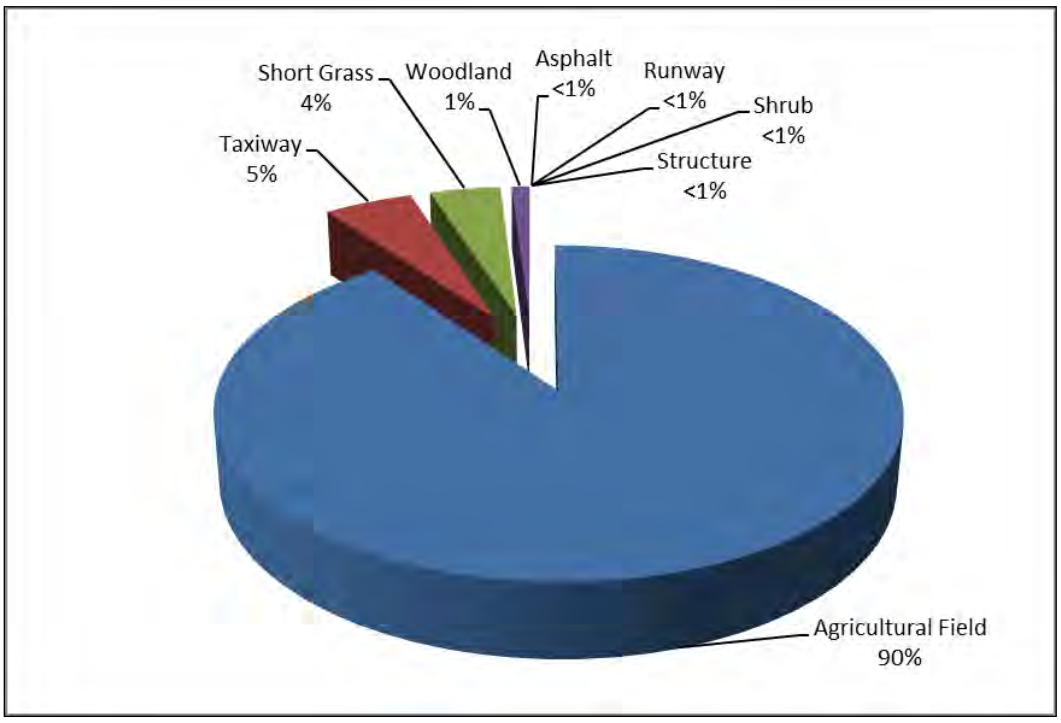

Figure 17: Blackbirds/Orioles habitat use at NALFF, October 2011 through September 2012.

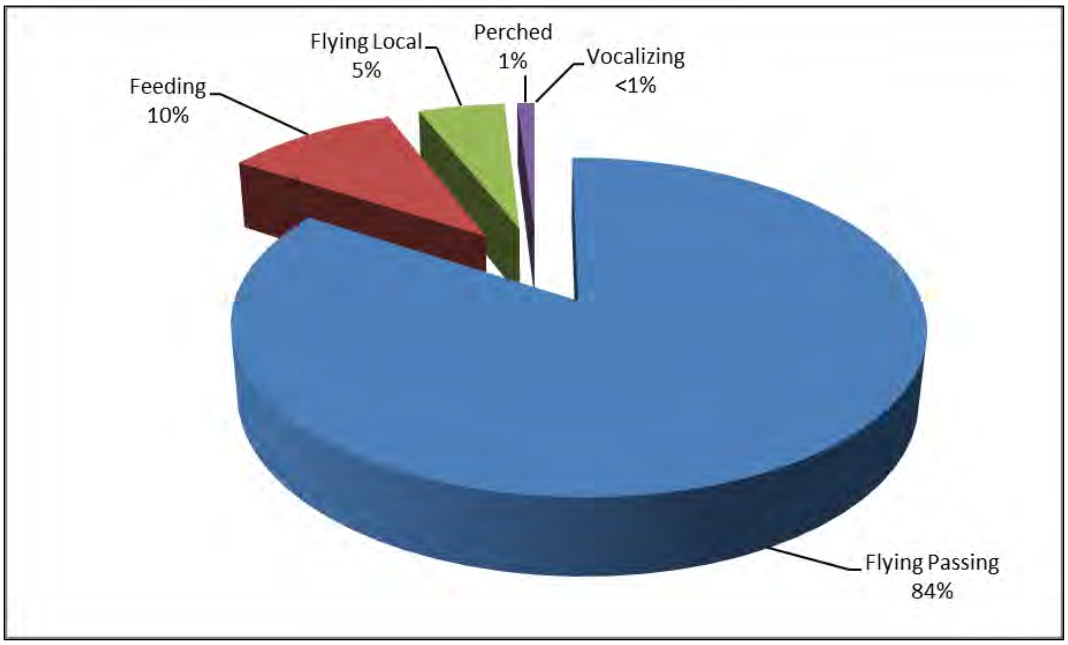

Figure 18: Blackbirds/Orioles activity on NALFF, October 2011 through September 2012.

Management Recommendations

Flocks of birds in these guilds may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse should be removed lethally by shooting and/or trapping under the FWS blackbird depredation order (50 CFR 21.43). Under this order, a permit is not necessary for the removal of blackbirds and crows causing damage or threats to human health and safety; however, it is required that all take and dispersal be reported. European starlings are not included in this order since they are an invasive/nuisance species and therefore do not require a permit. Grass management can be important for controlling these species. Grass that is tall enough to produce a seed head provides a food source and effective cover for species such as starlings and blackbirds, so grass in the airfield should be maintained at the recommended height of 6 to 10 inches (Dolbeer et al. 2011). Nest box traps can be used to manage populations of starlings in and around these areas.

6.6 Swallows

Swallows are listed as the seventh most hazardous guild identified at NALFF from October 2011 through September 2012 (Table 3). Surveys of swallows at NALFF are comprised of Tree Swallows, Barn Swallows and Purple Martins. Although these three species do not rank as high hazards to aviation safety from a perspective of reported damage, discussion is still warranted due to the number of observations during the study period.

From October 2011 through September 2012, swallows were the second most abundant guild observed at NALFF (Appendix F). Tree Swallows comprised over 93% (7,703

individuals) of this guild. This guild poses a high hazard to aviation in their feeding pattern and tendency to fly in large numbers across the airfield in search of food. From 1990- 2007, the FAA received 145 strikes involving tree swallows, 54 involved multiple tree swallows per incident becoming costly to airports in terms of mandatory aircraft damage inspections after swallow strikes, runway closings, and flight delays (Bernhardt et al. 2009).

Attractants

Species in this guild are attracted to NALFF and surrounding areas to feed on insects located over agricultural fields and fruiting trees, specifically bayberry (Figure 19). Surveys of NALFF show that bayberry trees are plentiful around the airfield, providing great foraging for swallows. Swallows were seen most often flying locally while feeding on insects (Figure 20). Swallows' feeding habits on insects on the airfield and agricultural fields occurs at a very low altitude, becoming a concern to landing and departing aircraft. Swallows also find the paved surfaces of the airfield perfect areas for loafing and resting during migrations.

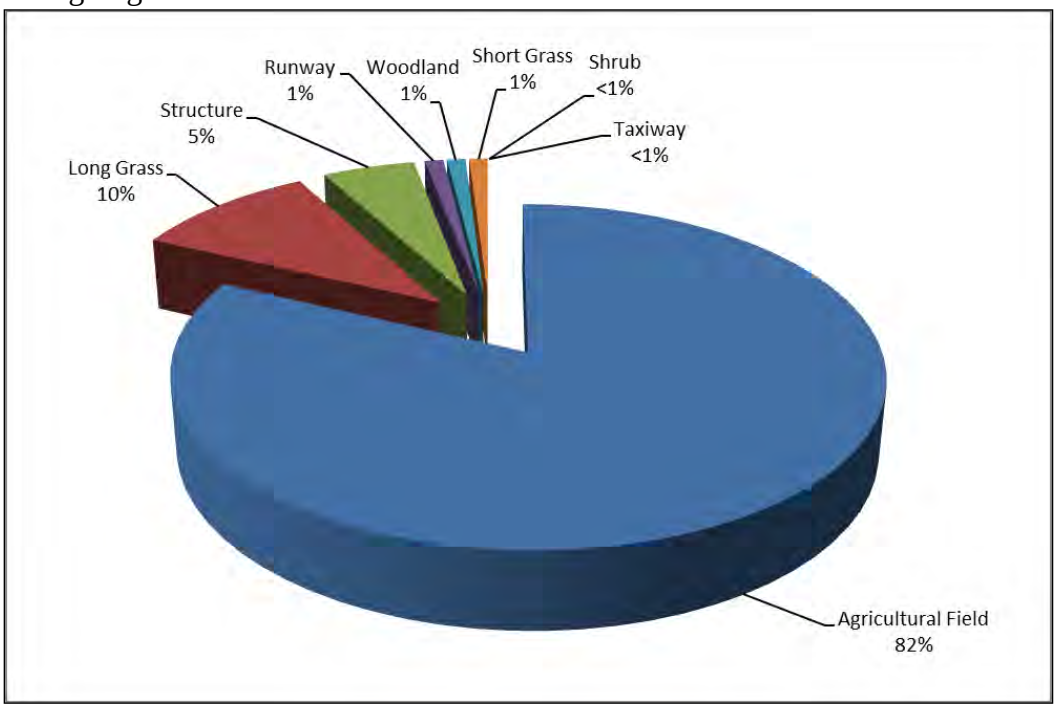

Figure 19: Swallow habitat use at NALFF, October 2011 through September 2012.

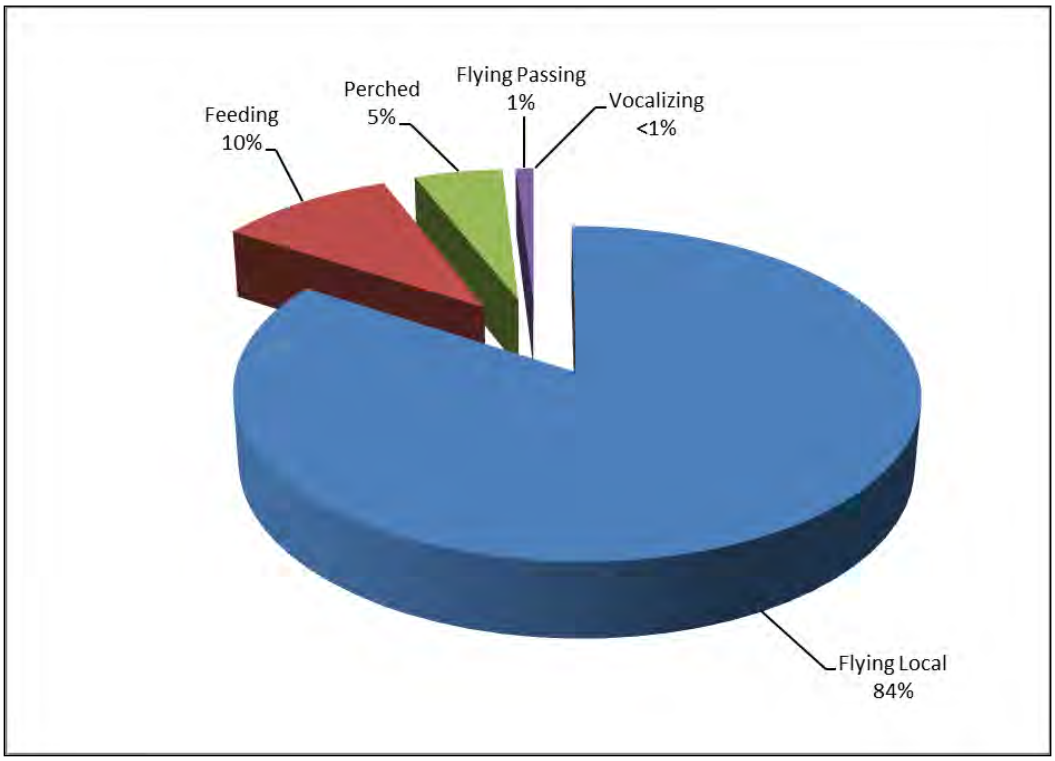

Figure 20: Swallow activity on NALFF, October 2011 through September 2012.

Management Recommendations
Flocks of birds in these guilds may be dispersed by using pyrotechnics, sirens, horns, or recorded distress calls. Persistent species that do not easily disperse may be removed lethally by shooting. Shrubby habitat to include bayberry trees should be removed and graded or re-seeded to grass and mowed regularly. WS recommends that NALFF notify squadrons of the increased swallow activity at dusk due to fall migration. If possible, limits on flying should be set around dusk to help prevent bird strikes. WS recommends insecticide application to areas of short grass surrounding the airfield to remove insects attractive to swallows. Mowing of the grass tends to attract swallows to the airfield as well. WS recommends that mowing be conducted at night if possible, in order to cut down on stirring up insects during swallow feeding periods.

6.7 Small Mammals

Small mammals are attractive prey to most carnivorous mammals and predatory birds. In particular, small rodents offer a consistent diet for raptors, wading birds and carnivorous mammals. Rodent abundance is dependent upon habitat conditions, predation, dispersal rate, biological disturbance, and/or cyclic population eruptions (Fergus 2003).

Attractants
Figure 21 shows that regularly mowed or disturbed habitat, like short grass, prevents the buildup of dead vegetative (duff) layers that small mammals need for concealment and survival. Rodents are less likely to use or maintain a viable population in habitats

without this duff layer due to the high rate of predation and exposure. Undisturbed habitats like secondary growth/shrubs provide excellent cover for small mammals (Table 4). High rodent populations can create an indirect hazard by attracting predators such as coyotes, fox and raptors. While hunting, these predators may create a direct threat to aviation. Rodents can also damage airfield structures due to their gnawing of wire cables which can lead to blackouts of critical airfield lighting and equipment.

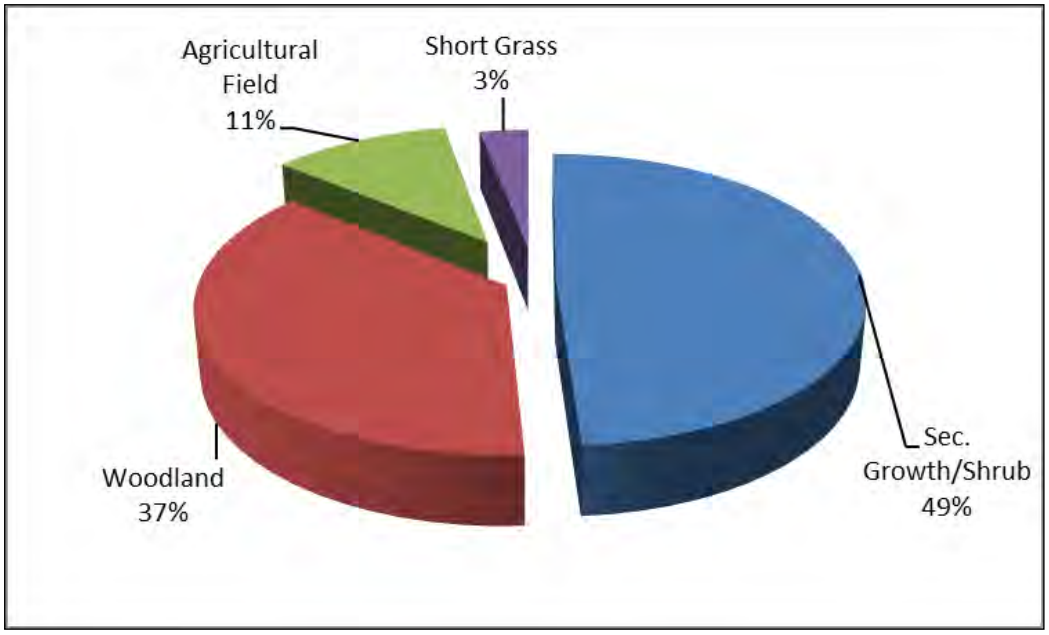

Figure 21: Small Mammal Habitat use at NALFF, fall 2011 and spring 2012.

The number of rodents captured per 100 adjusted trap nights (ATN) was significantly higher in secondary growth/shrub and woodland habitats as opposed to short grass (Table 4). This pattern indicates that the mowing height and frequency currently used at NALFF has been conducive to deterring small mammals from using short grass areas as habitat.

Table 4: Number of Small Mammals Captured per 100 adjusted trap nights (ATN) in fall 2011 and spring 2012 at NALFF.

Habitat Type	Fall Trapping 2011	Spring Trapping 2012	Average
Secondary Growth/Shrub	13	17.5	15.3
Woodland	6.7	14.1	10.4
Agricultural Field	3.6	2.1	2.9
Short Grass	0	1.4	0.7

Management Recommendations

The presence of small mammals in these secondary growth/shrub and woodland areas will be greatly reduced by removal of the trees, shrubs and secondary growth. Air operations management is currently removing areas of concern on the airfield that contain these two habitat types. WS recommends that these areas become part of the mowing and

agricultural lease to prevent secondary growth from reoccurring. WS recommends that NALFF apply rodenticides to specific areas according to the Virginia Cooperative Extension pesticide management procedures to remove and deter small mammals from inhabiting areas where carnivores and raptors are actively feeding.

6.8 All Other Guilds

Appendix F lists all guilds and species observed at NALFF during wildlife surveys from October 2011 through September 2012. For all other guilds observed during wildlife surveys, many, if not all of the management recommendations listed for artiodactyls, raptors, waterfowl, pigeons/doves and swallows are applicable in reducing their threats to aviation safety. Many species utilize the same habitats, so management for one species will likely affect another. As discussed earlier in this section, habitat management and exclusion are the two most important components for reducing the threat of wildlife strikes at NALFF. Vegetation and water management will likely have the greatest impact for most bird species, while maintaining a perimeter fence will be most effective in reducing the presence of larger mammal species (such as deer and coyotes).

6.9 Threatened and Endangered Species

Appendix E lists species that are considered endangered, threatened, or of concern in the Commonwealth of Virginia. Species that may be encountered at NALFF include but are not limited to Gull-billed Tern, Roseate Tern, Upland Sandpiper, and Wilson's Plover.

7.0 DIRECT CONTROL

In addition to conducting a wildlife hazard assessment, WS also provided direct control services to NALFF from October 2011 through September 2012. Due to construction on the airfield, white-tailed deer was the only species directly controlled on the airfield during this study period. From October 2011 through September 2012, 295 deer were surveyed and 14 deer were removed.

8.0 RECOMMENDATIONS

In addition to placing an emphasis on the management of the species discussed in Section 6, WS recommends that the following actions are implemented at NALFF to improve wildlife hazard management at NALFF and further reduce the threat of wildlife/aircraft strikes:

Install a Security/Wildlife fence around the perimeter of the entire airfield

The Federal Aviation Administration (FAA) recommends that civil airports in areas of high deer populations install a 10 to 12 foot chain-link fence with outriggers supporting three strands of barbwire projecting away from the airfield. FAA also supports a 4 foot

skirt of chain link fence attached at the bottom of the fence and buried at a 45 degree angle away from the airfield to exclude wildlife from digging or slipping under the fence. A properly installed wildlife fence will greatly improve safety and security of the airfield.

Update the NASO/NALFF BASH Plan (WHMP) Based on the WHA

NASO/NALFF's current BASH plan (NASOCEANAINST 3750.2B) was developed in 2008 by Geo-Marine, Inc. and was not based on a WHA. The plan provides the framework for the base to address wildlife hazards. The BASH plan lacks base specific details of wildlife hazards, and who, how and when the programs outlined in the plan will be conducted. It is recommended that the BASH plan be updated to reflect the information contained in this WHA.

Training of Airfield Personnel in Wildlife Hazard Management

FAA regulations require that civilian airport personnel who are responsible for implementing wildlife control measures are properly trained in wildlife hazard management by a qualified wildlife biologist [14 CFR Part 139.303 (c) and (e)]. NALFF currently does not have a formalized training. Formalized training topics should include: USN regulations, policies, and procedures; wildlife strike reporting; wildlife attractants; habitat management; species identification; safety; and hands-on demonstrations of wildlife management tools and techniques. It is recommended that NALFF develop formalized training for airfield personnel that may encounter wildlife on the airfield. The current BASH plan outlines this and WS recommends that NALFF develop and formalize a Bird Detection and Dispersal Team (BDDT).

Establish a Formal BASH Working Group

The current NASO/NALFF BASH Plan and the Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance (CNICINST 3700, 7 Jul 2011) both outline the functions and personnel to be involved with the BASH Working Group (BWG). WS recommends that NALFF continue the current BWG in accordance with CNICINST 3700. The functions of this group are important, as it will facilitate greater sharing of information and cooperation among those who have a stake in managing wildlife hazards at NALFF.

Utilize the Wildlife Activity Log and Report Bird Strikes

It is recommended that operations personnel begin using a wildlife activity log to include information such as the number of birds involved, cover type, and location on the airfield. WS recommends that this log also be extended to other personnel such as the crash captain and federal firefighters at NALFF. This information can be useful in determining trends and prioritizing management objectives.

Bird strikes should be reported online via WESS and a sample submitted to the Smithsonian Feather ID Lab for positive identification. Evaluation of the WESS data base has shown a lack in bird strike reporting. WS has seen an increase in strike reporting since June 2010. It is important that aircrews conducting the majority of their operations at NALFF who encounter a bird strike report the strike as occurring at NALFF if the location of the strike is unknown. WS should continue training on proper strike reporting to airfield personnel and squadrons. Damage to aircraft following a strike or wildlife incidence is seldom recorded. WS recommends that NALFF formalizes a process for recording damage. Damage should include aircraft structural damage, aircraft down time, repair, cleaning, and all other costs associated with a wildlife incidence. WS recommends that NALFF work with the Naval Safety Center to ensure that the WESS data base is being updated with species identification and associated damages. This information is usually not available at the time a WESS report is initially submitted.

Maintain Necessary Permits to Control Wildlife

As stated previously, federal and state permits are necessary for lethal take of migratory bird species and state-managed species such as deer and turkeys. In addition, a federal permit is needed before Bald Eagles may be harassed from the airfield. NALFF currently holds a migratory bird depredation permit and a state permit. WS recommends that these permits be maintained to address wildlife species as necessary. WS also recommends NALFF obtain a Bald Eagle Harassment permit from the USFWS. Without this permit, Bald Eagles using the airfield cannot be harassed and may pose a serious aviation threat if left on or near the airfield.

Have Control Supplies on Hand

WS recommends that airfield personnel that are members of the BDDT who are responsible for wildlife hazard management are provided with adequate equipment needed to disperse wildlife. Such devices may include pyrotechnics and launchers, propane cannons, and vehicles equipped with sirens and lights. WS recommends that BDDT members are properly trained in the safe use and storage of these devices.

Evaluate Potential Wildlife Hazards When Planning New Construction or Land Use Changes

NALFF has recently completed a major expansion and improvement project. It is critical to consider wildlife attractants during these planning phases. Several aspects to consider will be the planting of new vegetation, which may provide food to wildlife in the form of seeds and fruits, and the creation of water bodies or drainage basins that provide fresh water. NALFF airfield manager currently reviews airfield maintenance projects with WS for possible BASH concerns. WS recommends that this process continue and be expanded to all construction and maintenance projects on base property. In addition, adjacent off-site projects within 5 miles of the airfield such as: industrial development, road construction, recreational development, etc. need to be considered as potential wildlife attractant hazards and reviewed for potential wildlife attractants prior to budget

commitments. If the review is conducted after the project budget is established, changes to the project are unlikely.

Continue to Monitor Wildlife Populations and Habitat Use Patterns in the Airfield

The intent of this WHA has been to document general occurrence, land-use patterns, and population characteristics of wildlife at NALFF. It must be realized that wildlife abundance and use patterns on airfields are affected by a host of variables that are rarely the same from year-to-year. Hence, conclusions based on wildlife populations and patterns during this study are only meant to be a guide and may or may not be consistent in subsequent years. Survey routes and methods were established in a manner that facilitates continued monitoring. Data from this study will provide a baseline for comparison in subsequent years and NALFF should continue to monitor wildlife populations by conducting monthly surveys using the same stations established in this assessment. While surveys conducted in subsequent years may not be conducted with the same frequency or intensity as this initial hazard assessment, they will still provide general insights into wildlife use patterns over time and enable NALFF to gauge the effectiveness of its control efforts.

Habitat Modification and Exclusion

As discussed in Section 6, habitat modification and exclusion are two of the most important components of a wildlife hazard management plan. NALFF airfield maintenance personnel have been diligent in maintaining grass in the airfield at the recommended height (6 to 10 inches), and WS recommends that regular mowing is continued. Grass management is seasonal, and frequency of mowing may need to be increased during growing season as resources permit. Woody vegetation growing in drainage ditches should be removed and these areas should be maintained to prevent creating thick, shrub-like habitat that can provide cover for small mammals and perching sites for raptors. Most ditches within the airfield have been allowed to become clogged with woody vegetation. This not only attracts wildlife but prevents water from effectively draining from the airfield compounding the problem with areas of standing water and/or high water table within the airfield. These high water tables increase the chance of field equipment rutting the airfield when driving across or avoiding the area completely during mowing operations.

Because all species are attracted to water, areas of standing water should be eliminated where possible. Low lying areas should be filled or graded to improve drainage. Underground drainage culverts in the airfield should be inspected regularly and be maintained to reduce standing water following heavy rains.

Throughout the year and WHA, observations were made regarding the airfield improvement project that likely resulted in attracting certain species of wildlife to the airfield. Loose gravel and soil remained exposed for several months providing good habitat for Mourning Doves and Killdeer. Prior to re-opening, all areas of loose soil were

re-graded, compacted, and seeded to insure stabilization of the soil. These areas must be maintained and re-graded as necessary.

Agricultural Practices

Agricultural crops can attract hazardous wildlife to the airfield. Consideration should be given to the crops that are planted and the agricultural practices used for their production. Cereal grain products should be avoided. These crops attract large numbers of waterfowl for forage. Agricultural practices should minimize tilling. Tilling exposes prey (i.e. insects, worms, etc.) that attract large numbers of gulls. Care should be taken during harvest to ensure excess amounts of grains are not spilled. If spills occur they should be cleaned up or buried.

Evaluation of Off Base Aviation Hazards and Seeking Landowner Cooperation

As discussed in Section 6, wildlife on properties near the airfield may pose serious threats to aviation safety at NALFF. The FAA recommends a separation distance of 5 statute miles between the farthest edge of the airports AOA and hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace (FAA AC 150/5200-33B). WS recommends that NALFF continues to identify areas within 5 miles of the airport that may provide roosting and/or foraging areas for birds that utilize the airspace at NALFF, especially Canada Geese. NALFF should approach these landowners to seek cooperation on removing these hazards. WS has identified several potential areas that attract hazardous wildlife within the approach/departure and circling airspace of NALF Fentress. A couple areas noted: water impoundment across Mount Pleasant Rd., agricultural fields (corn, soybeans, winter wheat), Battlefield, Signature at West Neck, Virginia Beach National and Stumpy Lake golf courses (Appendix G and H). Areas identified as potential hazards should be and/or continue to be evaluated for wildlife use and BASH mitigation procedures implemented to reduce hazards.

9.0 SUMMARY

Based on data collected during the WHA, records from the WESS wildlife strike database, and control efforts by WS and NALFF personnel, several species were identified that threaten aviation safety at NALFF. The guilds/group that are of most concern to aviation safety include deer, raptors, waterfowl, pigeons/doves, blackbirds/orioles, starlings, and swallows. Several management strategies may be implemented to reduce wildlife hazards at NALFF, including habitat modification, exclusion, harassment, and lethal removal of hazardous wildlife species. WS recommends that NALFF continues to take an active approach to wildlife hazard management, utilizing the information contained in this WHA to reduce wildlife hazards and provide a safe environment for aircraft operations.

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NAVAL AIR STATION OCEANA

NATURAL RESOURCES

AIRFIELD OBSTRUCTION VEGETATION LAND MANAGEMENT ZONES

Legend

- Installation Boundary
- Potential Agriculture
- 2015 Agricultural Outlease Parcels

Land Management Zone

Vegetation Management Type

- Agricultural/Grassland
- Pulp Forest Mgmt Eligible
- Saw Timber/Pulp Forest Mgmt Eligible
- Natural Growth/Select Tree Removal
- Wetland (linear)
- Wetland (polygon)
- Special Interest Areas
- Airfield Imaginary Surfaces

Map created by:

K. Dean Wright
NAVFAC MIDLANT
EV GIS Coordinator

on August 06, 2015

N
W E
S

0 500 1,000 2,000 3,000 4,000 Feet

0 160 320 640 960 1,280 Meters

NAVAL AUXILIARY LANDING FIELD FENTRESS

NATURAL RESOURCES

AIRFIELD OBSTRUCTION VEGETATION LAND MANAGEMENT ZONES

Legend

- Installation Boundary
- Potential Agriculture
- 2015 Agricultural Outlease Parcels

Land Management Zone

Vegetation Management Type

- Agricultural/Grassland
- Pulp Forest Mgmt Eligible
- Saw Timber/Pulp Forest Mgmt Eligible
- Natural Growth/Select Tree Removal
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Map created by:

K. Dean Wright
NAVFAC MIDLANT
EV GIS Coordinator

on August 06, 2015

N W E S

0 500 1,000 2,000 3,000 4,000 Feet

0 150 300 600 900 1,200 Meters

Enclosure 4. UUSFWS Migratory Bird Depredation & VDGIF Kill Permits

DEPREDATION AT AIRPORTS

Permit Number: MB734656-0
Effective: 02/01/2017 Expires: 01/31/2018

Issuing Office:

Department of the Interior
U.S. FISH AND WILDLIFE SERVICE
Migratory Bird Permit Office
P.O. Box 779
Hadley, MA 01035-0779
Tel: 413-253-8643 Fax: 413-253-8424

CHIEF, MIGRATORY BIRD PERMIT OFFICE - REGION 5

Permittee:

U.S. NAVY, NAVFAC MIDLANT
ATTN: TAYLOR AUSTIN
93240 VIRGINIA & TAUSSING AVE.
BLDG Z-144, 2ND FLR RM 214
NORFOLK, VA 23511

Name and Title of Principal Officer:
TAYLOR S. AUSTIN - NATURAL RESOURCES REGIONAL MANAGER

Authority: Statutes and Regulations: 16 USC 703-712; 50 CFR Part 13, 50 CFR 21.41.

Location where authorized activity may be conducted:
(1) NAVAL AIR STATION OCEANA, VIRGINIA BEACH, VA; (2) NAVAL AUXILIARY LANDING FIELD FENTRESS, CHESAPEAKE, VA;
(3) CHAMBERS FIELD, NORFOLK, VA; (4) JOINT EXPEDITIOMARY BASE LITTLE CREEK

Reporting requirements:

ANNUAL REPORT DUE WITH NEXT RENEWAL or IF NOT RENEWING 30 days after permit expiration even if you had no activity. Forms at: <http://www.fws.gov/forms/3-202-9.pdf>

Conditions and Authorizations:

A. General conditions set out in Subpart B of 50 CFR 13, and specific conditions contained in Federal regulations cited above, are hereby made a part of this permit. All activities authorized herein must be carried out in accord with and for the purposes described in the application submitted. Continued validity, or renewal of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports.

B. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local tribal, or other federal law.

C. Valid for use by permittee named above

D. You are authorized to take, temporarily possess, and transport the migratory birds specified below to relieve or prevent injurious situations impacting public safety. All take must be done as part of an integrated wildlife damage management program that emphasizes nonlethal management techniques. You may not use this authority for situations in which migratory birds are merely causing a nuisance.

(1) The following may be taken by firearm, with non-toxic shot:

(a) 475 Canada Geese

(b) 450 Mourning doves
(c) 400 Laughing gulls
(d) 300 Ring-billed gulls
(e) 130 Killdeer
(f) 80 Barn Swallows
(g) 75 EACH: American Robins and Eastern Meadowlarks, Turkey Vultures
(h) 60 Herring gulls
(i) 55 Black Vultures
(j) 50 EACH: Great Black-backed Gulls, Mallard, Atlantic Brant,
(k) 40 Tree Swallows
(l) 25 EACH: Great Blue herons, Black Skimmer ,
(m) 20 Double-crested cormorants,
(n) 15 EACH: Osprey, Northern Mockingbird
(o) 10 EACH: Great Egret, Purple Martin
(p) 5 EACH: Brown Pelican, Caspian Tern, Common Tern, Foster's Tern, Royal Tern

(2) The following may be shot with a firearm or captured with Bal chatri, pole trap, a Swedish Goshawk trap:

(a) 50 Red-tailed hawks
(b) 40 American kestrel,
(c) 20 Northern Harrrier
(d) 12 Cooper's hawks,
(e) 5 Sharp-shinned hawks

(3) The following may be trapped and relocated:

(a) 15 Osprey,

(4) The following active nests (including eggs) may be destroyed:
(a) 65 Canada Goose,
(b) 15 Barn Swallow,
(c) 10 Osprey

State restrictions: Peregrine Falcons are listed as Endangered by Virginia State law and therefore may not be taken.

E. You are authorized in emergency situations only to take, trap, or relocate any migratory birds, nests and eggs, including species that are not listed in Condition D (except bald eagles, golden eagles, or endangered or threatened species) when the migratory birds, nests, or eggs are posing a direct threat to human safety. A direct threat to human safety is one which involves a threat of serious bodily injury or a risk to human life.

You must report any emergency take activity to your migratory bird permit issuing office, Hadley, Ma, 413-253-8424 (fax), within 72 hours after the emergency take action. Your report must include the species and number of birds taken, method, and a complete description of the circumstances warranting the emergency action.

F. You are authorized to salvage and temporarily possess migratory birds found dead or taken under this permit for (1) disposal, (2) transfer to the U.S. Department of Agriculture, (3) diagnostic purposes, (4) purposes of training airport personnel, (5) donation to a public charity (those suitable for human consumption), or (6) donation to a public scientific or educational institution as defined in 50 CFR 10.12. Any dead bald eagles or golden eagles

salvaged must be reported within 48 hours to the National Eagle Repository at (303) 287-2110 and to the migratory bird permit issuing office at fax 413-253-8424. The Repository will provide directions for shipment of these specimens.

G. You may not salvage and must immediately report to U.S. Fish and Wildlife Service Law Enforcement any migratory birds that appear to have been poisoned, shot, or otherwise injured as the result of criminal activity.

H. You may use the following methods of take: (1) firearms; (2) nets; (3) ONLY USDA Wildlife Services may use registered animal drugs (excluding nicarbazin), pesticides and repellents; (4) falconry abatement; and (5) legal lethal and live traps (including pole traps). Birds caught live may be euthanized or transported and relocated to another site approved by the appropriate State wildlife agency, if required. When using firearms, you may use rifles or air rifles to shoot any bird when you determine that the use of a shotgun is inadequate to resolve the injurious situation. The use of any of the above techniques is at your discretion for each situation.

I. You may temporarily possess and stabilize sick and injured migratory birds and immediately transport them to a federally licensed rehabilitator for care.

J. The following subpermittees are authorized: **Employees of the Department of the Navy; and employees of USDA/APHIS/Wildlife Services.** In addition, any other person who is (1) employed by or under contract to you for the activities specified in this permit, or (2) otherwise designated a subpermittee by you in writing, may exercise the authority of this permit.

K. You and any subpermittees must comply with the attached Standard Conditions for Migratory Bird Depredation Permits. **These standard conditions are a continuation of your permit conditions and must remain with your permit.**

G. A "No Feeding Policy" must be in place.

For Canada Geese Egg Addling or Nest Destruction you MUST register each year between January 1 and June 30 at: https://epermits.fws.gov/eRCGR. You must return to website and report your take before October 31 each year.

CAD # 1612036161

OFFICIAL KILL PERMIT

To Whom It May Concern:
Permission is herewith granted NAS Oceana * (Name (landowner or lessee)) 757 433-2151 (Telephone)

800 Oceana Blvd (Address) | Va Beach (City) | Va (State) | 23460 (Zip) | (E-Mail)

and those persons named below: (State law prohibits persons convicted of wildlife violations from being designated as a shooter or carrying out the authorized acrtivity for the landowner/lessee).

CO Authorized Kill Permit Team
NASO Natural Resources Staff
USDA Wildlife Services Staff

To kill UNLIMITED (Quantity) (Bear, Beaver, Deer, Muskrat, Rabbit, Raccoon, Squirrel) (Circle appropriate species) damaging the property of NAS Oceana. *

in Va Beach (County or City) for the period from 01/01/17 to 12/31/17

Time Restrictions: None - May Kill on Sunday and Trap as required

Damage control limited to the location described below or on the attachment. No one except those listed on this permit may assist or be present during the damage control activities. Additionally, the landowner/lessee acknowledges that all damage control operations will comply with local firearm ordinances. This permit authorizes the killing of wild animals pursuant to Sections 29.1-516, 29.1-517, 29.1-518, and 29.1-529 Code of Virginia. Unless otherwise authorized on this permit, deer killed on this permit must be anterless. Permit is not valid unless signed by the landowner/lessee and the authorizing Department representative. Permit must be carried and available for inspection during damage control activities.

Has the landowner/lessee been issued a kill permit previously on the requested parcel? Yes ☑ No ☐
Has the parcel been hunted in the previous hunting season for deer or bear? Yes ☑ No ☐ Indicate the number of days hunted: ___
How does the landowner/lessee plan to dispose of carcass(es) *(Required within 24 hours after killing a deer or bear)*:
Burial ☑ Personal Use ☑ Charitable Organization ☑ Other ___

The undersigned landowner/lessee agrees to the conditions of this permit and understands that failure to comply with these conditions may lead to its revocation or criminal prosecution. PWO, CDR Rockwell

Signature of Landowner or Lessee: _____ 13 Dec 16 (Date)

Signature of Department Representative: _____ 12/21/16 (Date)

1. Describe the type of damage or hazard: Airstrike Nuisance / Diseased Animals	Description and/or map of control area: * NAS Oceana Airfield NASO Dam Neck Annex NALF Fentress
2. Area type: Commercial/Agricultural ☑ Urban ☑	Antlered Deer, Turkey Oppussom, Fox, Hog Bobcat, Coyote Sunday Killing / Trapping
3. Type of crop/fruit trees/livestock/other:	Approved
4. Total acres in property/parcel:	
5. Total acres of damage within property/parcel:	
6. Total acres of crop/orchard:	
7. Total animals killed under previous permit:	
8. Total number of animals killed under this permit:	
9. Complete if this permit was for deer:	
Antlered Bucks	
Button Bucks	
Does	
10. DCAP Yes ☐ No ☑	

Copies: Sergeant-Final Report, Green-Issuing Game Warden, Yellow-Lieutenant, Pink-Deer Program, Gold-Landowner/Permittee

WILD-4 (5/14)

§ 29.1-529. Killing of deer, elk or bear damaging fruit trees, crops, livestock, or personal property; wildlife creating a hazard to aircraft or motor vehicles.

A. Whenever deer, elk or bear are damaging fruit trees, crops, livestock or personal property utilized for commercial agricultural production in the Commonwealth, the owner or lessee of the lands on which such damage is done shall immediately report the damage to the Director or his designee for investigation. If after investigation the Director or his designee finds that deer or bear are responsible for the damage, he shall authorize in writing the owner, lessee or any other person designated by the Director or his designee to kill such deer or bear when they are found upon the land upon which the damages occurred. However, the Director or his designee shall have the option of authorizing non-lethal control measures rather than authorizing the killing of elk or bear, provided that such measures occur within a reasonable period of time; and whenever deer cause damage on parcels of land of five acres or less, except when such acreage is used for commercial agricultural production, the Director or his designee shall have discretion as to whether to issue a written authorization to kill the deer. The Director or his designee may limit such authorization by specifying in writing the number of animals to be killed and duration for which the authorization is effective and may in proximity to residential areas and under other appropriate circumstances limit or prohibit the authorization between 11:00 p.m. and one-half hour before sunrise of the following day. The Director or his designee issuing these authorizations shall specify in writing that only antlerless deer shall be killed, unless the Director or his designee determines that there is clear and convincing evidence that the damage was done by deer with antlers. Any owner or lessee of land who has been issued a written authorization shall not be issued an authorization in subsequent years unless he can demonstrate to the satisfaction of the Director or his designee that during the period following the prior authorization, the owner or his designee has hunted bear or deer on the land for which he received a previous authorization.

B. Subject to the provisions of subsection A, the Director or his designee may issue a written authorization to kill deer causing damages to residential plants, whether ornamental, noncommercial agricultural, or other types of residential plants. The Director may charge a fee not to exceed actual costs. The holder of this written authorization shall be subject to local ordinances, including those regulating the discharge of firearms.

C. Whenever wildlife is creating a hazard to the operation of any aircraft or to the facilities connected with the operation of aircraft, the person or persons responsible for the safe operation of the aircraft or facilities shall report such fact to the Director or his designee for investigation. If after investigation the Director or his designee finds that wildlife is creating a hazard, he shall authorize such person or persons or their representative to kill wildlife when the wildlife is found to be creating such a hazard. As used in this subsection, the term"wildlife" shall not include any federally protected species.

D. Whenever deer are creating a hazard to the operation of motor vehicle traffic within the corporate limits of any city or town, the operator of a motor vehicle or chief law-enforcement officer of the city or town may report such fact to the Director or his designee for investigation. If after investigation the Director or his designee finds that deer are creating a hazard within such city or town, he may authorize responsible persons, or their representatives, to kill the deer when they are found to be creating such a hazard.

E. Whenever deer are damaging property in a locality in which deer herd population reduction has been recommended in the current Deer Management Plan adopted by the Board, the owner or lessee of the lands on which such damage is being done may report such damage to the Director or his designee for investigation. If after investigation the Director or his designee finds that deer are responsible for the damages, he may authorize in writing the owner, lessee or any other person designated by the Director or his designee to kill such deer when they are found upon the land upon which the damages occurred. The Director or his designee also may limit such authorization by specifying in writing the number of animals to be killed and the period of time for which the authorization is effective. The requirement in subsection A of this section, that an owner or lessee of land demonstrate that during the period following the prior authorization deer or bear have been hunted on his land, shall not apply to any locality that conducts a deer population control program authorized by the Department.

F. The Director or his designee may revoke or refuse to reissue any authorization granted under this section when it has been shown by a preponderance of the evidence that an abuse of the authorization has occurred. Such evidence may include a complaint filed by any person with the Department alleging that an abuse of the written authorization has occurred. Any person aggrieved by the issuance, denial or revocation of a written authorization can appeal the decision to the Department of Game and Inland Fisheries. Any person convicted of violating any provision of the hunting and trapping laws and regulations shall be entitled to receive written authorization to kill deer or bear. However, such person shall not (i) be designated as a shooter nor (ii) carry out the authorized activity for a person who has received such written authorization for a period of at least two years and up to five years following his most recent conviction for violating any provisions of the hunting and trapping laws and regulations. In determining the appropriate length of the restriction, the Director shall take into account the nature and severity of the most recent violation and of any past violations of the hunting and trapping laws and regulations by the applicant. No person shall be designated as a shooter under this section during a period when such person's hunting license or privileges to hunt have been suspended or revoked.

G. The Director or his designee may authorize, subject to the provisions of this section, the killing of deer over bait within the political boundaries of any city or town, or any county with a special late antlerless season, in the Commonwealth when requested by a certified letter from the governing body of such locality.

H. The parts of any deer or bear killed pursuant to this section or wildlife killed pursuant to subsection C shall not be used for the purposes of taxidermy, mounts, or any public display unless authorized by the Director or his designee. However, the meat of any such animal may be used for human consumption. The carcass and any unused meat of any such animal shall be disposed of within 24 hours of being killed. Any person who violates any provision of this subsection is guilty of a Class 3 misdemeanor.

I. It is unlawful to willfully and intentionally impede any person who is engaged in the lawful killing of a bear or deer pursuant to written authorization issued under this section. Any person convicted of a violation of this subsection is guilty of a Class 3 misdemeanor.

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Enclosure 5. USFWS Eagle Depredation Permit

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE

FEDERAL FISH AND WILDLIFE PERMIT

2 AUTHORITY-STATUTES
16 USC 668a

REGULATIONS
50 CFR Part 13
50 CFR 22.23

1 PERMITTEE

US NAVY
dba NAVAL AIR STATION OCEANA
NAVFAC MIDLANT NORTHEAST IPT ATTN: EMMETT CARAWAN
BLDG Z-144 VIRGINIA AVE, 2ND FLOOR, ROOM 214
NORFOLK, VA 23511
U.S.A.

3 NUMBER
MB65239A-0

4. RENEWABLE ☒ YES ☐ NO

5 MAY COPY ☒ YES ☐ NO

6. EFFECTIVE
03/21/2012

7 EXPIRES
12/30/2016

8 NAME AND TITLE OF PRINCIPAL OFFICER *(If 1 is a business)*
EMMETT W. CARAWAN
NATURAL RESOURCES MANAGER

9 TYPE OF PERMIT
EAGLE DEPREDATION

10 LOCATION WHERE AUTHORIZED ACTIVITY MAY BE CONDUCTED
Naval Air Station Oceana Property, Virginia Beach, VA

11 CONDITIONS AND AUTHORIZATIONS

A GENERAL CONDITIONS SET OUT IN SUBPART D OF 50 CFR 13, AND SPECIFIC CONDITIONS CONTAINED IN FEDERAL REGULATIONS CITED IN BLOCK #2 ABOVE, ARE HEREBY MADE A PART OF THIS PERMIT. ALL ACTIVITIES AUTHORIZED HEREIN MUST BE CARRIED OUT IN ACCORD WITH AND FOR THE PURPOSES DESCRIBED IN THE APPLICATION SUBMITTED. CONTINUED VALIDITY, OR RENEWAL, OF THIS PERMIT IS SUBJECT TO COMPLETE AND TIMELY COMPLIANCE WITH ALL APPLICABLE CONDITIONS, INCLUDING THE FILING OF ALL REQUIRED INFORMATION AND REPORTS

B. THE VALIDITY OF THIS PERMIT IS ALSO CONDITIONED UPON STRICT OBSERVANCE OF ALL APPLICABLE FOREIGN, STATE, LOCAL, TRIBAL, OR OTHER FEDERAL LAW

C. VALID FOR USE BY PERMITTEE NAMED ABOVE

D. You are authorized to use non-lethal scare devices, scare tactics or frightening devices to move or disperse **Bald eagles** endangering human safety due to a high risk of a serious bird strike to landing and departing aircraft. You are authorized to use airhorns, pyrotechnics, and drive vehicles with horns as necessary to scare eagles. Pyrotechnics must not be shot directly at the eagles.

E. You must make a continuous effort to eliminate attractants and other physical properties that may draw eagles to airport property.

F. This permit does not authorize the killing, injury or capture of any eagle or the destruction of any young or nests.

G. This permit does not authorize the disturbance of eagles at active nest sites that contain eggs or young or nests.

H. You must notify the permit issuing office at telephone 413-253-8643 within 48 hours of any injury or death of any eagle during project activities.

I. The following subpermittees are authorized: Naval Air Station Oceana flight safety personnel or environmental staff and *employees of USDA/APHIS/Wildlife Services*. In addition, any other person who is (1) employed by or under contract to you for the activities specified in this permit, or (2) otherwise designated a subpermittee by you in writing, may exercise the authority of this permit.

J. You must submit a report of activities conducted under this permit to the USFWS, Migratory Bird Permit Office, P.O. Box 779, Hadley, MA, 01035, by the due date specified on the face of the permit. The report form, 3-202-11, is available at: http://www.fws.gov/forms/3-202-11.pdf.

K. You must comply with the attached Standard Conditions for Eagle Depredation Permits. **These standard conditions are a continuation of your permit conditions *and must remain with your permit.***

For suspected illegal activity, immediately contact USFWS Law Enforcement at: Richmond, VA/DC 804-771-2883

☒ ADDITIONAL CONDITIONS AND AUTHORIZATIONS ALSO APPLY

12 REPORTING REQUIREMENTS

ANNUAL REPORT DUE 1/31, PER STANDARD CONDITION (J) OF THIS PERMIT
USFWS Forms can be found at: <http://www.fws.gov/migratorybirds/mbpermits.html>

ISSUED BY	TITLE	DATE
	CHIEF, MIGRATORY BIRD PERMIT OFFICE - REGION 5	03/21/2012

Standard Conditions
Eagle Depredation Permits
50 CFR 22.23

All of the provisions and conditions of the governing regulations at 50 CFR part 13 and 50 CFR part 22.23 are conditions of your permit. Failure to comply with the conditions of your permit could be cause for suspension of the permit. The standard conditions below are a continuation of your permit conditions and must remain with your permit. If you have questions regarding these conditions, refer to the regulations or, if necessary, contact your migratory bird permit issuing office. For copies of the regulations and forms, or to obtain contact information for your issuing office, visit: http://www.fws.gov/migratorybirds/mbpermits.html.

1. Unless otherwise specified on the face of this permit, you may not lethally take any bald eagle or golden eagle under this permit. Eagles may be taken only by the method(s) specified on the face of your permit. [*Note: Explosive Pest Control Devices (EPCDs) are regulated by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). If you plan to use EPCDs, you require a Federal explosives permit, unless you are exempt under 27 CFR 555.141. Information and contacts may be found at* www.atf.gov/explosives/how-to/become-an-fel.htm.]

2. If you encounter an eagle with a Federal band issued by the U.S. Geological Survey Bird Banding Laboratory, Laurel, MD, report the band number to 1-800-327-BAND (2263) or http://www.reportband.gov.

3. This permit does not authorize take or release of any bald eagle or golden eagle on Federal lands without additional prior written authorization from the applicable Federal agency, or on State lands or other public or private property without prior written permission or permits from the landowner or custodian.

4. Unless otherwise specified on the face of the permit, any bald eagle or golden eagle taken under this permit must be promptly turned over to a U.S. Fish and Wildlife Service (Service) agent or other wildlife law enforcement officer designated on the face of the permit.

5. Any person exercising the authorities of this permit must carry a legible copy of this permit, *including these Standard Conditions*, and display it upon request to any State or Federal officer when exercising its authority.

6. You must maintain records as required in 50 CFR 13.46. All records relating to the permitted activities must be kept at the location indicated in writing by you to the migratory bird permit issuing office.

7. Acceptance of this permit authorizes the Service to inspect any wildlife held, and to audit or copy any permits, books, or records required to be kept by the permit and governing regulations.

8. You may not conduct the activities authorized by this permit if doing so would violate the laws of the applicable State, county, municipal or tribal government or any other applicable law.

Enclosure 6. Commander, Navy Region Mid-Atlantic Instruction (COMNAVREG MIDLANT INST) 11015.3 (Natural Resources Management for Fish and Wildlife, Feral Animals, Invasive Species, and Certain Pests)

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DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION, MID-ATLANTIC
6506 HAMPTON BLVD.
NORFOLK, VA 23508-1273

IN REPLY REFER TO:
COMNAVREG MIDLANT
INST 11015.3
REG ENG/Code 90
12 MAR 2003

COMNAVREG MIDLANT INSTRUCTION 11015.3

Subj: NATURAL RESOURCES MANAGEMENT FOR FISH AND WILDLIFE, FERAL ANIMALS, INVASIVE SPECIES, AND CERTAIN PESTS

Ref: (a) E.O. 13112
(b) NAVFAC P-73, Vol. II
(c) OPNAVINST 5090.1 (Series)
(d) 18 U.S. Code § 42
(e) 16 U.S. Code §§ 703-704
(f) 16 U.S. Code §§ 668-668c
(g) 16 U.S. Code § 1361, *et seq.*
(h) 50 C.F.R. pt. 10
(i) 50 C.F.R. pt. 21
(j) SECNAVINST 6401.1 (Series)
(k) NASOCEANAINST 3750.2 (Series)

1. Purpose. To prescribe procedures and assign responsibility for management and control of fish and wildlife, feral animals, invasive species, and certain pests within Commander, Navy Region, Mid-Atlantic (COMNAVREG MIDLANT) Area of Responsibility (AOR). This includes the areas of Naval Weapons Station (WPNSTA), Yorktown (including Cheatham Annex); Naval Air Station (NAS), Oceana (including Naval Auxiliary Landing Field [NALF] Fentress, Camp Pendleton, and Dam Neck Annex); Naval Station (NAVSTA), Norfolk (including St. Julien's Creek Annex and St. Helena Annex); Naval Support Activity (NAVSUPPACT), Norfolk (including Northwest Annex); Naval Amphibious Base (NAVPHIBASE), Little Creek; Fleet and Industrial Supply Center (FISC), Norfolk (Craney Island Fuel Depot and Yorktown Fuel Terminal); and Norfolk Naval Shipyard (NAVSHIPYD Norfolk), Portsmouth, VA (only New Gosport Annex, Scott Center Annex, and South Gate Annex).

2. Policy

a. Per references (a) through (c), the Navy is authorized to take measures to control invasive species.

b. References (d) through (g), the Lacey, Migratory Bird Treaty, Eagle Protection, and Marine Mammal Protection Acts, respectively, protect designated wildlife and control activity involving protected wildlife parts. Violations of these statutes may result in criminal prosecution. Regulations contained in references (h) and (i) implement reference (e) and list species protected by Federal law. Reference (j) describes government responsibility for preventing injury and diseases from animals.

3. Definitions

a. Per reference (a), an "invasive species" is a species that is non-native (or alien to the ecosystem under consideration), and whose introduction causes, or is likely to cause harm to economic, environmental, or human health.

b. Per reference (e), "take" means to pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect.

c. Per reference (c), "pest" refers to any organism (except for microorganisms that cause human or animal diseases) that adversely affects the well-being of humans or animals, attacks real property, supplies, equipment or vegetation, or is otherwise undesirable.

d. Per reference (j), "feral" refers to wild animals and unowned dogs, cats, or other domestic animals.

4. Responsibilities

a. Regional Engineer. The Commanding Officer, Navy Public Works Center/Regional Engineer (PWC/RE), Norfolk, as the Regional Environmental Program Manager, is responsible for management and control of, and for providing services pertaining to, fish and wildlife, feral animals, invasive species, and pests. On behalf of COMNAVREG MIDLANT, the Regional Engineer obtains natural resources permits required by Federal law to carry out this program. Regional Engineer authority, in natural resources matters, may be sub-delegated to a properly trained Regional Natural Resources Program Manager, under the supervision of the Regional Environmental Group Head.

(1) Environmental Services Desk. The PWC/RE Environmental Group provides pest management services through the Environmental Services Department. In addition, the Environmental Services Department responds to routine service calls for removal of non-migratory birds and control of feral animals. These services may be requested through the Environmental Services Desk at (757) 444-7528 during working hours and (757) 444-3477 after hours. Requests for services involving animals, such as sea turtles, marine mammals, game animals and migratory birds or raptors, not under the purview of the Environmental Services Department, will be referred by Service Desk personnel to Natural Resources Managers.

(2) Natural Resources Specialists. Under the direction of the Regional Natural Resources Program Manager, installation Natural Resource Specialists use integrated management practices and procedures to manage fish and wildlife and control certain feral, nuisance and invasive species. Per reference (k), Natural Resources personnel also develop and execute depredation and

dispersal procedures for Bird Animal/Aircraft Strike Hazard (BASH) purposes, and personally supervise these activities when lethal methods are required. Natural Resources Managers, and all other PWC/RE personnel involved in lethal control activities, must be properly trained and duly certified for all weapons employed in accordance with applicable regulations. These personnel are located in Storefront Compliance Departments of the Regional Environmental Group. Natural Resources personnel will also identify bird and/or other animal remains associated with aircraft mishaps in accordance with reference (k).

(3) Conservation Officers. Under the direction of Natural Resources Managers, Conservation Officers enforce fish and wildlife and other natural resources laws and regulations. They may conduct field inspections and employ approved control methods for certain species. Control measures include, but are not limited to, live trapping, relocation, and lethal methods. Conservation Officers also perform wildlife forensic investigations and respond to wildlife damage complaints.

(4) Regional Natural Resources Managers. Regional natural resources managers shall:

(a) Provide direction to natural resources managers and game wardens regarding the management of fish and wildlife and the control of feral animals, invasive species, and pests.

(b) Ensure appropriate approval and procedures are in place to properly issue, store, carry, and use firearms.

(c) Ensure the natural resource manager and game warden weapons qualifications cards are certified and remain current.

(d) Coordinate with local and regional security for required range time, qualifications, and DoD training as needed.

b. NAVSHIPYD Norfolk. Pest control services for NAVSHIPYD Norfolk are currently provided through government contract; these services may be requested through LANTNAVFACENGCOM at (757) 396-5121, extension 200.

c. Security Officers. Security Officers respond to emergency wildlife complaints and requests for services. Security Officers are an after-hours emergency contact point for Natural Resources Managers, Conservation Officers, and pest management personnel. Within existing resources and according to established training priorities, Security Officers also assist Natural Resources personnel in obtaining required weapons qualifications.

d. Airfield Facilities Division Officer. All bird/animal strikes should be investigated and reported in accordance with reference (k). Animal remains will be collected by the Airfield Facilities Division Officer and placed in appropriate BASH freezers located in Building 102 at NAS Oceana and LP-167 at Chambers Field, NAVSTA Norfolk.

e. Aviation Squadrons. All bird strikes must be reported in accordance with reference (k). Airfield Facilities or Natural Resources should be immediately contacted following any strike to ensure bird/animal remains are collected and identified.

5. Review. The Regional Natural Resources Program Manager is responsible for review and update of this instruction.

G. E. EICHERT
Chief of Staff

Distribution: www.cnrma.navy.mil

Enclosure 7. Chief of Naval Operations (CNO) Policy Letter on Feral Cats and Dogs

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DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, D.C. 20350-2000

IN REPLY REFER TO

5090
Ser N456M/1U595820
10 JAN 2002

From: Chief of Naval Operations

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULATIONS ON NAVY PROPERTY

Ref: (a) SECNAVINST 6401-1A, of 16 Aug 94, Veterinary Health Services
(b) AFPMB TIM #37, Guidelines for Reducing Feral/Stray Cat Populations on Military Installations in the United States
(c) OPNAVINST 6250.4B, dtd 27 Aug. 1998, Pest Management Programs
(d) Executive Order 13112 of 3 Feb 1999, Invasive Species

1. This letter clarifies the application of reference (a) regarding the prevention of free roaming (also called wild, feral or stray) cat and dog populations on Navy installations. The objective is to prevent injury or disease to Navy personnel, and eliminate adverse impacts on native wildlife. It requires Navy commands to institute pro-active pet management procedures in order to prevent establishment of free roaming cat and dog populations. Free roaming cats and dogs pose a potential public health threat to personnel on Navy installations, and they pose a threat to wildlife including endangered species and migratory birds.

2. Existing policy at Paragraph 4-2c(4) of reference (a) states "Dogs, cats, and other privately-owned or stray animals will not be permitted to run at large on military reservations." Consistent with this policy, Navy commands must ensure the humane capture and removal of free roaming cats and dogs. Consistent with this requirement, Trap/Neuter/Release (TNR) programs will no longer be established on Navy land. All existing TNR programs on Navy land must be terminated no later than 1 January 2003.

3. Responsible pet ownership is a key factor in eliminating free roaming cat and dog populations. In consultation with supporting Army Veterinary Office, installations shall implement appropriate pet management measures to preclude establishment

of feral cat/dog populations, including, but not limited to the following:

Require installation residents to keep and feed pet animals indoors or under close supervision when outdoors (such as on leash and collar or other physical control device - cage, fenced yard etc.).

Encourage neutering or spaying of cats and dogs before they reach reproductive age (exceptions to this policy can be made on a case by case basis as determined by the Installation Commander).

Require routine vaccinations of cats and dogs for rabies and other diseases as required by federal, state and local laws and ordnances. A current vaccination record is required at time of registration of pets.

Require microchipping registration (or other system of pet identification approved by supporting veterinary office) of all pet cats and dogs brought onto installations. Installation residents must register cats and dogs and have pets wear registration or identification tags at all times.

Prohibit the feeding of feral animals on the installation.

Provide educational materials to pet owners regarding installation regulations and general pet management.

Enforce prohibition of abandonment of animals on installations.

Comply with all humane and animal control regulations at the federal, state and local level (and their equivalents in host nation countries).

Navy installations in Europe that do not have a supporting veterinary office contact 100th Medical Detachment (VA HQ) (011) 49-622-177-2868; for all other locations that do not have a supporting veterinary office the POC is the VETCOM HQ, Commander (210) 221-6522.

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULATIONS ON NAVY PROPERTY

4. Effective prevention, management and elimination of feral cat and dog populations requires close coordination and cooperation between natural resources, pest management, security, veterinary, and housing personnel to develop and implement an effective and humane program. Reference (b) provides information for preventing free roaming cat populations on military installations. General pest management guidelines are detailed in reference (c). Every effort should be made to work with other federal, state and local agencies to support reference (a) and reference (d) by eliminating free roaming cat and dog populations on Navy land. Navy commands should work with local animal control agencies to determine the best approach for the ultimate disposition of the captured animals. Every effort should be made, if practical, to find homes for adoptable feral cats and dogs.

5. My point of contact on this issue is Mr. Joe Cook, CNO N456M, at (703) 602-5335, or DSN 332-5335.

WILLIAM G. MATTHEIS
Deputy Director, Environmental Protection, Safety and Occupational Health Division

Distribution:
CINCLANTFLT (N465)
CINCPACFLT (N465)
COMNAVRESFOR (01E, N46)
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Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULTIONS ON NAVY PROPERTY

Distribution:
CHBUMED (NEHC-EPWR)
DIRSSP (SP20161)
ONI (411)

Copy to:
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OAGC (I&E)
CNO, N44, N46, 09BF
CMC, LFL
COMNAVREG MIDLANT
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COMNAVREG SW
COMNAVREG PEARL HARBOR
COMNAVMARIANAS
COMNAVREG NW
CNFJ
CNFK
PACNAVFACENGCOM PEARL HARBOR HI (CODE 23)
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SOUTHWESTNAVFACENGCOM SAN DIEGO CA (CODE 03EN)
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CO PWC GREAT LAKES
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CO PWC PEARL HARBOR
CO PWC PENSACOLA
CO PWC SAN DIEGO
CO PWC SAN FRANSICO BAY
CO PWC WASHINGTON DC
CO PWC YOKOSUKA
CO CBC PORT HUENEME
CO CBC GULFPORT
OESO
MESO
DODVSA/OTSG (Chief Animal Medicine)

Enclosure 8. Naval Air Station Oceana, Naval Auxiliary Landing Field Fentress, and Naval Air Station Oceana Dam Neck Annex Prescribed Burn and Smoke Management Plan (2010)

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ON HOLD PENDING UPDATED LAND CONDITION ANALYSIS IS FINALIZED and BURN AREAS ADJUSTED ACCORDINGLY.

NAVAL AIR STATION OCEANA

NAVAL AUXILIARY LANDING FIELD FENTRESS

NASO DAM NECK ANNEX

PRESCRIBED BURN AND SMOKE MANAGEMENT PLAN

Prepared by: _____ Date: _____
Natural Resources Manager, NAVFAC MidLant PWD Oceana, Environmental
(757) 433-3461

Reviewed by: _____ Date: _____
Regional Natural Resources Manager, NAVFAC MidLant
(757) 341-0495

Reviewed by: _____ Date: _____
Environmental Division Director, NAVFAC MidLant PWD Oceana, Environmental
(757) 433-3437

Reviewed by: _____ Date: _____
Public Works Officer, PWD Oceana
(757) 433-3321

Approved by: _____ Date: _____
Commanding Officer, NAS Oceana
(757) 433-2922

Distribution:
Executive Officer, NAS Oceana
OIC, NALF Fentress
Fire and Emergency Services, CNRMA
Security Department, NAS Oceana
Air Operations, NAS Oceana
Base Operations, NAS Oceana
Safety Department, CNRMA/NAS Oceana
VDOF Local Forester

Please sign below by respective department listing indicating you have reviewed this plan. Please review within one week of the date annotated by the Natural Resources Specialist line on the cover sheet of this plan.

Distribution:

Executive Officer, NAS Oceana:

_____

OIC, NALF Fentress:

_____

Fire and Emergency Services, CNRMA:

_____

Security Department, NAS Oceana:

_____

Safety Department, CNRMA/NASO:

_____

Air Operations, NAS Oceana:

_____

Base Operations, NAS Oceana:

_____

Local Forester, VDOF:

_____

Table of Contents

Plan developed in accordance with the 2009 Guidance for Implementation of Federal Wildland Fire Management Policy. Some verbiage in this document is taken directly from this guidance document.

DEFINITION: Wildland fire is a general term describing any non-structure fire that occurs in the wildland. There are two categories of wildland fire: wildfire and prescribed fire. Wildfire includes unplanned fire ignitions or prescribed fires that are declared wildfires (fires outside of planned management prescriptions). Prescribed fire ignitions are planned. Prescribed, or controlled, burning is defined as skillfully applying fire to forest and grassland fuels, in a definite place, for a specific purpose, and under exacting conditions to achieve management objectives.

BURN TECHNIQUES: For the purposes of this plan, all burning will be accomplished utilizing a combination of strip-head fire and backing fire techniques as appropriate.

PURPOSE/JUSTIFICATION: The main objectives of controlled burning are to reduce forest fuel (i.e. pine needles, fallen wood, leaves, etc.) accumulations and thick understory, improve wildlife habitat, reduce potential for an uncontrollable fire, and to maintain vegetation in compliance with security and runway requirements. Prescribed burning may be used also as a form of site preparation for planting.

Objective 1: Implement hazard reduction prescribed burning within areas that are designated in accordance with national fire management parameters.
Rational for Objective: Hazard reduction prescribed burning reduces the amounts of fuels in the forest. This would reduce the probability of major fires of long duration, which are difficult and expensive to suppress, as well as pose a greater threat to human health and private & government properties.
Strategies:
• Implement hazard reduction burns within designated areas.
• Participate in wildland urban interface programs that support reduction of fuel accumulations and development of fire breaks where off-base development and smoke-sensitive locations are threatened by base wildfires.

Objective 2: Implement sustainable ecosystem based habitat management prescribed burning within areas that are designated in accordance with national fire management parameters.
Rational for Objective: Hazard reduction and ecological enhancement prescribed burning alters the vegetation structure to either reduce or enhance wildlife and plant species as dictated by the installation's Integrated Natural Resources Management Plan (INRMP). Objective would support such INRMP programmatic areas as invasive species control, ecological restoration, bird/animal aircraft strike hazard species control, protected species management, etc.
Strategies:
• Implement hazard wildlife habitat reduction burns within designated areas.
• Implement restoration/enhancement burns within designated areas.

TIME FRAME/SEASON: Virginia State Code 10.1-1142-B designates the period from February 15 to April 30 as fire season. Due to other Navy directives the Navy cool season burning dates run from 01 Feb to 15 April. The general public is prohibited from any burning before 1600 hours. Federal facilities are exempt from state law due to exclusive jurisdiction, but should comply with the intent of the law. Although NAS Oceana may at some point need to perform a growing season burn for specific management purposes, every effort will be made to burn during the cool season.

The Bases will follow Virginia sanctioned burn bans. Exceptions can be made upon approval by the Bases' Commanding Officer (CO). The CO may re-instate burning privileges under the federal lands exclusive jurisdiction.

Air quality issues in the Hampton Roads area, as in most urban areas, are most often felt during the summer months, which are characterized by hot, humid weather, and the accompanying stagnant air mass. These conditions are typically unfavorable for prescribed burning. The environmental conditions make burning difficult, the desired effects of prescribed fire treatments are harder to achieve, and smoke management parameters, which are a key component of prescribed fire burn planning, generally prohibit burning during these times of year (2006 USFWS GDSNWR).

PLAN APPROVAL: This plan is part of the Integrated Natural Resources Management Plan (INRMP). Upon signature of this plan it will be adopted into the INRMP as an approved plan and no further signatory approvals will be required beyond the signatures on the INRMP. In the event that there are major changes specific to the Fire Plan and not to the INRMP in general, the fire plan will be revised and new signatures will be required on the plan before updating the INRMP with the revision.

NEPA REVIEW: As the Prescribed Burn and Smoke Management Plan Units were reviewed under the INRMP's associated Environmental Assessment (EA), no additional NEPA review is required. In the event that new burn areas are added to the Burn Plan additional NEPA review will be required prior to Plan approval and inclusion in the INRMP.

Restrictions on when and how to burn are tied to multiple variables to include but are not limited to: military mission requirements; National Environmental Policy Act (NEPA); Threatened and Endangered Species (T&E) considerations; Migratory Bird Treaty Act (MBTA); water quality and impacts on riparian areas; administrative constraints imposed by Congress (e.g., roadless and wilderness area designations); impacts on archeological resources; smoke management program requirements; and other state or federal environmental or forestry regulations.

SMOKE MANAGEMENT PLAN: Each Burn Area will specify required conditions upon which burning may take place to minimize impacts to identified downwind sensitive smoke receptors (Appendix D). These sensitive targets include hospitals, nursing homes; interstate or other major

high-speed highways, runways, and heavily populated areas. Target areas around NAS Oceana include Interstate 264 to the North, and heavily populated areas to the west and north of the installation. Target areas on NAS Oceana include the airfield, Tomcat Boulevard and Hornet Drive, the Branch Medical Facility and the Married Officers Quarters (MOQ) and Bachelors Officers Quarters (BOQ). Sensitive areas around and on board NALF Fentress include Mount Pleasant Road, Fentress Airfield Road, and the Operations building 100. Areas surrounding and on board Dam Neck Annex that are considered smoke sensitive include Dam Neck Road, the Medical Dental Facility, the MOQ and Combined Bachelors Quarters, the Navy Lodge, and densely populated areas to the south (Sandbridge) and to the west including Ocean Lakes Elementary School.

Each burn area plan includes the following details:

- Reason for burn.
- Required weather conditions including direction and speed of surface and transport winds.
- Required mixing height.

Preferred wind direction will be indicated in the description of the burn areas and in Appendix D. Weather conditions will be checked for appropriate burning conditions commencing 24 hours prior until the onset of burning. Given that general weather conditions are appropriate for burning, the areas to be burned each day will be decided upon based on wind direction and any air operations restrictions. Air operations restrictions are determined by contacting the Air Operations Officer. Additionally, the following burn area descriptions contain a priority listing of High, Med. or Low to be used in the decision making process on the day of a burn. Although these areas have been prioritized, weather and site conditions may direct prescribed burning to lower priority areas. Note that certain low priority areas may be burned in advance of higher priority areas to provide crew training, to test communication procedures and test equipment. Some of these areas are smaller than high priority burn areas and are located in accessible and secure locations.

The size of the designated burn areas has been kept relatively small to help reduce emission generation during a given burn event.

DESCRIPTION OF BURN AREAS:

Burn Areas are listed in order of burn priority for the year (the first burn area listed is the #1 priority burn for the year, the second listed is the #2 priority burn for the year, etc.). Burn priority rankings were established through coordination with Base Ops, Planning, and Natural Resources.

Acreages and mapped areas for burn units have been updated, as such some information may differ from what was reported in past burn plans.

Locations of proposed burn areas are shown in Appendices A and B. A consolidated burn prescription chart is located in Appendix D. A burn history chart is provided in Appendix K. Future plans for the prescribed burning program are located in Appendix I.

NAS Oceana:

Burn Area 4-7 is a 54.14 acre parcel located in hunting areas 4 through 7 (Appendices A, B, and C). This site is recommended for burning to: facilitate control of *Phragmites* and 3 acres of Warm Season Grasses (WSG); to maintain vegetation in compliance with airfield height restrictions; and to reduce BASH. The burn area is located 400 feet west of NAS Oceana runway 5R and 1000 feet south of 5L. The burn areas are bounded: on the north/northeast and east/southeast by mowed airfield clearzone; on the south/southwest by a maintained bulldozed firebreak; and on the west by a ditch with agricultural fields as secondary containment (Appendices A, B, and C). Close coordination with NAS Oceana Air Operations will prevent impedance to aircraft using adjacent runways. Annual burning will facilitate compliance with airfield vegetation height requirements and reduce BASH potential. This area was burned in 2006 and again in January 2007. Weather conditions and staff availability prevented burning from occurring in 2008. Burning can proceed with wind direction between 270° to 30° and a mixing height of 1,640 feet. (Priority: High)

Burn Area 47 is a 22.01 acre site consisting of early successional woods and WSG plots (Appendices A, B, and C). Boulevard. The area is located between the NAS Oceana skeet range and the MWR long-term storage area, approximately 1600 feet south and west of the intersection of Potters Road and Mitcher Blvd. Active or abandoned concrete roads and the runway clearzone define most boundaries and act as firebreaks. A ditch along the NE boundary acts as a secondary firebreak. The site was drumchopped in 1997 to meet airfield clearzone height restrictions and receives periodic burn or mowing treatments to maintain it. Burning will economically prepare the site for development of a wildlife management area, maintain airfield vegetation height requirements and remove undesirable pioneer plant species. In 1998, 10 acres of native warm season grasses (WSG) were planted and added to this parcel for burning. This area is located on the fringe of the airfield clearzone by runway 14L. The warm season grass portion of this area was last burned in 2006. In 2008 the MWR skeet range installed a new fence which altered the boundary of this parcel reducing the acreage from 51.80 acres to the current 22.01 acres. Burning can proceed with wind direction between 300° to 30° and a mixing height of 1,640 feet. (Priority: High)

Burn Area 41/41A is a 21.94/4.03 acre site, respectively, and consists of hunting area 41, a portion of the airfield clearzone planted in WSG in 1998, and an adjacent field to the northeast (Appendices A, B, and C). The area is located 1800 feet west of Oceana Boulevard and 400 feet northeast of the approach end of Runway 32R. Burning will facilitate compliance with airfield vegetation height requirements and maintenance of portions of the area in an early successional stage. The adjacent field east of the ditch (area 41A) was added this year in an attempt to reduce deer bedding locations in close proximity to the runway. Area 41 is bounded: on the east and south

by a wide drainage ditch; on the north by paved road; and on the west by the mowed clearzone area. Either taxiway or agricultural fields act as secondary containment on the west, east and south sides of the burn area. Area 41A is bounded: on the west by a drainage ditch; on the southeast by agricultural fields; and on the northeast by a security fence mowed boundary. The south end of 41 (~8 acres) was successfully burned in 2008. As typical of "wildland" prescribed burning, the area burned in a patch-work manner (meaning some areas burned and others did not, with in the entire burn area). Burning can proceed with wind direction between 300° to 120° and a mixing height of 1,640 feet. (Priority: High)

Burn Area 53 is a 43.61 acre site located within hunting areas 52 and 53 and a portion of hunting area 54 (Appendices A, B, and C). Area 53 is an abandoned field approximately 1500 feet south of the approach end of NAS Oceana runway 5R. Area 54 contains *Phragmites* in the northwestern portion and will be burned for the control of this invasive species. Hunting area 53 contains grasses, early successional shrubs and/or small trees and has been partially burned annually from 1993 to 2007. Prescribed burning facilitates compliance with airfield vegetation height requirements and maintains the field in an early successional stage. The field is bounded: on the north/northeast by a paved road network; on the east by a combination of ditch and dirt road/plowed firebreak; on the south/southwest by a gravel road (former railroad track); and on the west by a mowed portion of the airfield clearzone. This area was burned in 2006. The northern end of this area was successfully burned in February of 2007. Burning can proceed with wind direction between 270° to 30° and a mixing height of 1,640 feet. (Priority: High)

Burn Area 9 is a 9.15 acre parcel adjacent to hunting area 9. It is located approximately 600 feet northwest of the approach end of Runway 5L (Appendices A, B, and C). The area was drumchopped in 1997 and 1998 to meet airfield height restrictions and a portion of the area was planted in WSG. It is recommended that this site be burned annually as routine maintenance. A successful burn was completed in January of 2007. The area is bounded: on the north, east, and west sides by a combination of mow and till firebreaks and ditches; and on the south by an agricultural field. Secondary containment on the east side includes the mowed airfield clearzone. This area was burned in 2006. Burning can proceed with wind direction between 270° to 30° and a mixing height of 1,640 feet. (Priority: High)

Burn Area 31 is a 2.24 acre plot on the southwest corner of hunting area 31 and southeast corner of hunting area 30(Appendices A, B, and C). This area is located in the airfield clearzone for runway 23R and was burned in 2006. This area is burned to maintain compliance with airfield vegetation height requirements. Firebreaks consist of the clearzone to the south and east and a maintained firebreak to the north and west. Burning can proceed with wind direction between 270° to 90° and a minimum mixing height of 1,640 feet. (Priority: High)

Burn Area 32 is a low-lying 1.65 acre plot of an invasive species called Tree of Heaven (Appendices A, B, and C). This site is being burned to maintain airfield vegetation height

requirements and control invasive species. Firebreaks consist of the clearzone to the north, south, and west, and the horse trail to the east. Burning can proceed with wind direction between 0° to 60° and a minimum mixing height of 1,640 feet. (Priority: High)

Burn Area 42 is 17.61 acre parcel located in hunting area 42 (Appendices A, B, and C). A 4.5 acre portion of this site was drumchopped in 1997. It is recommended that this area be burned annually for maintenance. The area is bounded: on the west and south by a combination of ditches, agricultural land, and mowed field; and on the north and east by mowed airfield clearzone. This area was burned in 2004. Burning can proceed with wind direction between 270° to 0° and a mixing height of 1,640 feet. (Priority: High)

Burn Area 11-21 is a 121.14 acre parcel located within the hunting area complex north of the fuel farm (Appendices A, B, and C). This area was timbered in 1998-99 and consists of nine hunting areas numbered 11-13 and 16-21. Burning can: facilitate establishment of a primarily pine forest community; benefit wildlife; reduce fuel load; and maintain a thin stand density for maintenance of line-of-sight and radio communications. The area is bounded: on the west by a paved road, 'Sludge Road'; on the east by a plowed (mow/till) line with the mowed airfield clearzone and and existing drainage ditch as a secondary containment; and on the north and south of each unit with plowed (mow/till) firebreaks. In 2004 hunt areas 14, 16 and 18 were burned. In 2005 hunting areas 12, 13, 19 and 20 were burned. In 2006 hunting areas 20, 19, 18, 17, 16, were burned. March 2007 area 11 was burned. During the 2007 burn complications/control issues were encountered and required additional assistance. Recognizing the high visibility of burning in the fuel farm area, the Navy Regional Fire and Emergency Services will provide backup during the initial burning of the most southern unit (area 21) until complete. After completion of this burn, this area will provide sufficient black line to ensure the security of the fuel farm area. Burning can proceed with wind direction between 180° and 270° or between 0° and 30° with a minimum mixing height of 1,640 feet to prevent smoke impacts to adjacent sensitive areas (London Bridge Road and the airfield). (Priority: Med.)

Burn Area 30 is a 3.32 acre site that has recently been fenced in as part of the skeet range/MWR facility area (Appendices A, B, and C). This area is not scheduled to be burned in 2009 and is under consideration for complete removal from the prescribed burn program.

Burn Area 33 is a 2.01 acre site located north of FACSFACVACAPES in hunting areas 33 and 35 (Appendices A, B, and C). It is on top of a 1995 restoration area and planted in WSGs and other small shrubs. Burning will maintain this site in a scrub/shrub habitat for wildlife improvements and reduced fuel load. The area is bounded: on the south and east by a hard packed dirt road; and on the north and west by a combination of ditches, trails, and plowed (mox & till) firebreaks. An initial burn occurred in 2001. The site was burned again in 2006. Burning can proceed with wind direction between 0° and 90° with a minimum mixing height of 1,640 feet to

prevent smoke impacts to adjacent sensitive areas (Oceana Boulevard and approach end of RW 23). (Priority: Low)

Burn Area OP is a 3.51-acre parcel immediately north of Oceana Pond (Appendices A, B, and C). The area consists mostly of old abandoned fields but in the past has been used as an unplanned dumpsite for wood debris. A 2008 USACE wetland survey has indicates that the majority of this area has converted to wetland habitat. A 2008 survey by installation staff regarding specific invasive species has indicated that phragmites has established on this site as well. Until a plan of action for controlling invasive species on site is established no burning will commence in this burn unit. This area was first burned in 2001. Once burning is allowed, burning can proceed with wind direction between 270° and 30° and a minimum mixing height of 1,640 feet. (Priority: Low)

NALF Fentress:

Burn Area 5/5A is a 21.51/40.32 acre site, respectively located at the south end of runway 5 in hunting area 5 (Appendices A, B, and C). This site was a 15-year old loblolly pine stand. Timber clearing of this area occurred in 2004 to meet airfield approach clearance requirements. This area has a dense understory of switchcane. Prescribed burning will: prevent re-invasion of hardwoods; reduce fuel loading; and improve habitat for several state listed rare animal species. Firebreaks consist of the airfield clearzone to the north, access roads on the east and west and a 30-foot bulldozed firebreak to the south. Pocaty Creek provides secondary containment to the south. Burning can proceed with wind direction between 300 degrees and 240 degrees with a minimum mixing height of 1640 feet. (Priority: Medium, Rotation: 3 years)

Burn Area B-6 is a 21.66 acre site located directly south of the TACAN in hunting area B-5 (Appendices A, B, and C). This site was cleared in 1998-99 for line-of-sight clearance from the TACAN to the runway. This area will be burned to maintain vegetation height requirements and to reduce fuel loading. Firebreaks consist of agricultural fields to the west, the clearzone and a drainage ditch to the east and plowed firebreaks, which will be installed prior to burning, to the north and south. Burning can proceed with wind direction between 60° and 230° with a minimum mixing height of 1,640 feet. (Priority: Med.)

Burn Area 21 is an 18.12 acre site located at the approach end of NALF Fentress runway 23 in hunting areas 20 and 21 (Appendices A, B, and C). Half of the area was cleared in 1995 as part of the airfield clearzone maintenance and a portion was cleared in 2003. The burn will maintain this area in compliance with clearzone requirements and provide wildlife benefits. Firebreaks will be established along the north, west, south and east ends of the burn area prior to burning. The runway clearzone also provides a firebreak along the south boundary. Burning can proceed with wind direction between 180° and 60° with a minimum mixing height of 1,640.
(Priority: High)

Burn Area 2 is a 57.12 acre parcel of loblolly pine located north of burn area 3 in hunting areas 2 and 1 (Appendices A, B, and C). Approximately 30 acres of this area received pre-commercial pine thinning in the spring of 1997 and a prescribed burn in 1998,1999, 2001, 2003, 2004, and 2006. The section of woods north of this area was cleared in 2004. Prescribed burning will prevent re-invasion of hardwoods in this stand and reduce the fuel loading in the remaining 20 acres. This area will be burned in two sections with a firebreak dividing the ~20 and ~30 acre plots. Firebreaks have been established on the north, northeast and south sides of this tract. Fentress Airfield Road will serve as a firebreak on the east and agricultural fields will provide a break on the west. Burning can proceed with wind direction between 30° and 180° with a minimum mixing height of 1,640 feet. (Priority: High)

Burn Area 3 is a 74.75 acre parcel of prior converted croplands located 3500 feet east of the approach end of NALF Fentress Runway 23 and approximately 800 feet north of Fentress Airfield Road in hunting areas 3 and 4 (Appendices A, B, and C). These fields contain grasses, early successional shrubs and near-mature pine and hardwood trees. This area will be burned for wildlife management and to alleviate competition to pine species. Drainage ditches bound the area to the south. Agricultural fields serve as firebreaks to the west and north. Plowed firebreaks and Fentress Airfield Road contain this area on the east. This area was burned in 2004. Burning can proceed with wind direction between 30° and 180° with a minimum mixing height of 1,640 feet. (Priority: Med.)

Burn Area 19 is a 22.93 acre parcel located east of burn area B-2 and inside the old taxiway in hunting area 19 (Appendices A, B, and C). Burning is prescribed to improve timber stand quality. The old taxiway will serve as the firebreak to the north, south, east and west. Burning can proceed with wind direction between 270° and 60° with a minimum mixing height of 1,640.
(Priority: Med.)

Burn Area B-2 is a 23.48 acre S-shaped timber stand of Loblolly Pine located east of Carter Rd. and south of Mt. Pleasant Rd. in hunting area B-2 (Appendices A, B, and C). Prescribed burning is being used to improve the quality of the timber, the appearance and wildlife habitat. Firebreaks include the tarmac to the east and agricultural fields to the north, south, and west. Burning can proceed with wind direction between 300° and 60° with a minimum mixing height of 1,640. (Priority: Low)

Dam Neck Annex:

Over several years DNA has not received the desired prescribed burning attention, due to weather conditions and staff availability issues. DNA burn areas need to be reassessed before burning is initiated, DNA will not undergo prescribed burning in 2009. Appropriate areas may

be mowed to maintain desired habitat structure. A general map of the past burn areas is located in Appendix A. For further information regarding any of these sites please contact the installation Natural Resources Manager.

RESPONSIBILITIES:

Training requirements for individuals involved with the prescribed burning program are located in Appendices G & H.

NAVFAC MidLant Regional Natural Resources Managers:

1. Act as or designate an appropriately trained person to act as burn boss and conduct the safety brief for any given burn.
2. Supervise burning procedures on the day of the burn (acting burn boss).
3. Release burn crew from burn site after mop-up (acting burn boss).
4. Review the burn plan.
5. Provide technical assistance.

NAS Oceana Natural Resources Specialist:

1. Develop prescribed burn plan.
2. Coordinate personnel and equipment prior to burn.
3. Conduct post-burn evaluation.
4. Notify chain-of-command and concerned parties prior to burning.
5. Provide 4 portable radios with access to Security and Fire Dept. frequencies.
6. Establish firebreaks.
7. Maintain training log of crew/personnel members (Appendix H)

NAS Oceana Public Works Officer:

1. Review prescribed burn plan.

Air Operations:

1. Coordinate burning requirements with flight traffic patterns.
2. Notify burn crew if smoke interferes with flight operations.

Navy Region Mid-Atlantic Fire and Emergency Services:

1. Provide standby fire crew in case of emergency.
2. Coordinate available assistance from the local fire department.
3. If requested by the Natural Resources Manager, make hourly site inspections for three consecutive hours after burn crew personnel have secured the burn site.

NAS Oceana/NALF Fentress/Dam Neck Annex Security Department:

1. Provide traffic control in the event of emergencies or impaired visibility due to smoke.

2. Liaison with NALF Fentress and the Chesapeake Police Department for law enforcement support in accordance with the memorandum of understanding between the City of Chesapeake and NAS Oceana.

NAS Oceana Public Affairs:

1. Provide burn information to inquiring individuals, nearby residents, and the news media if requested.

REQUIRED WEATHER CONDITIONS:

The following conditions must be met before burning is initiated (Appendix D):

- No significant rain three to seven days prior to burning.
- Winds of 10 mph or less with gusts no higher than 15 mph.
- Preferred relative humidity of 30 to 50 percent.
- Preferred temperature of 20 to 50 degrees F.
- Front no less than four hours distant.
- Specific wind direction may be required to reduce smoke (see burn area description section of plan or Appendix D).
- Per the Virginia Department of Forestry, no prescribed burning will occur above the 500 CSI (Cumulative Severity Index) maximum, which will be checked prior to burning commencement.

BURN PREPARATION:

Notification:

All concerned parties in the notification section of this plan will be contacted and informed of the necessary details specific to the proposed burn (Appendix F). Weather and air operations are the controlling factors and will generally limit coordination to less than 24 hours and almost always less than one week prior to burning.

Fire Breaks:

Establishment of fire control breaks is discussed in the preceding burn area descriptions. Secondary firebreaks, consisting of roads, runways, ditches, clearzones, and agricultural fields are located around all burn areas, which further prevent fire from escaping outside of Navy property as well as protect structures on board the installations.

Personnel/Materials:
A list of work crew personnel and equipment needed to control the burn is contained in the equipment section of this plan and Appendices E and F.

Required Clothing:
A list of required field clothing is contained in the personal protection equipment section of this plan (Appendix E).

Day of Burn Procedures:

1. Obtain current weather and burn forecast information.
   - Virginia Department of Forestry; (757) 465-6840; www.state.vipnet.org/dof/index.html
   - National Oceanic and Atmospheric Administration; www.nws.noaa.gov/
   - NAS Oceana (latest observation); (757) 433-2177/433-2274
2. Notify all concerned parties prior to and immediately after burning.
3. Conduct a briefing by the Burn Boss covering the following items:
   - Burn objectives
   - Techniques to be used
   - Safety
   - Burn boundaries
   - Radio transmission signals
   - Use of fire tools
   - Chain of Command: natural resources staff, headed by the burn boss, gives direction to the work crew. Natural resources staff will remain in radio contact with the tower and fire department should there be any issues that arise requiring a halt to or redirection of the burning operation. Such direction may be given by the Commanding Officer (Command Duty Officer in the absence of the CO), Air Operations, or the Public Works Officer.
4. Burn in accordance with burn plan prescriptions recording appropriate information throughout the burn.

Note: Example data sheets for tracking and recording information are provided in Appendix J.

Burn Completion:
When all open flames within 25 feet of the burn perimeter and all smoldering material are extinguished, and the burn has been completed to the satisfaction of the burn boss, he/she may release the burn crew from the site. If requested, by the Regional Natural Resources Manager or designated burn boss, the Navy Regional Fire and Emergency Services and/or NALF Fentress field crews will make hourly site inspections for three consecutive hours after the burn crew has secured

the site. Burn crew personnel should be called back only if fire escapes the burn perimeter or open flames persist within 100 feet of the burn perimeter during winds over 25 mph.

Post Burn Evaluation:
Each burn event will be evaluated in respect to the following questions:

- Was there adherence to the burn plan?
- Were pre-burn preparations made?
- Were conditions of weather, fuel and fire behavior within planned limits?
- Was the burning technique employed correctly?
- Was the fire confined by the fire control breaks?
- Did any accidents or near accidents occur?
- What were the environmental effects on soil, air, vegetation, water and wildlife?
- Were objectives met?
- Were costs comparable with benefits derived?

Note: Example data sheets for tracking and recording information are provided in Appendix J.

EMERGENCY ACTION:

1. In the event of an emergency, when called for assistance, the Fire Chief will assume command of the scene and will coordinate extinguishment of the fire using a unified command with all resources needed to control the incident:
    a. Fire chief to be briefed by the Burn Boss/wildland fire fighting expert. Briefing will include discussion of onsite wildland fire personnel, weather information, and wildland fire fighting techniques. The Burn Boss will be incorporated as part of the unified command;
    b. Stop lighting new sections but let the existing fire continue to burn. However, under certain conditions, and in coordination with the Fire Department, backfires may be used to help control or extinguish fires.
    c. Continue normal burning procedures.
2. In case of a fire escape that cannot be controlled by the burn crew and the Navy Regional Fire and Emergency Services, the following will be contacted for assistance (the call for additional resources will only be made by the incident commander): (Appendix F has additional contact information for these offices)
    a. Virginia Department of Forestry (757) 365-6209
    b. Virginia Beach Fire Department (757) 385-5000
    c. Chesapeake Fire Department Dispatch (757) 382-6165

"WATCH OUT" SITUATIONS:

IF ANY OF THE FOLLOWING CONDITIONS EXISTS, THE BURN WILL BE HALTED AND EXISTING FIRE WILL BE PLOWED OUT:

- Fire behaves erratically.
- Spot fires occur and are difficult to control.
- Winds shifting or other unforeseen changes in weather.
- Smoke not dispersing as predicted.
- Public Roads or sensitive areas 'smoked in'.
- Burn does not comply with all laws, regulations and standards.
- Large fuels igniting and burning, not enough personnel available to secure before dark, and likely to 'smoke in' sensitive areas

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U.S. Fish and Wildlife Service. 1998b. Fire Management Plan, Great Dismal Swamp National Wildlife
Refuge.

Great Dismal Swamp National Wildlife Refuge and Nansemond National Wildlife Refuge Final Comprehensive Conservation Plan. July 2006.

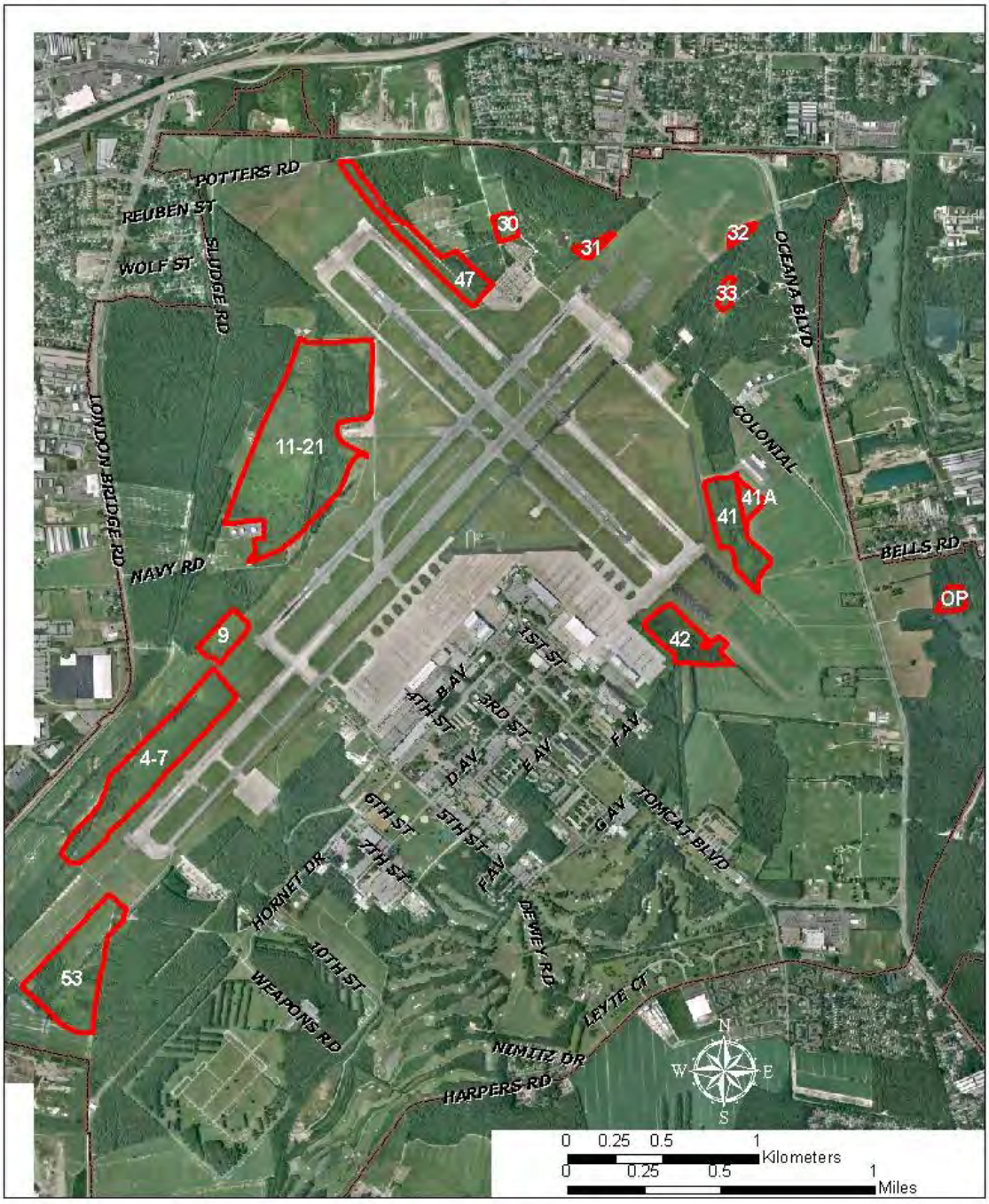
http://www.dof.virginia.gov/fire/vpfc.htm

APPENDIX A
GENERAL BURN AREA MAPS:

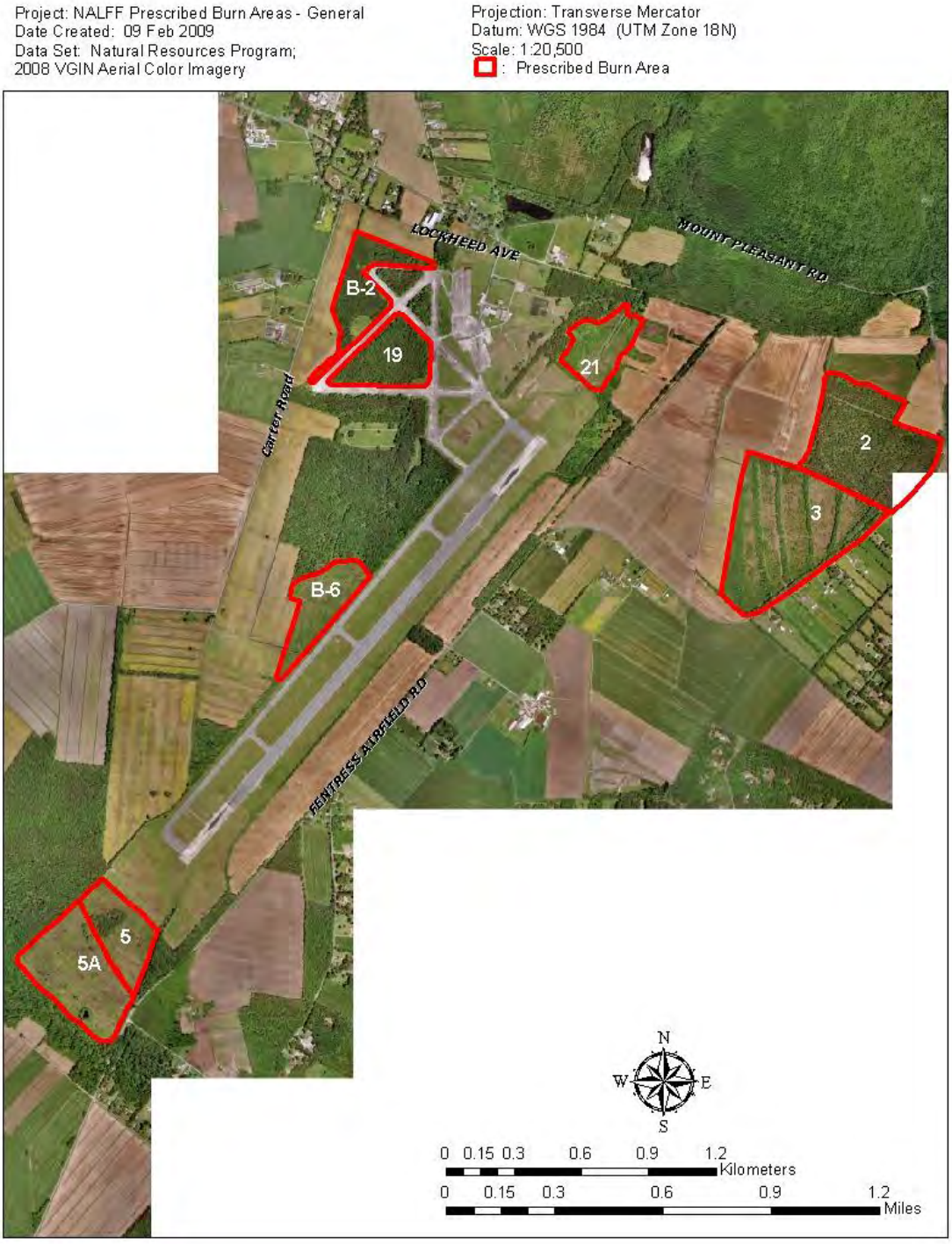
NAS Oceana Burn Areas

Project: NASO Prescribed Burn Areas - General
Date Created: 17 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:25,000
: Prescribed Burn Area



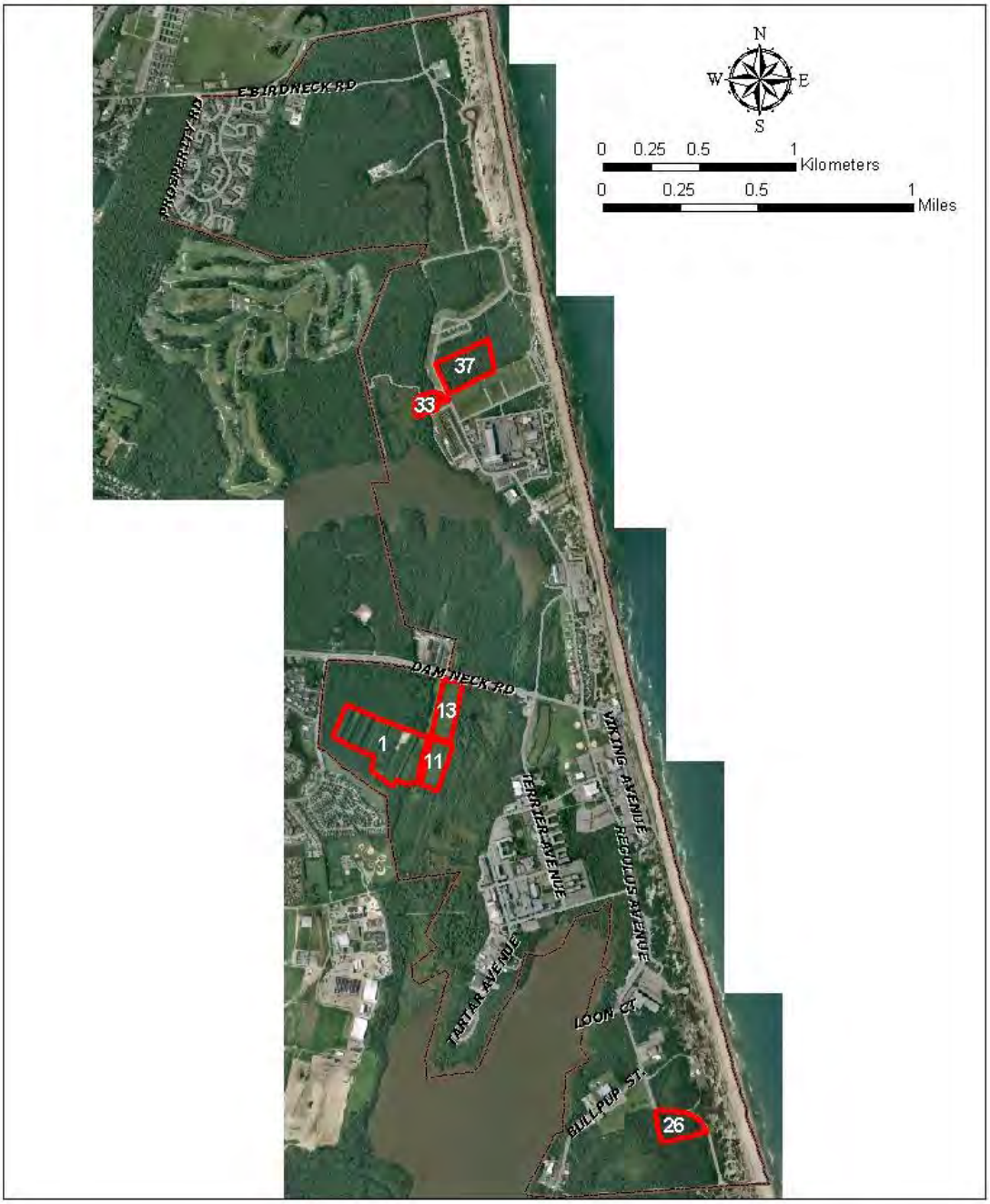
NALF Fentress Burn Areas



NASO Dam Neck Annex Burn Areas

Project: NASO DNA Prescribed Burn Areas - General
Date Created: 17 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:24,759
: Prescribed Burn Area

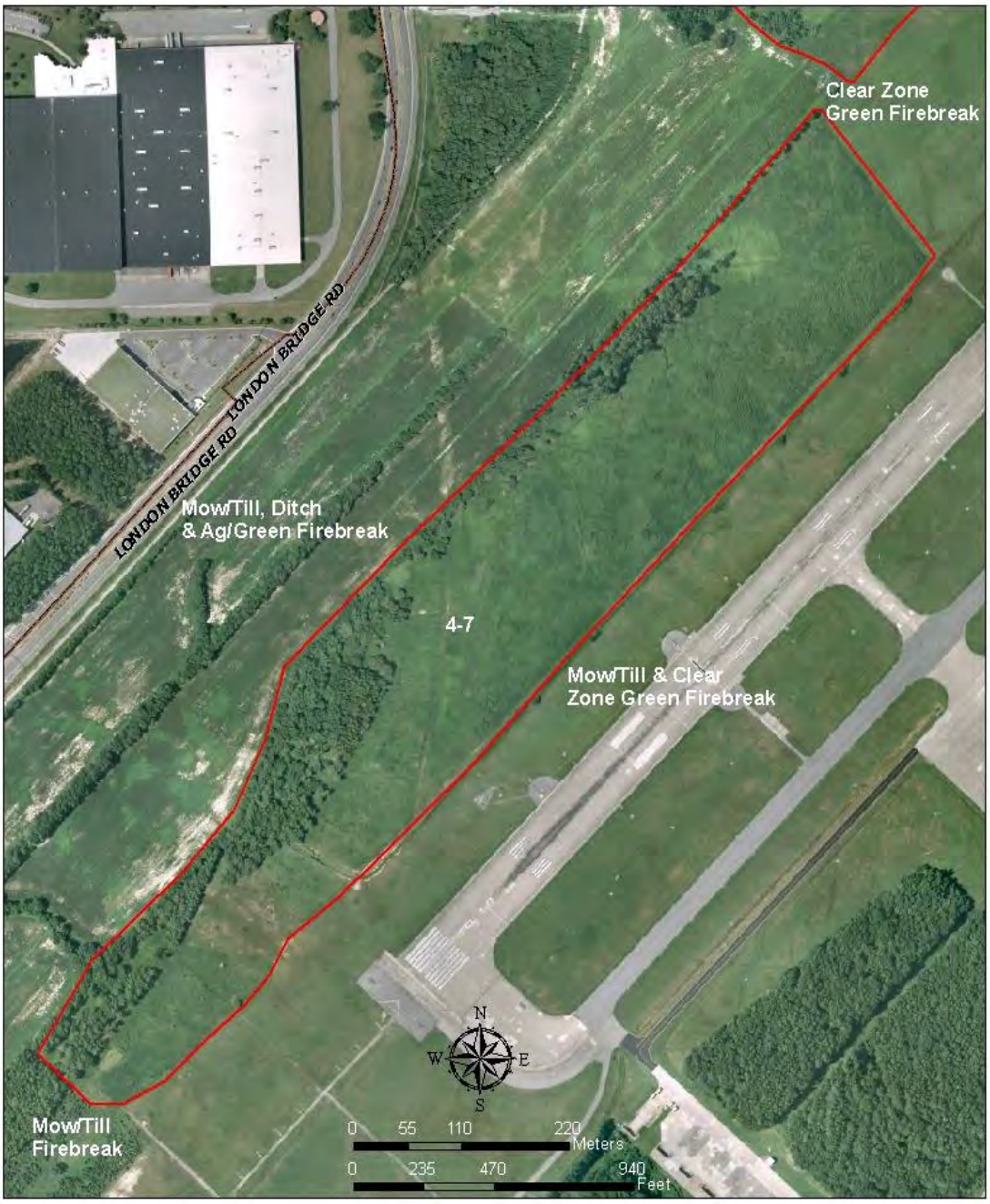


APPENDIX B
2009 SITE SPECIFIC BURN AREA MAPS:

NASO Burn Area 4-7

Project: NASO Prescribed Burn Area - 4-7
Date Created: 17 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:4,900
: Prescribed Burn Area



NASO Burn Area 47

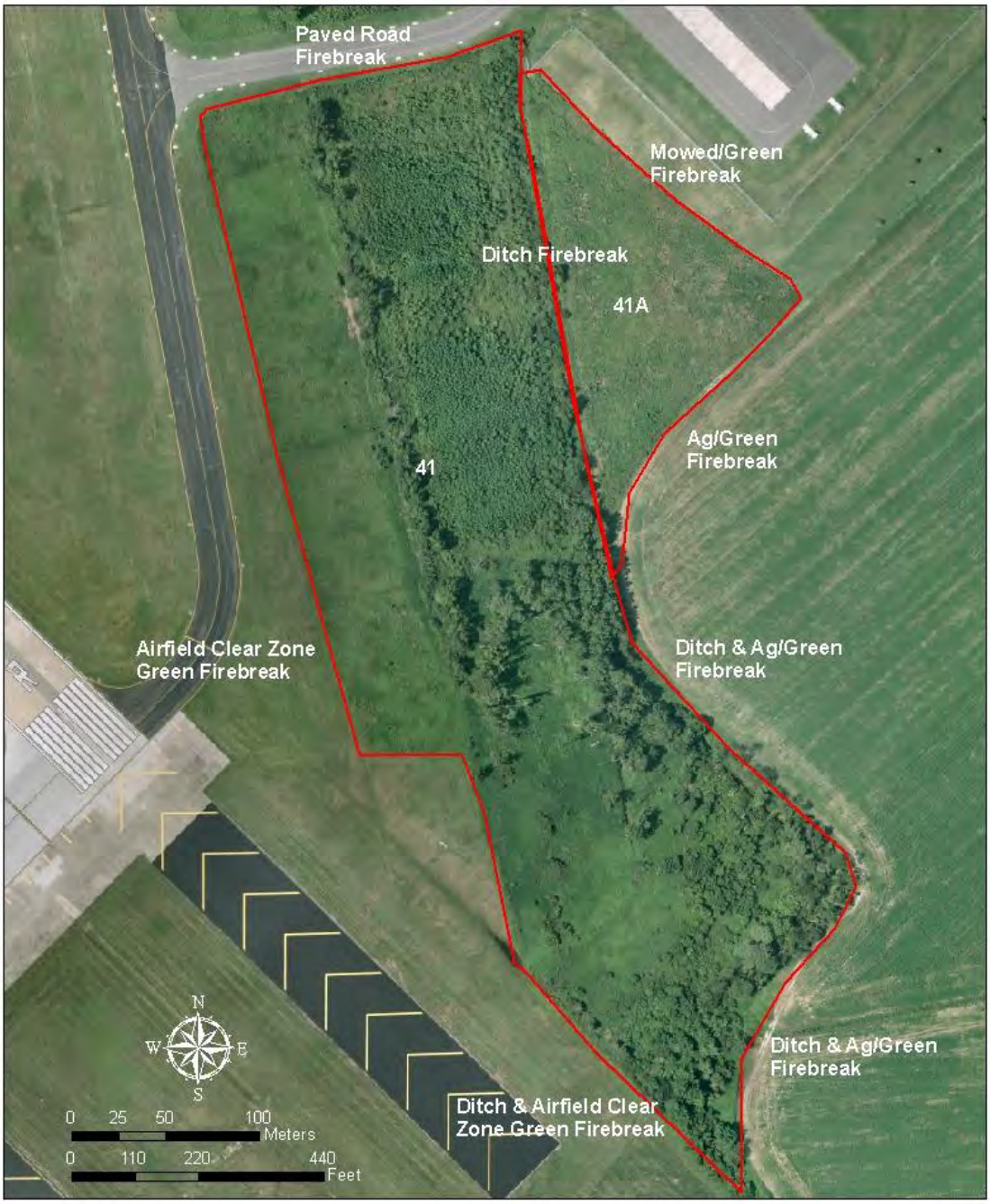
Project: NASO Prescribed Burn Area - 47
Date Created: 17 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:4,200
: Prescribed Burn Area

NASO Burn Area 41

Project: NASO Prescribed Burn Area - 41/41A
Date Created: 17 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:2,550
: Prescribed Burn Area



NASO Burn Area 53

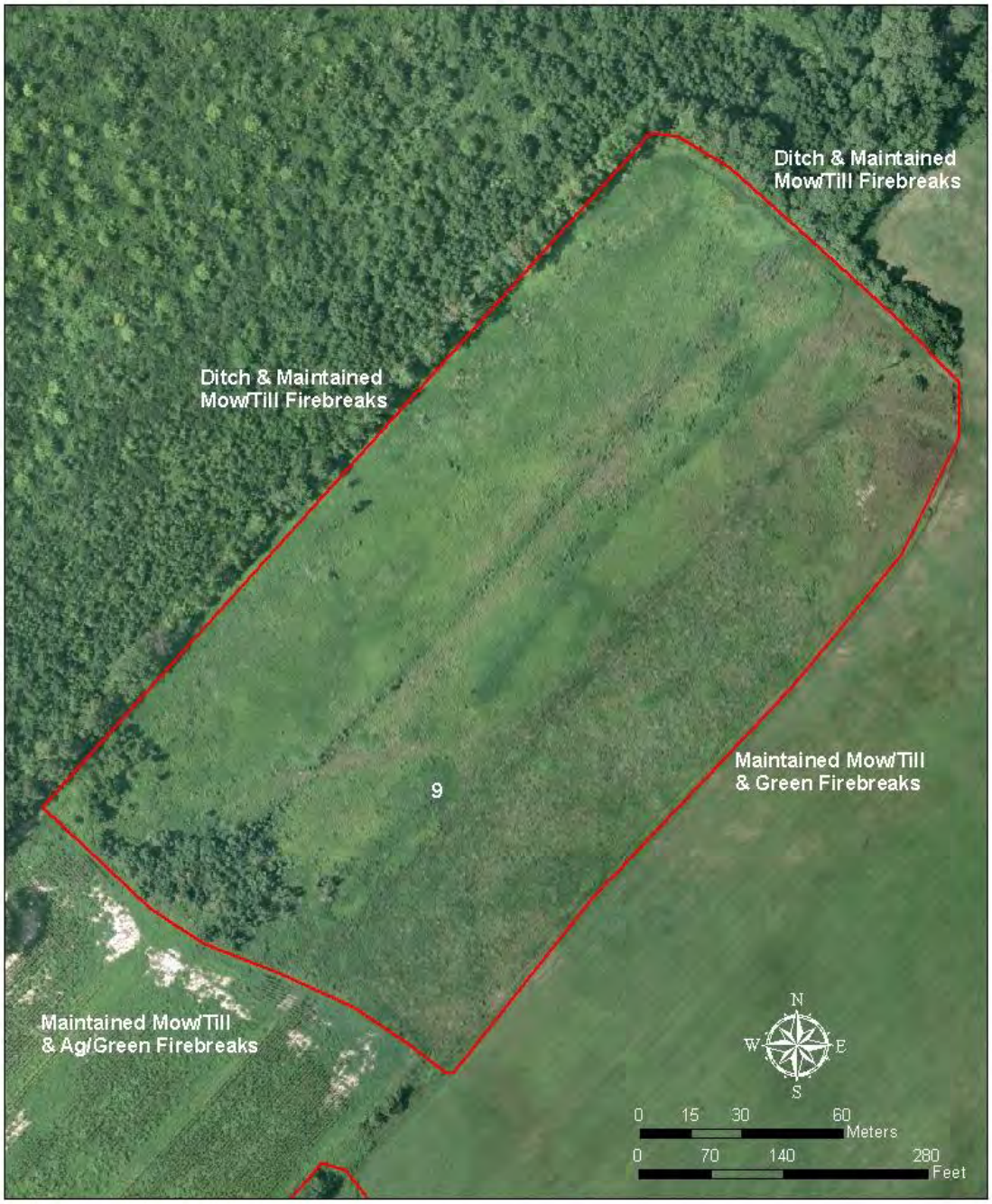
Project: NASO Prescribed Burn Area - 53
Date Created: 17 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:3,100
: Prescribed Burn Area

NASO Burn Area 9

Project: NASO Prescribed Burn Area - 9
Date Created: 17 Feb 2009
Data Set: Natural Resources Program; 2008 VGIN Aerial Color Imagery

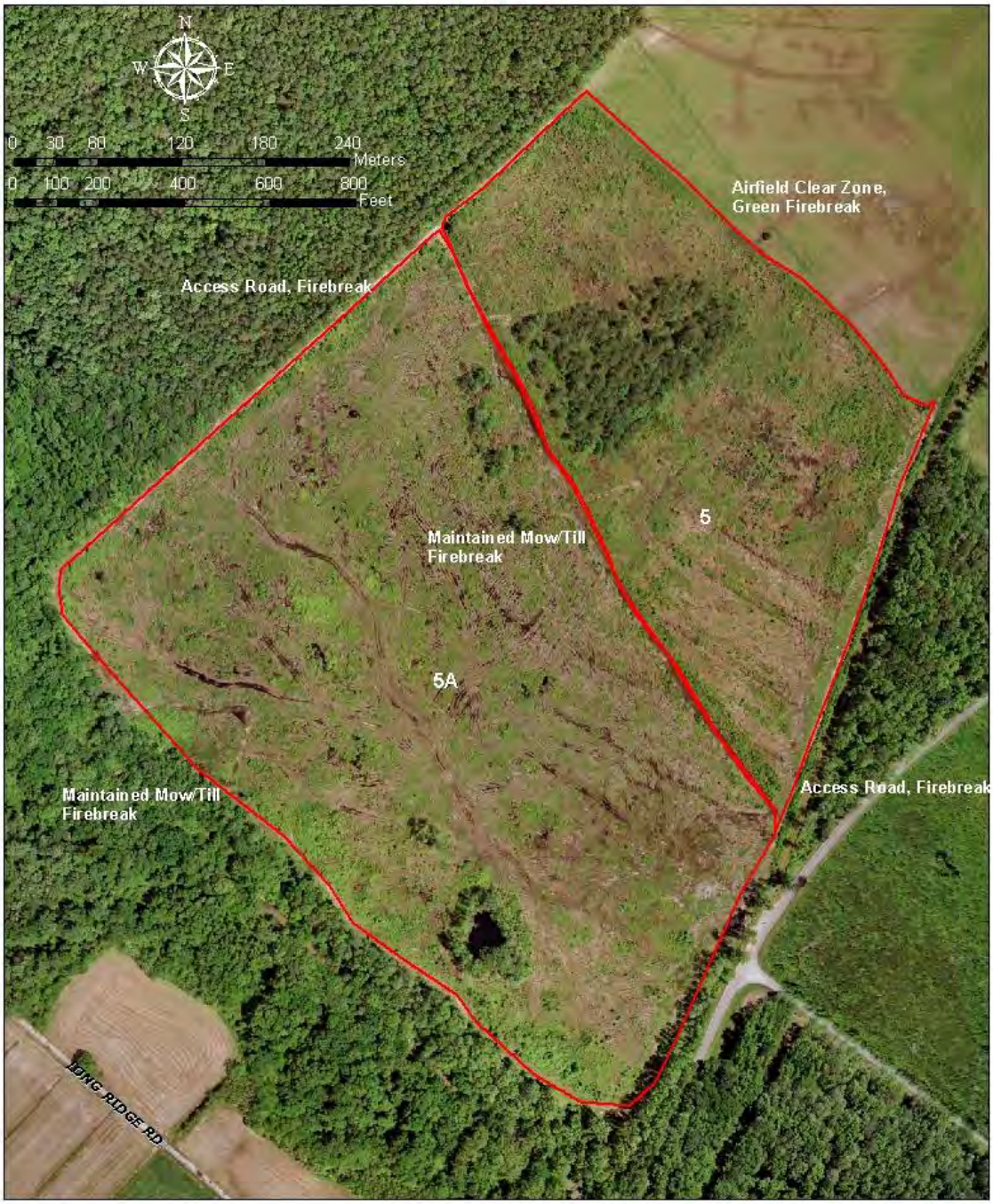
Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:1,416
: Prescribed Burn Area



NALFF Burn Area 5/5A

Project: NALFF Prescribed Burn Areas - 5/5A
Date Created: 09 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:3,406
: Prescribed Burn Area



NALFF Burn Area B-6

Project: NALFF Prescribed Burn Areas - B-6
Date Created: 09 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:2,318
: Prescribed Burn Area

NALFF Burn Area 21

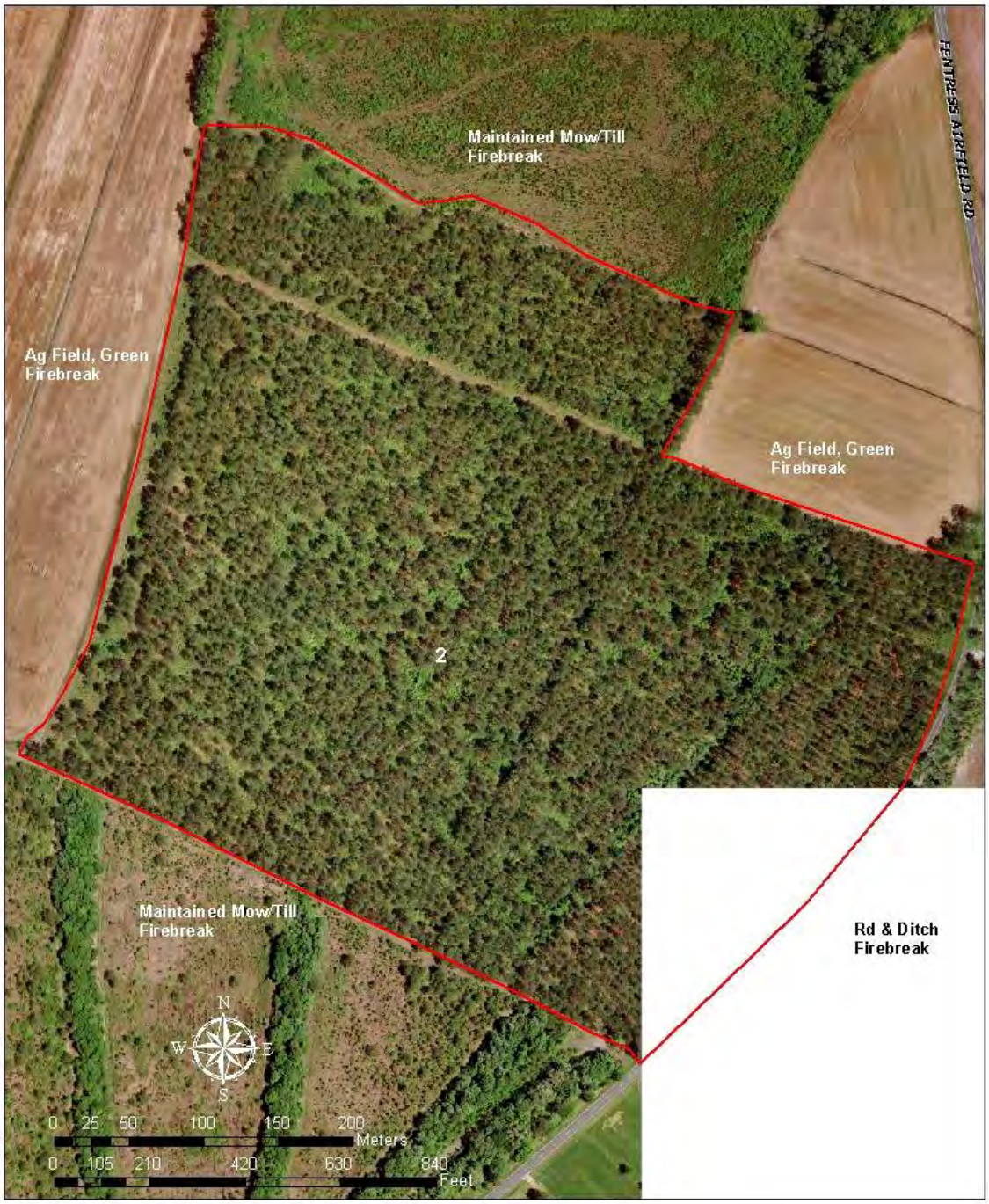
Project: NALFF Prescribed Burn Areas - 21
Date Created: 09 Feb 2009
Data Set: Natural Resources Program;
2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:1,900
: Prescribed Burn Area

NALFF Burn Area 2

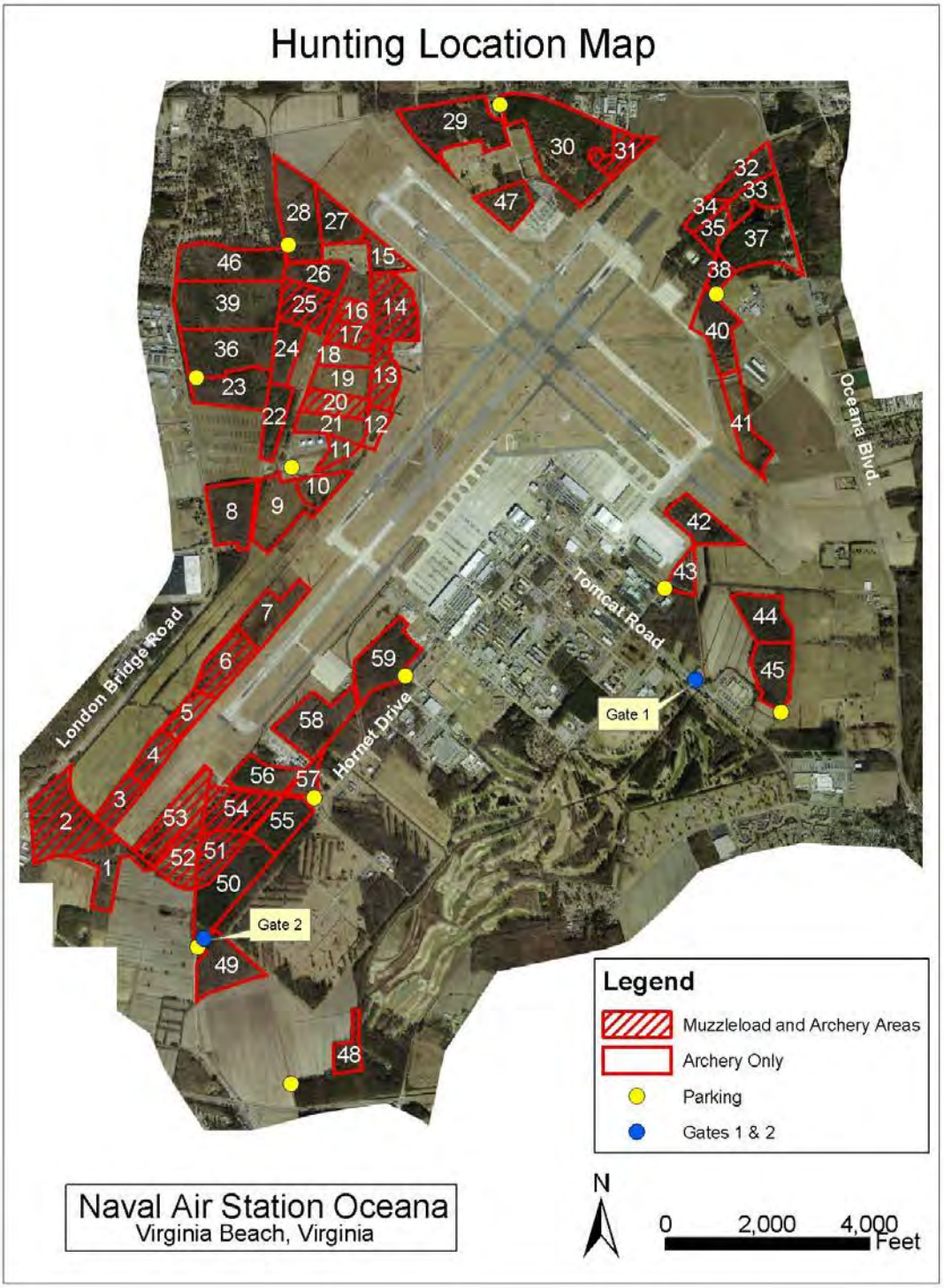
Project: NALFF Prescribed Burn Areas - 2
Date Created: 17 Feb 2009
Data Set: Natural Resources Program; 2008 VGIN Aerial Color Imagery

Projection: Transverse Mercator
Datum: WGS 1984 (UTM Zone 18N)
Scale: 1:3,200
: Prescribed Burn Area

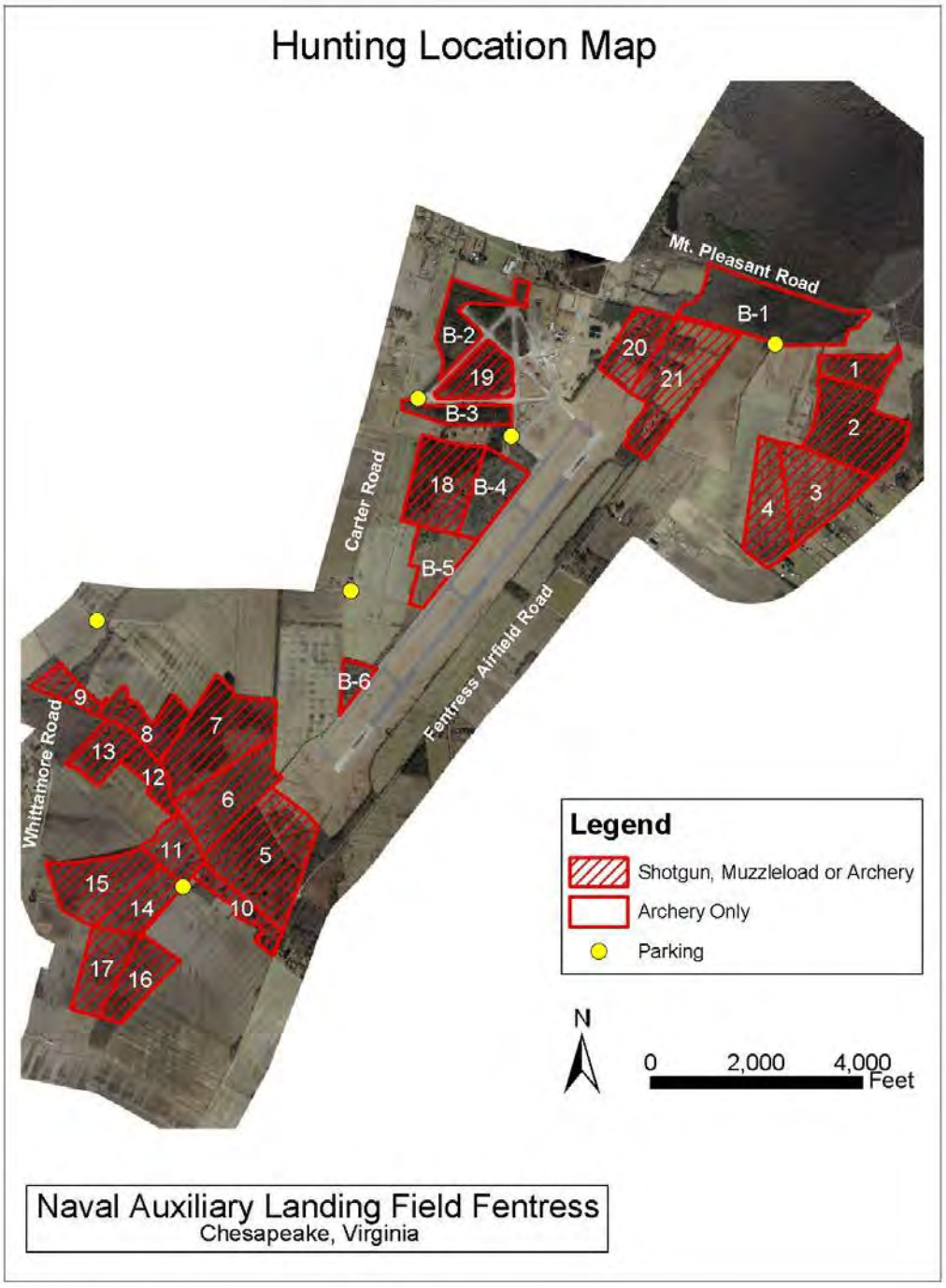


APPENDIX C
BASE HUNTING AREA MAPS:

NAS Oceana Hunting Areas

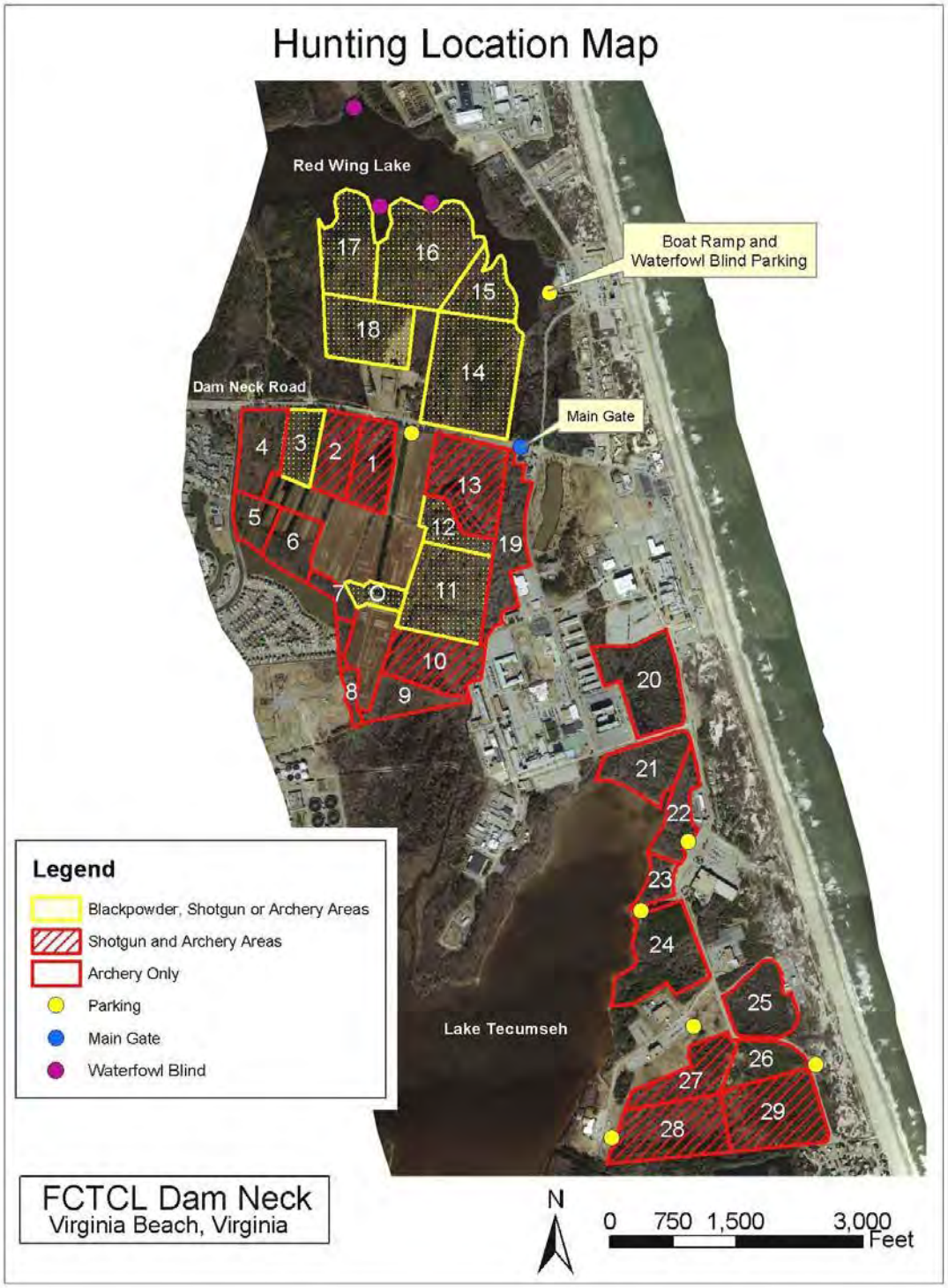


NALF Fentress Hunting Areas



NASO

Dam Neck Annex Hunting Areas



APPENDIX D
CONSOLIDATED BURNING PRESCRIPTION CHART:

Base	2009 Order	Priority	Burn Area	~Acres	Veg. Type	Wind Direction (degrees)	Wind Speed	Rain	Pref. Rel. Humidity (%)	Pref. Temp. (degrees F)	Fronts	Cumulative Severity Index, Max.	Required Personnel, Min.
NASO	1	High	4-7	54.14	(phrag.) WSG & Shrub	270 to 30	<= 10mph with gusts no higher than 15mph	No significant rain three to seven days prior to burning.	30 to 50	20 to 50	No less than four hours distance	500	8
	2	High	47	22.01	Early Successional Woods; WSG & Shrub	300 to 30							
	3	High	41/41A	21.94/4.03	WSG & Shrub	300 to 120							
	4	High	53	43.61	(phrag.) grass/shrub early successional	270 to 30							
	5	High	9	9.15	WSG & Shrub	270 to 30							
NALFF	6	Med.	5/5A	21.51/40.32	Mixed, early successional wood/shrub	300 to 240							
	7	Med.	B-6	21.66	Mixed, early successional wood/shrub	60 to 230							
	8	High	21	18.12	Mixed, early successional wood/shrub	180 to 60							
	9	High	2	57.12	Forest	30 to 180							

	Immediate priority, open to consideration during State Burn Bans due to Base Ops Safety and Security around the Airfield.
	High priority
	Medium priority
	Low priority

APPENDIX E
CREW AND EQUIPMENT:
Burn Plan Work Crew and Materials Needed

1. Minimum of 8 personnel made up of active duty/retired military, DoD civilians or other personnel under DoD cooperative agreements.
2. Minimum of 4 portable radios.
3. Backpack pumps.
4. Fire tools (flappers, rakes, shovels).
5. 4 drip torches.
6. Matches, fuel and mixing container.
7. Compass.
8. First aid kits.
9. Maps and/or aerial photographs.
10. Fireproof clothing and boots.
11. Water coolers and cups.
12. Personal Protective Equipment (PPE)

Required Personal Protective Equipment (PPE)

1. Hardhat.
2. Leather gloves.
3. Bandanna or other smoke inhalant protection.
4. Leather boots.
5. Nomex fire proof or 100% cotton clothing.

Natural Resources Prescribed Burn Equipment Inventory

Date of Inventory	Item	Available Quantity	Operational Status	Comments
Feb 2008	Water Bags	7 ea		
Feb 2008	Road Smoke Signs	2 ea		
Feb 2008	Ear Plugs	900 pairs		
Feb 2008	1st Aide Kit/Emergency Burn	1 ea		
Feb 2008	Burn Shrouds	6 ea		
Feb 2008	Saline Bottle	5 ea		
Feb 2008	Fire Rake	6 ea		
Feb 2008	Axe	2 ea		
Feb 2008	Shovel	1 ea		
Feb 2008	Flapper	11 ea		
Feb 2008	Gloves	20 pairs		
Feb 2008	Helemet	10		
Feb 2008	Goggles	8 ea		
Feb 2008	Filtered Bandit Scarf	10 ea		
Feb 2008	Nomex Shirt	17 ea		
Feb 2008	Nomex Pants	1 ea		
Feb 2008	Drip-Torch	4 ea		
Feb 2008	Gas Can	6 ea		
Feb 2008	Panama Pump	1 ea		
Feb 2008	ATV	2 ea		
Feb 2008	Burn Tailor	1 ea		
Feb 2008	Tractor	3 ea	1 available, 2 off-line (as of Feb 2009).	Primarily utilized for firebreak installation and fuel/veg height reduction. Equipment repairs require tires and hydraulic fluid

APPENDIX F
CONTACT LISTS:
Prescribed Burn Notification List (Non-Crew)

Contact & Email	Phone
1. Commanding Officer –	
Executive Officer-	
2. Base Fire Departments: NAS Oceana – Chief Assistant Chief or Acting Chief	
3. Base Security –	
4. Air Operations –	
5. Base Operations –	
6. Public Works Officer –	
7. Public Affairs Officer –	
8. OIC Dam Neck Annex –	
9. OIC NALF Fentress –	
10. Medical/Dental Clinics: NAS Oceana – (disaster preparedness/emergency services)	
11. Base Safety –	
12. Virginia Division of Forestry – Waverly Regional Office Chesapeake and Va. Beach Field Office Command Center	
13. Virginia Air Pollution Control Board (PReP)	
14. Virginia Beach Fire Department	
15. Chesapeake Fire Department	
16. Back Bay National Wildlife Refuge	
17. Command Duty Officer – Quarter Deck	

Burn Crew Contact Information

Made up of active duty/retired military, DoD civilians, State and Federal Cooperators. Each person identified will receive a pre-fire briefing to go over safety procedures, burn plan of action, job descriptions, general prescribed burning training, etc. The prescribed burning program is supported by the base CO and the NAVFAC MidLant Env Director. All people participating in burning activities must first get approval from their supervisors to aide this program. This list is every changing and will be updated as information becomes available (current list maintained by the NASO Natural Resources Manager).

Name	Phone	Email

Burn Crew Emergency Contact Information:

Crew Member	Crew C-Phone	Contact Name	Relation	Contact Phone

APPENDIX G
PRESCRIBED BURN FIRE FIGHTER TRAINING REQUIREMENTS:

The training program is currently under construction. There is currently no official Navy identified mechanism for obtaining the core and refresher training portions of these requirements. Because of this issue core and refresher training is being phased into the training requirements. There is NO substitution for taking the advanced training (as appropriate) or the burn day training. Once the training program is finalized, there will be no substitutions for taking core, refresher, and burn day trainings. Our goal is to promote safety through training and actions.

Core Training

Required for all new prescribed burn fire-fighters (and those old fire-fighters that have not taken the course), one time course:

1. I-100, all online (<http://training.nwcg.gov/courses.html>)
2. S-110, all online (<http://training.nwcg.gov/courses.html>)
3. S-190 (<http://training.nwcg.gov/courses.html>)
4. S-130, online & field day components (<http://training.nwcg.gov/courses.html>)

Advanced Training

Required for all prescribed burn Burn Bosses, one time course:

1. Virginia Dept of Forestry Prescribed Burn Certification Course

Refresher Training

Required annually for ALL prescribed burn fire-fighters who have completed Core and/or Advanced Training:

1. Annual Refresher Course
    a. *Note: Advanced training course can substitute for refresher training during a given year.*
    b. *Refresher Training is not required for potential prescribed burn fire-fighters taking the Core Training courses for the 1st time. Refresher Training will be required for following years.*

Burn Day Training/Briefing

Required for all prescribed burn fire-fighters that will be participating in that particular day's burn. This training will temporarily substitute for core and refresher training until the training program is finalized. Fire-fighters who miss the burn day training will not burn on that day. Burn Day training will be provided by the burn boss or burn boss identified support personnel.

Certificates of completion and contact information for each individual should be forwarded to the Installation Natural Resources Program Manager and the Assistant Fire Chief in Charge of Training. Copies will be stored in the prescribed burning training documentation files.

APPENDIX H
PRESCRIBED BURN NAVY FIRE FIGHTER TRAINING LOG:

Name	I-100	S-110	S-190	S-130	VDOF Cert	Annual Refresher	Comments

APPENDIX I
FUTURE PLANS FOR PRESCRIBED BURNING PROGRAM:

1. Establish Cooperative Agreements with state, city, and federal agencies as appropriate to provide services to support prescribed burning activities. The need to set up cooperative agreements is warranted because the NAVY does not have a dedicated large pool of prescribed-burn/wildland fire fighters available to carry out base specific burning requirements. In southeastern Hampton Roads, VA the days available to burn are limited due to weather restrictions, smoke management restrictions (Urban Area influences), species/habitat restrictions, etc. The various restrictions coupled with a small pool of people to conduct burns results in many burn objectives not being met for all bases in Hampton Roads, VA.

2. Conduct habitat and fire management assessments for NASO, NASO DNA, and NALFF with State and Federal Wildlife agencies, as appropriate. Many burn areas have not been burned as originally scheduled as such these areas have become overgrow or have accumulated heavy fire fuels. Given this knowledge these areas will require additional work to get them under control for safe burning conditions and into intended habitat structure.

3. Develop and implement a mandatory training program for people assisting with prescribed burning activities on Navy Property in Hampton Roads, VA. (Appendix G)

4. Research programs which may have funding available in support of prescribed burning initiatives (i.e. Forestry Program, Base Operations, etc.).

APPENDIX J
STATE AND FEDERAL PRESCRIBED/WILDLAND FIRE REPORTING DOCUMENTS

VA State Prescribed Burn Management Plan

Form 69
08/01/1999
f069_po.dot

VIRGINIA DEPARTMENT OF FORESTRY
PRESCRIBED BURN MANAGEMENT PLAN

I. Location and Identification

Landowner Information

Name: _____ Phone Number: _____

Address: _____

Tract Information

County: _____ Coordinates: _____

Location: _____

Acres: _____ Tract #: _____ Parcel: _____ Map Attached: ☐Yes ☐No

Reason for the burn: ☐ Site Prep ☐Fuel Reduction ☐Wildlife

II. Weather

Prescription Conditions

A. Surface Wind _____ Direction _____ MPH

B. Transport Wind _____ Direction

C. Mixing Height (meters) _____

D. Relative Humidity (%) _____

E. Temperature _____

F. Cumulative Severity Index _____

Burn Day

	Forecast				On Site			
	Day		Night		Prior		At Conclusion	
A. Surface Wind	Direction	MPH	Direction	MPH	Direction	MPH	Direction	MPH
B. Transport Wind	Direction	MPH	Direction	MPH				
C. Mixing Height (meters)								
D. Relative Humidity (%)								
E. Temperature								
F. Cumulative Severity Index								

III. Objectives of the Burn

_____

_____

_____

VA State Prescribed Burn Management Plan…continued

Form 69
08/01/1999
f069_po.dot

VIRGINIA DEPARTMENT OF FORESTRY
PRESCRIBED BURN MANAGEMENT PLAN

IV. Screening for Smoke Sensitive Targets

Use double 30 degree template. Attach map.

A. None within 20 miles: Proceed with burn, follow recommendations to reduce smoke impact for all forestry burns. (located in VA Smoke Management Guide)

B. Target(s) within 10 to 20 miles: The following minimum conditions must be met, and the above mentioned recommendations should also be followed.

Mixing Height: 500 meters (1,640 ft.)

Ventilation Factor of 2,000
[Mixing Height (meters) X Transport Wind Speed (meters/sec)]

C. Target(s) within 10 miles:

SPECIAL CAUTION IS NECESSARY

All of the conditions in A and B above must be met and the following should be considered. The distance to the target, nature of the target, size of the burn, amount and nature of the fuel, fuel moisture, topography, and presence of organic soil. These factors along with the meteorological conditions all combine to determine the quantity and duration of the smoke produced.

An alternative to burning may need to be prescribed unless conditions change allowing the potential target(s) to not be impacted by the smoke from your burn.

V. Other Considerations

A. Department of Forestry Regional office notified, as well as county fire department dispatcher.

B. Home owners within 1,000 feet. (Permission required through the Emission Standards for Open Burning according to the State Air Pollution Control Board.)

C. Local Ordinances and the Forest Fire Laws of Virginia.

D. Keep fires out of large piles of debris and sawdust piles which may produce smoke for extended periods of time. It is DOF policy not to burn bulldozed piled debris as a site preparation method.

E. If smoke does cross a road you need to place a flag person at both ends with radio communications.

F. Burn to be completed 1 hour prior to sunset.

G. What are the fuel conditions and characteristics? _____

_____

_____

VI. Burning Plan / Strategy

A. Equipment On Site	Recommended	Actual
Number of tractor / fire plow units	_____	_____
Number of pickups	_____	_____
Additional water supply	_____	_____
Burn trailer	_____	_____
Number of hand carried radios	_____	_____

Other, specify _____

VA State Prescribed Burn Management Plan…continued

Form 69
08/01/1999
f069_po.dot

VIRGINIA DEPARTMENT OF FORESTRY
PRESCRIBED BURN MANAGEMENT PLAN

B. Personnel On Site — Recommended — Actual

Number of DOF employees _____ _____

Number of non-DOF employees _____ _____

Landowner(s) list _____

Other, specify _____

C. Ignition Pattern (starting point shown on map) _____

D. Ignition Method ☐ Drip Torch ☐ Aerial ☐ Other _____

E. Special Fire Control and Smoke Considerations _____

E. Planned Mop-up Activities _____

Prepared By

PRINT NAME _____ SIGNATURE _____ DATE _____

CERTIFICATION NUMBER _____ PHONE NUMBER _____

VA State Prescribed Burn Management Plan…continued

Form 69
08/01/1999
f069_po.dot

VIRGINIA DEPARTMENT OF FORESTRY
PRESCRIBED BURN MANAGEMENT PLAN

EVALUATION IMMEDIATELY AFTER THE BURN

Evaluation By _____ (PRINT NAME) _____ (SIGNATURE)

1. Acres Burned _____
2. Spotting _____ Distance (comments) _____
3. Any Escapes _____
4. Objectives Met _____
5. Smoke Problems _____
6. % Understory Vegetation Consumed ☐ < 25% ☐ 26-50% ☐ 51-75% ☐ >75%
7. % Material > 3" Diameter Consumed ☐ < 25% ☐ 26-50% ☐ 51-75% ☐ >75%
8. % Of Area With Crown Discoloration ☐ < 25% ☐ 26-50% ☐ 51-75% ☐ >75%
9. Live Crown Consumption _____
10. Adverse Publicity _____
11. Remarks _____

FUTURE EVALUATION

Evaluation By _____ (PRINT NAME) _____ (SIGNATURE) _____ (DATE)

1. Insect / Disease Damage _____
2. Tree Mortality _____
3. % Understory Kill ☐ < 25% ☐ 26-50% ☐ 51-75% ☐ >75%
4. Soil Movement _____
5. Other Remarks _____

Federal Interagency Wildfire Coordinating Group Fire Reporting Documents

NWCG PRESCRIBED FIRE GO/NO-GO CHECKLIST

Yes	No	Questions
		Are ALL fire prescription elements met?
		Are ALL smoke management specifications met?
		Has ALL required current and projected fire weather forecast been obtained and are they it favorable?
		Are ALL planned operations personnel and equipment on-site, available, and operational?
		Has the availability of ALL contingency resources been checked, and are they available?
		Have ALL personnel been briefed on the project objectives, their assignment, safety hazards, escape routes, and safety zones?
		Have all the pre-burn considerations identified in the prescribed fire plan been completed or addressed?
		Have ALL the required notifications been made?
		Are ALL permits and clearances obtained?
		In your opinion, can the burn be carried out according to the prescribed fire plan and will it meet the planned objective?

If all the questions were answered "YES" proceed with a test fire. Document the current conditions, location, and results

PMS 421 (1/02)

Federal Interagency Wildfire Coordinating Group Fire Reporting Documents…continued

NWCG AGENCY ADMINISTRATOR GO/NO-GO PRE-IGNITION APPROVAL

Prescribed Fire Name: _____ Date: _____

Instructions: The Agency Administrator's Go/No-Go Pre-Ignition Approval is the intermediate planning review process (i.e., between the Prescribed Fire Complexity Rating System Guide and Go/No-Go Checklist) that should be completed before a prescribed fire can be implemented. The Agency Administrator's Go/No-Go Pre-Ignition Approval evaluates whether compliance requirements, prescribed fire plan elements, and internal and external notifications have been completed and expresses the Agency Administrator's intent to implement the prescribed fire plan. If ignition of the prescribed fire is not initiated prior to expiration date determined by the Agency Administrator, a new approval will be required.

Yes	No	Key Element Questions
		Is the prescribed fire plan up to date? *Hints: changes, amendments, seasonality.*
		Have all compliance requirements been completed? *Hints: cultural, threatened and endangered species, smoke management, NEPA.*
		Is risk management in place and the residual risk acceptable? *Hints: Prescribed Fire Complexity Rating Guide completed with rational and mitigation measures identified and documented.*
		Will all elements of the prescribed fire plan be met? *Hints: Preparation work, mitigation, weather, organization, prescription, contingency resources.*
		Have all internal and external notifications and media releases been completed?
		Are key agency staff fully briefed and understand prescribed fire implementation?
		Other: _____

Recommended by: _____ Date: _____
FMO/Prescribed Fire Burn Boss

Approved by: _____ Date: _____
Agency Administrator

Approval expires (date): _____

PMS 422 (1/04)

Federal Interagency Wildfire Coordinating Group Fire Reporting Documents…continued

INCIDENT BRIEFING	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED
4. MAP SKETCH			
ICS 201 (12/93) NFES 1325	PAGE 1	5. PREPARED BY (NAME AND POSITION)	

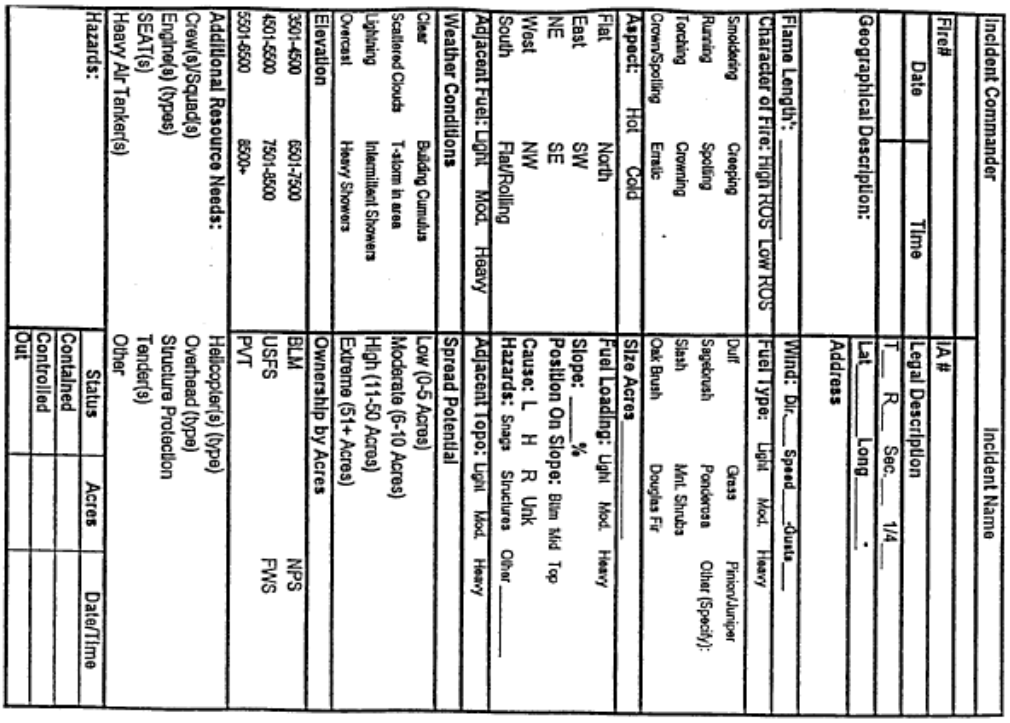
Federal Interagency Wildfire Coordinating Group Fire Reporting Documents…continued

6. SUMMARY OF CURRENT ACTIONS		
ICS 201 (12/93) NFES 1325	PAGE 2	

Federal Interagency Wildfire Coordinating Group Fire Reporting Documents…continued

8. RESOURCES SUMMARY				
RESOURCES ORDERED	RESOURCES IDENTIFICATION	ETA	ON SCENE √	LOCATION/ASSIGNMENT
ICS 201 (12/93) NFES 1325	PAGE 4			

Federal Interagency Wildfire Coordinating Group Fire Reporting Documents…continued



Incident Commander | Incident Name

Fire# | IA #

Date | Time | Legal Description

T___ R___ Sec.___ 1/4___

Geographical Description: | Lat_____Long_____ | Address

Flame Length: _____

Character of Fire: High ROS Low ROS | Wind: Dir.___ Speed___Gusts___

Fuel Type: Light Mod. Heavy

Smoldering Creeping | Duff | Grass | Pinion/Juniper

Running Spotting | Sagebrush | Ponderosa | Other (Specify):

Torching Crowning | Slash | Mnt. Shrubs

Crown/Spotting Erratic | Oak Brush | Douglas Fir

Aspect: Hot Cold | Size Acres _____

Flat | North | Fuel Loading: Light Mod. Heavy

East | SW | Slope: _____%

NE | SE | Position On Slope: Btm Mid Top

West | NW | Cause: L H R Unk

South | Flat/Rolling | Hazards: Snags Structures Other _____

Adjacent Fuel: Light Mod. Heavy | Adjacent Topo: Light Mod. Heavy

Weather Conditions | Spread Potential

Clear Building Cumulus | Low (0-5 Acres)

Scattered Clouds T-storm in area | Moderate (6-10 Acres)

Lightning Intermittent Showers | High (11-50 Acres)

Overcast Heavy Showers | Extreme (51+ Acres)

Elevation | Ownership by Acres

3501-4500 6501-7500 | BLM NPS

4501-5500 7501-8500 | USFS FWS

5501-6500 8500+ | PVT

Additional Resource Needs: | Helicopter(s) (type)

Crew(s)/Squad(s) | Overhead (type)

Engine(s) (type) | Structure Protection

SEAT(s) | Tender(s)

Heavy Air Tanker(s) | Other

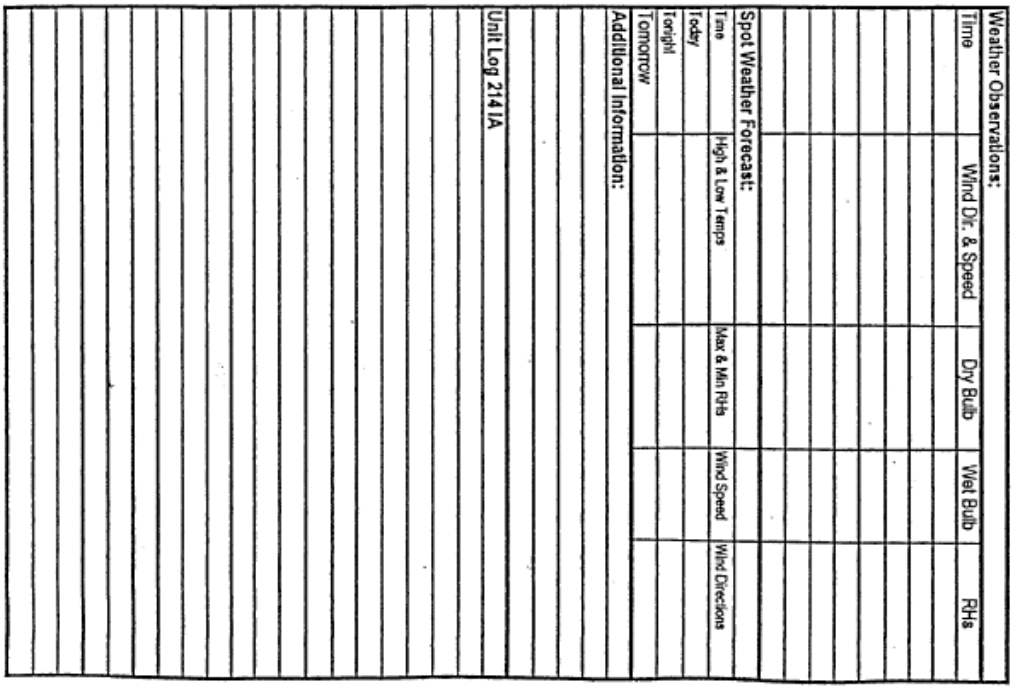
Hazards:

| Status | Acres | Date/Time

Contained

Controlled

Out



Weather Observations:

Time | Wind Dir. & Speed | Dry Bulb | Wet Bulb | RHs

Spot Weather Forecast:

Time | High & Low Temps | Max & Min RHs | Wind Speed | Wind Directions

Today

Tonight

Tomorrow

Additional Information:

Unit Log 214 IA

APPENDIX K
BURN HISTORY CHART:
Information is currently in hard copy format. Once required information is extrapolated from the hard copy text it will be converted to digital format and added to this table as appropriate.

Burn Area	Burn Area Acreage	Year of Burn	Acreage Burned	Type of Burn	Comments
NASO - 41		2008		Stripping	Patchy burn typical of moist habitat burns. Successful, no reportable incidents.

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Enclosure 9. Hunting Regulations and Information

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DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION, MID-ATLANTIC
6506 HAMPTON BLVD.
NORFOLK, VA 23508-1273

IN REPLY REFER TO:

COMNAVREG MIDLANT
INST 11015.2A
REG ENG Code 90
12 NOV 2002

COMNAVREG MIDLANT INSTRUCTION 11015.2A

Subj: HUNTING AND TRAPPING PROGRAM

Ref: (a) 16 U.S. Code § 670 *et seq.*
(b) 10 U.S. Code § 2671
(c) 32 C.F.R. Part 190
(d) 29.1 VA Code Chapters 3 and 5; 4 VA Admin. Code, Agency 15 (Dept. of Game and Inland Fisheries)
(e) NC General Statutes, CH. 113, Subchapters 3 and 4
(f) 50 C.F.R. Chapter 1, Subchapter B
(g) OPNAVINST 5090.1B, Chapter 22
(h) NAVSEA OP-5, Vol. 1, § 2-1.6
(i) JAGMAN

Encl: (1) Station Permit Suspension/Revocation
(2) Hunter Application Form
(3) Qualification Proficiency Standards
(4) Deer Hunting on NAS Oceana or Dam Neck Annex
(5) Deer Hunting on NALF Fentress
(6) Deer Hunting on WPNSTA Yorktown
(7) Deer Hunting on Cheatham Annex
(8) Deer Hunting on NAVSUPPACT Norfolk, Northwest Annex
(9) Waterfowl Hunting on Dam Neck Annex
(10) Spring Turkey (Gobbler) WPNSTA Yorktown
(11) Spring Turkey (Gobbler) Hunting on Cheatham Annex
(12) Small Game Hunting on NAS Oceana
(13) Small Game Hunting on NALF Fentress
(14) Small Game Hunting on NAVSUPPACT Norfolk, Northwest Annex
(15) Small Game Hunting on WPNSTA Yorktown
(16) Dove Hunting on NAS Oceana, NALF Fentress, and NAVSUPPACT Norfolk, Northwest Annex
(17) Trapping at NAS Oceana, NALF Fentress, Dam Neck Annex, and NAVSUPPACT Norfolk, Northwest Annex

1. Purpose. To regulate hunting and trapping on board Naval Weapons Station (WPNSTA), Yorktown, including Cheatham Annex; Naval Air Station (NAS), Oceana, including Dam Neck Annex and Naval Auxiliary Landing Field (NALF), Fentress; and Naval Support Activity (NAVSUPPACT), Norfolk, Northwest Annex.

2. Cancellation. NSGANWINST 11015.2D; COMNAVREGMIDLANTINST 11015.2.

3. Policy

a. Reference (a) requires sustainable, multi-purpose use of natural resources on naval installations, consistent with combat readiness. These uses can include hunting and trapping and must conform to safety and security requirements and provide for public access.

b. Reference (b) requires compliance with Federal and State hunting laws, prescribes that State hunting licenses must be obtained if State law authorizes licenses for non-resident active duty personnel on the same terms as residents, and grants access to Naval installations by State wildlife management officials.

c. Reference (c) implements reference (a), providing, among other things, for public access to naval installations, unless a specific determination is made that safety or security reasons prohibit, or carrying capacity of wildlife resources precludes such access. Reference (c) also provides that hunting and trapping fees collected pursuant to reference (a) shall be used only to defray the costs of wildlife management programs at the installation collecting the fees. Collection, handling, and disbursement of funds shall comply with requirements prescribed by Commander, Naval Facilities Engineering Command (COMNAVFACENGCOM) and the Regional Comptroller Office.

d. Hunting and trapping on board WPNSTA Yorktown and Cheatham Annex; NAS Oceana, Dam Neck Annex, and NALF Fentress; and NAVSUPPACT Norfolk, Northwest Annex shall comply with references (d) or (e), Virginia and/or North Carolina hunting and trapping laws and regulations per reference (f). The U.S. Fish and Wildlife Service regulations pertain to endangered and threatened species and migratory birds per reference (g), the Navy's Natural Resources Program instruction. Reference (h) places special limits on hunting and trapping in the vicinity of explosives handling and storage areas.

e. Hunting and trapping safety, to include the security of personnel, operations, and facilities, are matters within the authority and responsibility of Installation Commanders (ICs). Suspected violations of Federal and State statutes and regulations shall be reported to the cognizant Natural Resources Manager or to Naval law enforcement personnel. These violations will be investigated with a view to referral to the United States Attorney or, depending on the nature of the suspected violation, to Virginia civil authorities. Other suspected violations of this Instruction, not amounting to a violation of Federal or State law, shall be investigated and forwarded to the cognizant IC for disposition. As required by reference (c), investigation and enforcement may be conducted only by properly trained Federal

and State personnel under the direction of, or in coordination with, Natural Resources Managers. Enclosure (1) pertains.

f. Hunting and trapping related incidents involving personal injury or property damage, especially those with potential to result in claims for or against the Government, shall be investigated and adjudicated as per reference (i). ALL HANDS ARE REMINDED TO REPORT SUCH INCIDENTS PROMPTLY. Initial reports of the occurrence of personal injury or property damage may be made by the most expeditious means available to Natural Resources Managers, Hunt Captains, security, medical emergency, or law enforcement personnel, Command Duty Officers (CDOs), and others in the IC chain of command.

g. Acceptance of a permit to hunt or trap on board any Commander, Navy Region, Mid-Atlantic (COMNAVREG MIDLANT) installation constitutes consent to inspection at any time by Navy, Federal, and State authorized personnel for purposes of safety, security, and/or compliance with the statutes and regulations referenced in this instruction. Enclosure (2) will so specify.

4. Responsibilities

a. Regional Engineer (PWC Norfolk)

(1) Natural Resources Manager. The Natural Resources Managers are responsible for managing fish and wildlife resources to include control of game harvesting and the designation of hunting/trapping areas. The Natural Resources Managers and Conservation Officers resolve disputes involving ownership of harvested game and enforce all Federal, State, and local game laws and regulations.

Subject to 10 U.S. Code § 1588, Natural Resources Managers are authorized to accept voluntary services in support of hunting and trapping-related natural resources programs, functions, and activities. This includes, without limitation, Hunt Captains at WPNSTA Yorktown, operating and maintaining the archery range at NAS Oceana (Building 78), conducting hunter qualification programs, and investigating alleged violations of hunting and trapping laws and regulations.

(2) Designated Conservation Officers. Conservation Officers are trained personnel assigned to the Regional Engineer's storefront compliance departments who, acting under the Natural Resources Managers, are responsible for enforcing Federal, State, and local wildlife laws and regulations. Conservation Officers are authorized to conduct game and hunter

inspections to determine compliance with all applicable laws, regulations, and policies.

b. Regional Public Safety Program Manager. Security Officers at NAS Oceana; NAVSUPPACT Norfolk, Northwest Annex; and WPNSTA Yorktown will provide hunter check-in and check-out assistance and support Natural Resources Managers and Conservation Officers with law enforcement issues upon request.

c. Hunters and Trappers. Acceptance of a permit to hunt or trap on board a COMNAVREG MIDLANT installation constitutes consent to abide by Federal and State statutes and regulations incorporated herein by reference, and directives of Natural Resources Managers, Hunt Captains, and Conservation Officers. Enclosure (2) will so specify.

5. General

a. Authorized Personnel. For reasons of safety, security, and resource carrying capacity, only the following persons are authorized to hunt and trap on WPNSTA Yorktown, Cheatham Annex; NAS Oceana, NALF Fentress, and Dam Neck Annex; and NAVSUPPACT Norfolk, Northwest Annex:

(1) Active duty military personnel and their dependents.

(2) Retired military personnel and their dependents.

(3) Federal civilian employees at COMNAVREG MIDLANT installations and their dependents.

(4) Reservists and their dependents.

(5) Retired Federal civilian employees at the installation from which they retired.

(6) The above-listed authorized personnel may sponsor one guest while hunting white-tailed deer or turkey, or two guests while hunting small game. Additional security measures may be required for guests to hunt. Contact appropriate Natural Resources staff for details: WPNSTA Yorktown (757) 887-7605, NAS Oceana/NALF Fentress/Dam Neck Annex (757) 433-2151, and NAVSUPPACT Norfolk, Northwest Annex (757) 421-8043.

(7) In instances where demand for a hunting activity exceeds availability, active duty personnel will be assigned to available slots prior to other applicants.

b. Hunting Equipment

(1) General. Shotguns, bows and arrows may be brought onto a station only by those given permission to hunt and then only the day of an authorized hunt. At WPNSTA Yorktown and Cheatham Annex, off-station residents must have permission in advance from the Security Officer to bring weapons on board for practicing, qualifying, etc. on days other than hunting days. Off-station residents will remove weapons from the station immediately upon securing from hunting or checking out from the Hunt Station.

(2) Firearms

(a) The use of centerfire and rimfire rifles or handguns for hunting is prohibited on all installations covered under this instruction.

(b) Shotguns may be used for deer hunting at designated areas on WPNSTA Yorktown; Cheatham Annex; NALF Fentress; Dam Neck Annex; and NAVSUPPACT Norfolk, Northwest Annex and for small game hunting at all installations covered under this instruction. With the exception of waterfowl, there is no small game hunting on Dam Neck Annex. There is no squirrel hunting on NAVSUPPACT Norfolk, Northwest Annex.

(c) Shotguns must be 10-gauge or less, the magazines of which have been cut off or plugged so the gun will hold no more than three shells - chamber and magazine combined. A minimum 20-gauge is required for deer hunting.

(d) Muzzleload firemarms for the special NAS Oceana, NALF Fentress and Dam Neck Annex, and NAVSUPPACT Norfolk, Northwest Annex hunts shall comply with current Virginia or North Carolina regulations.

(e) It is prohibited to transport a loaded firearm in a vehicle or to carry a loaded firearm on a hard surface road.

(3) Ammunition

(a) Shot size #7½ or less must be used for doves and upland birds. Waterfowl hunters must use steel or other federally-approved non-toxic alternatives to lead shot. Recommended shot size for waterfowl is BB through #6.

(b) Shot size #6 or less is authorized for rabbits, squirrels, and small game other than doves or upland birds.

(c) Buckshot (#1, 0, 00, and 000) is permitted for deer only on WPNSTA Yorktown, Cheatham Annex, NALF Fentress, and Dam Neck Annex. Shotgun slugs are permitted only on NAVSUPPACT Norfolk, Northwest Annex pending hunter qualification with this ammunition.

(d) Turkey hunters are restricted to shot size between #2 and #6.

(4) Archery. Equipment for deer hunting at all locations must be hand-held and hand-drawn (release aids are permitted). Archery equipment shall conform to all applicable regulations in references (d) or (e).

c. Safety/Security Requirements

(1) Hunter Safety

(a) All firearm hunters must have attended a hunter safety course approved by the Virginia Game Division. Proof of successful completion must be presented upon purchase of installation hunting permits.

(b) All bowhunters at NAS Oceana, NALF Fentress, and Dam Neck Annex must produce a certificate of completion from an International Bowhunter Education Program (IBEP) safety course at the time of station permit purchase or during proficiency qualifications. IBEP is strongly recommended for bowhunters at WPNSTA Yorktown and Cheatham Annex.

(2) Blaze Orange

(a) All deer hunters are required to wear blaze orange while walking to and from their stand and while pursuing wounded game. In addition, bowhunters and muzzleload hunters must adhere to all applicable blaze orange requirements specified in references (d) or (e) during the regular firearms season. Outside the regular firearms season, and while on stand, bowhunters and muzzleload hunters must display solid blaze orange material (at least 100 square inches) at shoulder level within arms reach and visible from 360 degrees.

(b) Small game hunters are required to wear applicable blaze orange in accordance with references (d) or (e). Blaze orange is not required while dove or waterfowl hunting, or during the spring turkey season.

(c) During deer and small game season, trappers are required to follow blaze orange requirements as specified above.

(3) Vehicles/Parking

(a) WPNSTA Yorktown and Cheatham Annex. During shotgun deer season at WPNSTA Yorktown, designated Hunt Captains will transport hunters to their hunting area. Each Hunt Captain is responsible for the conduct and safety of his or her group and shall make sure the members of the group follow Federal and State regulations and this instruction. During other seasons, two personal operating vehicles (POVs) will be allowed per hunting area. The Natural Resources staff will register the vehicles and provide a dashboard pass the morning of the hunt authorizing POV entry into the restricted area. During all hunting seasons at Cheatham Annex, designated vehicle parking areas will be described during the indoctrination brief, and vehicle parking passes will be distributed. Hunting while parked in other than designated areas, or failure to display a parking pass while hunting, is prohibited. All parking passes must be returned to Natural Resources when checking out at the conclusion of the hunt.

(b) NAS Oceana, NALF Fentress, Dam Neck Annex and NAVSUPPACT Norfolk, Northwest Annex. Designated vehicle parking areas will be described during the required indoctrination. Vehicle parking passes will be distributed at hunter check-in. Parking in other areas, or without a displayed parking pass, is prohibited.

(4) General

(a) Drive-hunting deer, using hunters as drivers, without permission is prohibited. The Natural Resources Manager may organize and execute man-drives in situations where he deems population management is necessary.

(b) It is prohibited to hunt, carry a loaded weapon, or discharge a weapon within 150 yards of an occupied structure or horse trail, or within 200 yards of exposed working personnel, recreation areas, buffer zones, or roads. Hunting over horse trails is authorized at WPNSTA Yorktown, as trail-riding is not permitted on hunt days.

(c) Hunting or trapping while in possession or under the influence of alcohol, as defined by State law, or of any substance prohibited by Federal or State law, is likewise prohibited. Appropriate action will be taken to address personal accountability for all instances of alcohol and substance abuse. Similarly, smoking is prohibited in all hunting areas and in all Government buildings.

d. Dog Use and Training

(1) Training. As noted in reference (d), the training of dogs-on-live-wild-animals is considered hunting and is unlawful during the closed season.

(2) NAS Oceana, NALF Fentress, Dam Neck Annex and NAVSUPPACT Norfolk, Northwest Annex. Dogs shall not be used to hunt white-tailed deer. Dogs are permitted for use by small game hunters on NAS Oceana, NALF Fentress and NAVSUPPACT Norfolk, Northwest Annex and must be in control of the handler at all times.

(3) WPNSTA Yorktown and Cheatham Annex. Dogs may be used to hunt deer and small game only if approved in advance by the Natural Resources Manager.

(4) Waterfowl. Use of retrieving dogs is permitted and encouraged for waterfowl hunters on Dam Neck Annex although they will not be allowed to roam freely outside hunting locations.

(5) Vaccinations/Ownership. All hunting dogs must have current vaccinations and owner identification on the animal's collar.

e. Tree-Stands. Permanent tree-stands, or those affixed to trees by screws or nails, may be provided at WPNSTA Yorktown, Cheatham Annex, or NAVSUPPACT Norfolk, Northwest Annex. In addition, disabled veterans may contact the Natural Resources Staff at WPNSTA Yorktown regarding the availability of a wheelchair accessible tree stand. Use of this stand is reserved for disabled veterans, but the application process is the same for hunting in general. Permanent stands are prohibited on other COMNAVREG MIDLANT installations. Pruning of small limbs (less than two inches in diameter) is permitted around temporary tree-stands for safe bow limb clearance. Removal of large limbs or trees for creation of shooting lanes is prohibited. All temporary tree-stands, which must be clearly marked with the owner's name and permit number, are to be removed no later than 30 days from the completion of the hunting season.

f. Protected Wildlife. Protected wildlife, as defined by reference (f), such as songbirds, hawks, owls, eagles, gulls, herons, egrets, and vultures shall not be hunted or trapped at any time. Killing, capturing, or harassing other non-game species is prohibited. There shall be no open season on any wildlife except as specified by references (d) or (e) and this instruction.

g. Wildlife Harassment. Unless specifically needed to maintain flightline safety, wildlife harassment is prohibited at all installations.

h. Spotlighting. It is unlawful for any person to cast the rays of an artificial light as a hunting or trapping aid on any station field or woodland area at any time except for routine census checks conducted by the Natural Resources Manager.

i. Injured Wildlife. Injured wildlife shall be immediately reported to the Natural Resources Manager for determination of disposition. Hunters are required to make every possible effort to retrieve wounded deer. On NAS Oceana and NAVSUPPACT Norfolk, Northwest Annex, if a wounded deer is lost, hunters shall notify security. The Natural Resources Manager, Conservation Officers, Hunt Captains, and hunting and trapping program volunteers may offer assistance in tracking, if required.

6. Procedures

a. Hunting Licenses. Each hunter must possess a valid Virginia or North Carolina hunting license as appropriate. A big game license is required for deer and turkey hunting, and a migratory bird stamp and a Virginia Harvest Information Program (HIP) number is required for hunting waterfowl and other migratory birds.

b. Station Permits. In addition to a valid hunting license, a current station hunting permit is required of all persons who hunt or trap on board installations covered under this instruction. Each station permit will cover all authorized small and big game hunting allowed on the installation during the current hunting season. Annual permits are valid concurrent with the hunting licenses from 1 July through 30 June. Additional information on permits and hunting dates is available on the Navy Public Works Center (PWC) Norfolk website, www.norfolk.navy.mil/pwc.

(1) WPNSTA Yorktown and Cheatham Annex. All hunters on WPNSTA Yorktown or Cheatham Annex must possess a WPNSTA Yorktown Hunting Permit. Permits may be obtained for $10 from WPNSTA Yorktown Morale, Welfare and Recreation (MWR), Building 705, and Cheatham Annex MWR, Building 130. This permit covers all small and big game hunting on either unit.

(2) NAS Oceana, NALF Fentress, Dam Neck Annex, and NAVSUPPACT Norfolk, Northwest Annex. All hunters on NAS Oceana, NALF Fentress, Dam Neck Annex, or NAVSUPPACT Norfolk, Northwest Annex must obtain a NAS Oceana Hunting Permit. Hunting and

trapping permits are obtainable only from the Regional Engineer, Oceana Compliance Department staff located at the Natural Resources Center (NRC), Building 78, or Building 404 at NAVSUPPACT Norfolk, Northwest Annex. Permits are available for sale at all scheduled proficiency qualifications and indoctrinations. The cost for a hunting, trapping, or range-only permit is $20 per season. Purchase of a season permit allows use of the Archery Range at the NRC and covers all small game, big game, and waterfowl hunting on these installations.

(3) Upon submitting an application to hunt, individuals shall be required to sign a general release statement that relieves the Federal Government of liability in case of accident or injury. Individuals are responsible for having read and understood all applicable Federal, State, local and installation hunting regulations.

(4) All guests must adhere to application procedures specified in enclosure (2), obtain a valid installation hunting permit, and comply with all applicable qualifications as outlined below. Guests are the responsibility of their sponsor while hunting.

(5) For individuals under 18 years of age, a parent or legal guardian must sign the hunting application. Minors are the responsibility of their adult sponsor who holds a valid hunting permit. Dependents under the age of 12 must be in the same stand or in direct contact with the parent or legal guardian at all times while hunting.

c. Qualifications. Persons wishing to hunt deer with archery equipment, or muzzleloading rifles, or use shotgun slugs at NAVSUPPACT Norfolk, Northwest Annex, must complete an annual proficiency qualification. There is no qualification required of shotgun hunters not utilizing slugs. Qualification dates and times will be announced during the first weeks of August and September in installation plans of the week (POW) and will also be posted at the NAS Oceana NRC, Building 78; WPNSTA Yorktown Hunt Station, Building 53; and Cheatham Annex MWR, Building 130. Standards are provided in enclosure (3).

d. Site-specific Hunting Procedures. Enclosures (4) through (17) detail specific procedures for hunting various types of game at COMNAVREG MIDLANT installations.

7. Enforcement. On bases covered herein, Navy regulations, and Federal, State, and local game laws are enforced by Natural Resources Management personnel acting as Station Conservation Officers by authority of the IC. They have the power to

apprehend and arrest all violators of Federal, State, and station game laws and regulations. In addition, they have the authority to dismiss any hunter in violation of this instruction or whomever they consider unsafe for any reason. All violations of this instruction or other applicable laws and regulations shall be reported to the Installation Natural Resources Manager or Security Officer.

8. Review Authority. The Regional Engineer's Natural Resources Program Manager is responsible for the reviewing and updating of this instruction.

G. E. EICHERT
Chief of Staff

Distribution: www.cnrma.navy.mil

STATION PERMIT SUSPENSION/REVOCATION

A-1 POLICY. The privilege of hunting on COMNAVREG MIDLANT installations is governed by the IC of the appropriate installation.

A-2 AUTHORITY. The Natural Resources Manager and Conservation Officer(s) shall enforce regulations and have the authority to suspend or revoke hunting privileges as appropriate.

A-3 VIOLATIONS. The following is a list of common violations and administrative actions that may be taken against personnel who violate applicable State and Federal hunting and trapping laws and regulations, and this instruction. Permit suspensions may be in addition to criminal prosecution and/or prosecution through the Uniform Code of Military Justice. Suspensions are measured in "hunting days from date of violation." Penalties for the second offense are indefinite revocation of hunting privileges. ICs have unlimited authority to control access to their installations and provide for the safety and security thereof. Penalties for the first offense are listed below:

VIOLATION	ACTION
Violation of parking requirements, or parking in an unauthorized area	10 Days
Guest not accompanied by sponsor	30 Days
Violation of blaze orange requirements	30 Days
Littering	30 Days
First violation of any station regulation, not a violation of State regulations	30 Days
Violation of station permit procedures	60 Days
Unauthorized stocking or release of domesticated or wild animals	60 Days
Violation of check-in or check-out procedures	TERMINATION FOR SEASON
Hunting on unauthorized days	TERMINATION FOR SEASON
Hunting in unauthorized areas or unauthorized movement into other hunting areas or stands	TERMINATION FOR SEASON
Second violation of any station regulation, not a violation of State regulations	1 Year
Violation of any State or Federal Wildlife Statute	PERMANENT HUNTING BAN
Use of unauthorized weapons or ammunition	PERMANENT HUNTING BAN

HUNTING APPLICATION

1. **SEASON - CHECK ONLY ONE BOX PER APPLICATION:**
(Applications with more than one box check will be discarded.)

☐	☐	☐	☐	☐
SPRING TURKEY (Cheatham)	SPRING TURKEY (Yorktown)	GUN DEER (Cheatham)	BOW DEER (Cheatham)	GUN DEER (Yorktown)
Deadline: 15 MAR	15 MAR	1 NOV	15 SEP	1 NOV

2. **PREFERRED HUNTING DATE (List choices in priority order.):**

Date(s): _____
(Go to www.norfolk.navy.mil/pwc or call 887-7605 for available dates.)

3. **APPLICANT INFORMATION:**

NAME: _____

MIL ☐ OR CIV ☐ HUNTER SAFETY CARD NO. _____
(Check only one.) *(Attach photocopy with application.)*

COMMAND: _____

HOME MAILING ADDRESS: _____

_____

PHONE NUMBER: _____ (DAY) _____ (EVENING)

WPNSTA Yorktown PERMIT NUMBER: _____
(If obtained by date of application.)

4. **NAME OF GUEST (IF ANY) YOU WISH CONSIDERED ON THIS APPLICATION:**

NAME: _____ HUNTER SAFETY #: _____

5. **AGREEMENT:** By signing this application, I certify I have read, understand and will abide by COMNAVREGMIDLANTINST 11015.2 (Series) and all applicable State and Federal hunting laws. I consent to inspection at any time by duly authorized personnel (Navy, Federal, and State), for purposes of safety, security, or compliance with said instruction. Subject to penalties provided by law, I attest that I am not prohibited by Chapter 44 of title 18, U.S. Code, from possessing firearms or ammunition; and that the possession of firearms or ammunition will not violate a statute of the Commonwealth of Virginia or an ordinance applicable to the locality in which I reside. I attest that I have full knowledge of the risks and dangers involved in hunting and trapping, and hereby relieve the Federal Government of all liability for loss, damage, personal injury, or death sustained therein on board COMNAVREG MIDLANT installations. I agree that this release not only binds me, but also my family, heirs, assigns, administrators, and executors.

SIGNATURE: _____ **DATE:** _____

SIGNATURE: _____ **DATE:** _____ (Guest)

HUNTING APPLICATION INSTRUCTIONS

1. General. Print or type all required information except for signature. All information must be included. Applications must be mailed (or FAXED) and received at the following address by dates specified on the application. Late applications will not be considered unless available slots remain unfilled. **A photocopy of applicable military or Department of Defense (DOD) civilian identification, and hunter safety or IBEP card must be submitted with the application.**

For WPNSTA Yorktown or Cheatham Annex hunts:

Navy Public Works Center/Regional Engineer (Code 950)
9742 Maryland Avenue
Norfolk, VA 23511-3095

FAX: (757) 887-4478

2. Season. Check only one box per application. **If you wish to submit an application for more than one type of hunting, separate applications must be submitted.** Applications with more than one box checked in this section will be discarded.

3. Preferred Hunting Date. List preferred hunting dates. Available hunting dates may change for each calendar year based on State regulations and installation requirements. Go to **www.norfolk.navy.mil/pwc** for available dates or contact the Natural Resources Manager at WPNSTA Yorktown, (757) 887-7605.

4. Applicant Information. Print all information, including address and zip code. Ensure a block designating military or civilian is checked. List current station hunting permit number, if obtained.

5. Name of Guest. Eligible personnel may sponsor one guest while hunting deer or turkey. Guests must adhere to all application procedures, obtain an installation hunting permit and comply with all applicable qualifications. If an applicant is approved, the sponsored guest is also selected to hunt on that day. Include photocopy of guests hunter safety card.

6. Signature (Required). By signing page one of enclosure (2), applicants acknowledge they have read and understood this instruction and all applicable State and Federal hunting laws.

QUALIFICATION PROFICIENCY STANDARDS

1. BOWHUNTING

a. Archers shall be permitted up to three qualifying attempts per year. All attempts can be made on the same day if so desired.

b. Archers shall shoot two arrows each at three designated targets. Six arrows are required for any qualifying attempt. Qualification distances shall not exceed 25 yards.

c. On each target, one of two arrows must land inside a marked kill-zone. The shaft of an arrow breaking the line is a valid shot.

d. Arrows must be tipped with hunting broadheads, and equipment must be that to be used during the hunting season. All broadheads and shafts must match and be numbered with the last four digits of the archer's Social Security Number. Archers using mechanical broadheads can qualify with field points provided mechanical broadheads are presented at the qualification and used during the hunting season.

e. The bow hunting range shall be closed 30 minutes prior to all qualifications. No practice shots are allowed prior to the qualification period.

2. MUZZLELOADER/SHOTGUN SLUG

a. Participants shall be permitted one qualifying attempt per day. If more than one qualification shoot is scheduled for the year, shooters may attempt an additional qualification on the second day, within allotted range time, after all first time qualifiers have been given an initial attempt.

b. Participants may shoot up to three shots at the target from a bench rest distance of 50 yards. A 9" diameter target will have an internal 3½" diameter inner ring. Any shot inside the inner ring will be scored as 75 points and any in the outer ring will be scored as 50 points. Qualification consists of a minimum 125 point score. A shot breaking the edge of either ring is a valid shot.

c. Equipment used in qualifying shall be the same as that used for hunting.

d. No practice rounds permitted.

DEER HUNTING ON NAS OCEANA OR DAM NECK ANNEX

1. Season Dates/Hunting Hours. Unless specifically restricted by Natural Resources staff, seasons and hours will conform to those in reference (d). There shall be no hunting at NAS Oceana during, and two days prior to, the annual air show.

2. Area Closures. The Natural Resources Manager and/or the Security Officer may close specific areas at any time. Such announcements will be posted at NAS Oceana Security, Building 320 and at the Naval Resources Center (NRC), Building 78.

3. Indoctrination Brief. All persons wishing to hunt deer are required to attend an indoctrination brief given by the Natural Resources staff. This brief will help hunters familiarize themselves with hunting areas, base regulations, and all procedures not covered herein. These procedures are enforceable as indicated by enclosure (1). Dates for indoctrination will be posted at the NRC, Building 78, and in the NAS Oceana POW beginning in August.

4. Check-in Procedures

a. Each hunter shall sign-out at NAS Oceana Security, Building 320, for a specific area immediately before going into the field for hunting or scouting. Hunters may sign-out for an area as early as 1½ hours prior to sunrise. Hunters must report to the check station within 1½ hours after sunset of that hunting day or forfeit hunting privileges for the season. A hunter may not proceed to another hunting area without signing back-in and then back-out for the new area. Log forms must be completed at the end of each day's hunt. This includes information on hours hunted, game seen and harvested, and hunter identification.

b. Only one hunter shall be allowed in each hunting area for deer hunting unless a hunter is sponsoring a guest or hunters have prearranged with each other to hunt in the area. Hunters who plan to hunt in the same area must all be present at the time of check-in for an area.

c. Hunters shall be issued parking passes upon check-in for hunting areas. The parking pass must be displayed on the vehicle dashboard.

5. Permits/Application Process. No application other than purchase of the required State license and installation hunting permit is required.

6. Scouting

a. Scouting is permitted at any time during the year for individuals with a valid hunting permit. Scouting shall be

closed two weeks prior to the opening day of the regularly scheduled deer season, and may be closed at other times by the Natural Resources Manager or NAS Oceana Security Officer.

b. Individuals wishing to scout must report to NAS Oceana Security, Building 320, and check-out under the same procedures for hunting outlined above.

7. Handling of Harvested Game. Hunters may field-dress deer off station or in wooded areas where animals were harvested. No field-dressing is permitted within 200 yards of occupied buildings, roads, horse trails, agricultural areas, or within Airfield Clear Zone Boundaries.

8. Game Check-In. Per reference (d), a hunter harvesting a deer shall immediately attach the appropriate big game tag from their license or Deer Management Assistance Program (DMAP) tag to the animal before moving it from the place of kill. Successful hunters must contact the Natural Resource Manager (433-3461 or 433-2151 until 1600) to be issued a Virginia Department of Game and Inland Fisheries (VDGIF) Check Card and for collection of biological data from the animal. After 1600, the Natural Resources Manager may be contacted through NAS Oceana Security (433-3103). All check-in of deer will occur at the NAS Oceana NRC, Building 78.

DEER HUNTING ON NALF FENTRESS

1. Season Dates/Hunting Hours. Hunting at NALF Fentress is during the general Chesapeake firearms season unless otherwise designated by the Natural Resources Manager. Unless specifically restricted by Natural Resources staff, seasons and hours will conform to reference (d).

2. Area Closures. The Natural Resources Manager and/or Security Officer may close specific areas at any time. Such announcements will be posted at the Crash Captain's Watch Desk, Building 100, and the NAS Oceana NRC, Building 78.

3. Indoctrination Brief. All persons wishing to hunt deer are required to attend an indoctrination brief given by the Natural Resources staff. This brief will help hunters familiarize themselves with hunting areas, base regulations, and all procedures not covered herein. Dates for indoctrination will be posted at the NAS Oceana NRC, Building 78, NALF Fentress, Building 100, and in the NAS Oceana POW beginning in August.

4. Check-In Procedures. Hunters shall sign-out for a specific area as early as 1½ hours prior to sunrise at the Crash Captain's Watch Desk, NALF Fentress, Building 100, immediately before going into the field for hunting or scouting. Hunters must report to Building 100 within 1½ hours after sunset of that hunting day and complete a log form or forfeit hunting privileges for the season. A hunter may not proceed to another hunting area without signing back-in and then back-out for the new area.

5. Permits/Application Process. No application other than purchase of the required State license and installation hunting permit is required.

6. Scouting. Individuals wishing to scout must report to the Crash Captain, Building 100, and check-out for an area under the same procedures for hunting outlined above.

7. Handling of Harvested Game. Hunters may field-dress deer off station or in wooded areas where animals were harvested. No field-dressing is permitted within 200 yards of occupied buildings, roads, agricultural areas, or within Airfield Clear Zone Boundaries.

8. Game Check-In. Per reference (d), a hunter harvesting a deer shall immediately attach the appropriate big game tag from their license or DMAP tag to the animal before moving it from the place of kill. Successful hunter must contact the Natural Resource Manager (433-3461 or 433-2151 until 1600) to be issued a VDGIF Check Card and for collection of biological data from the animal. After 1600, the Natural Resources Manager may be contacted through NAS Oceana Security (433-3103). All check-in of deer will occur at the NAS Oceana NRC, Building 78.

DEER HUNTING ON WPNSTA YORKTOWN

1. Season Dates/Hunting Hours. Hunting is permitted only on Saturdays or specified Holidays that fall within the established Virginia hunting seasons, or on other dates within the established seasons as authorized by the Commanding Officer. The hunting day will be in accordance with reference (d), or as otherwise directed by the Natural Resources staff. A list of hunting days will be announced annually during the first week of August and September in the WPNSTA Yorktown POW and will also be posted at the WPNSTA Yorktown Hunt Station, Building 53, and Cheatham Annex MWR, Building 130.

2. Area Closures. The Natural Resources Manager and/or the Security Officer may close specific stands or areas at any time. Such announcements will be made during the Indoctrination Brief.

3. Indoctrination Brief. On the morning of the hunt, all hunters must first check-in by 0500 with the Natural Resources personnel at the WPNSTA Yorktown Hunt Station, Building 53, before proceeding to their assigned hunt area. Hunters will be given an indoctrination brief, assigned a marked stand, and taken to their assigned hunting stand by a designated Hunt Captain.

4. Check-In Procedures. Hunters shall remain within their assigned area. No hunter will be permitted to leave the stand unless the Hunt Captain is with them, except to return to the drop-off point, and/or collect and field-dress harvested game. No hunter shall solicit or accept a ride back to the Hunt Station by any individual other than their Hunt Captain. During the early archery season, all bowhunters will assemble at the WPNSTA Yorktown Hunt Station where they are scheduled to hunt at a time directed by the Natural Resources staff.

5. Permits/Application Process. In addition to the State license and installation permit, anyone wishing to hunt at WPNSTA Yorktown shall fill-out enclosure (2) and submit by stated application deadlines and according to directions. A drawing to select participants for each hunt will be held and successful applicants notified. In the event that all hunting spaces are not filled, the Natural Resources Manager may accept late applications.

6. Scouting. There is no scouting permitted on WPNSTA Yorktown.

7. Handling of Harvested Game. Hunters may retrieve and field-dress any deer taken within direct line-of-sight of their assigned stand. If a wounded animal leaves direct line-of-sight, the hunter should wait for arrival of a designated Hunt Captain before pursuing.

8. Game Check-In. Upon return from the hunting area, all hunters shall check-in at the Hunt Station, Building 53. Successful hunters will then report kills and exchange their license tab for an official VDGIF Check Card.

DEER HUNTING ON CHEATHAM ANNEX

1. Season Dates/Hunting Hours. Hunting is permitted on Wednesday beginning at 1200 and on Saturdays, or specified Holidays that fall within the established Virginia hunting seasons, or on other dates within the established seasons as authorized by Commanding Officer, WPNSTA Yorktown. The hunting hours will be in accordance with reference (d), or as otherwise directed by the Natural Resources staff. A list of hunting days will be announced annually during the first week of August and September in the WPNSTA Yorktown POW and will also be posted at the WPNSTA Yorktown Hunt Station, Building 53, and Cheatham Annex MWR, Building 130.

2. Area Closures. The Natural Resources Manager and/or the Security Officer may close specific stands or areas at any time. Adjustments to hunting days/hours may be made by the Natural Resources Manager as required. Such announcements will be made during the indoctrination brief.

3. Indoctrination Brief. Selected hunters shall assemble at a location specified by the Natural Resources Staff by 1130 Wednesdays or by 0430 on Saturdays on their scheduled hunt day. Hunters will be given an indoctrination brief, and be assigned a hunting area. Hunters will be issued a parking pass and map of their assigned hunt area showing the boundaries and the designated parking area, and at that point, may proceed to the field.

4. Check-In Procedures

a. Hunters shall remain within their assigned area. Hunters must check out in person at the conclusion of their hunt, no later than 1½ hours after sunset of that hunting day or as otherwise directed by the Natural Resources staff, or forfeit hunting privileges for the season. A hunter may not proceed to another hunting area without clearance from the Natural Resources staff. Temporary tree stands shall be removed from the woods at the conclusion of each hunt day.

b. Only one hunter will be allowed in each hunting area, except that individuals under 16 years of age may occupy the same area as their sponsor, but only one bow or gun will be allowed in each area.

5. Permits/Application Process. In addition to the State license and installation permit, anyone wishing to hunt at Cheatham Annex shall fill out enclosure (2) and submit by deadline dates, according to directions. A drawing to select participants for each hunt will be held and successful applicants notified. In the event not all hunting spaces are filled, the Natural Resources Manager may accept late applications.

6. Scouting. Scouting will be permitted in advance of the early archery season by contacting the WPNSTA Yorktown, Security Officer.

7. Handling of Harvested Game. All deer shall be field-dressed in the wooded area where the animal was harvested. Hunters may not pursue wounded animals beyond the boundaries of their assigned hunt area without permission from the Natural Resources staff.

8. Game Check-In. Per reference (d), a hunter harvesting a deer shall immediately attach the appropriate big game tag from his or her license or DMAP tag to the animal before moving it from the place of kill. All deer harvested must be checked in, at which time hunters will exchange their license tab for an official VDGIF Check Card.

DEER HUNTING ON NAVSUPPACT NORFOLK, NORTHWEST ANNEX

1. Season Dates/Hunting Hours. Hunting at NAVSUPPACT Norfolk, Northwest Annex is on Tuesdays, Thursdays, and Saturdays during the general Chesapeake or Currituck County firearms season unless otherwise designated by the Natural Resources Manager. Unless specifically restricted by Natural Resources staff, seasons and hours will conform to those listed in references (d) and (e).

2. Area Closures. The Natural Resources Manager and/or the Security Officer may close specific stands or areas at any time. Such announcements will be made during the indoctrination brief. MWR is responsible for notifying Natural Resources personnel and the Security Officer one week prior to scheduling use of campground areas.

3. Indoctrination Brief. All persons wishing to hunt deer are required to attend an indoctrination brief given by the Natural Resources staff. This brief will help hunters familiarize themselves with hunting areas, base regulations, and all procedures not covered in this instruction. Dates for indoctrination will be posted at the NAS Oceana NRC, Building 78, Northwest Annex, Building 404, and in the Northwest Annex POW beginning in August.

4. Check-In Procedures. Hunters shall sign-out for a specific area as early as 1½ hours prior to sunrise at Building 145, Northwest Annex, Security immediately before going into the field for hunting or scouting. Hunters must report to Building 145 within 1½ hours after sunset of that hunting day and complete a log form, or forfeit hunting privileges for the season. A hunter may not proceed to another hunting area without signing back-in and then back-out for the new area.

5. Permits/Application Process. No application other than purchase of the required State license and installation hunting permit is required.

6. Scouting. Individuals wishing to scout must report to Building 145, Security Office, and check-out for an area under the same procedures for hunting outlined above.

7. Handling of Harvested Game. Hunters may field-dress deer off station or in wooded areas where animals were harvested.

8. Game Check-In. Per references (d) and (e), a hunter harvesting a deer shall immediately attach the appropriate big game tag from their license or DMAP tag to the animal before moving it from the place of kill. Successful hunters must contact the Natural Resource Manager (421-8043 until 1600) to be issued a VDGIF Check Card and for collection of biological data from the animal. After 1600, the Natural Resources Manager may be contacted through Northwest Annex, Security (421-8000). All check-in of deer will occur at the game check station, Building 295.

WATERFOWL HUNTING ON DAM NECK ANNEX

1. Season Dates/Hunting Hours. Waterfowl seasons will be in accordance with all State and/or Federal seasons. All Federal bag limits and other migratory waterfowl regulations apply.

2. Blinds/Area Closures. Waterfowl hunters will be allowed to hunt only from duck blind locations maintained by the Natural Resources Manager. Blind locations will be posted at NAS Oceana, Security, Building 320, and the NRC, Building 78. Hunters may not hunt from shore, boats, or any area other than authorized blind locations. The Natural Resources Manager and/or the Security Officer may close specific blinds at any time. Such announcements will be posted at the Security Office, Building 320.

3. Check-in Procedures. Blinds will be drawn on a first-come basis on the opening day of each split season and the following Wednesdays and Saturdays during the season. Blind reservations shall not be accepted. Waterfowl hunters must check-out blinds at NAS Oceana, Security, Building 320, on the day they are hunting no earlier than 1½ hours before sunrise. Hunters must check-in with Security no later than one hour after sunset.

4. Permits/Application Process. All waterfowl hunters must have a Federal migratory duck stamp and Harvest Information Program (HIP) number in addition to their State hunting license and station permit.

5. Game Check-In. Upon return from the hunting area, all hunters shall check-in at the Security Office to turn in parking passes and report harvest information.

6. Restrictions. Boats used for waterfowling may be propelled by gasoline engines in Redwing Lake only; however, "no wake" limitations will be strictly enforced. Boats are not permitted on Lake Tecumseh unless written permission is obtained from the private landowner. For boating and personal safety, no more than four hunters are permitted to hunt from a duck blind.

SPRING TURKEY (GOBBLER) SEASON ON WPNSTA YORKTOWN

1. Season Dates/Hunting hours. Hunting is permitted on WPNSTA Yorktown on Saturdays during the established Virginia Spring Hunting Season for bearded birds only. All Virginia bag limits and regulations apply. The hunting day will be from 30 minutes before sunrise until 1200.

2. Indoctrination Brief. Selected hunters are to assemble at the Hunt Station, Building 53, on their scheduled hunt day at a time directed by the Natural Resources Manager. Hunters will be briefed and assigned a hunting area prior to going into the field.

3. Permits/Application Process. Due to security concerns, turkey hunting at WPNSTA Yorktown is restricted to Yorktown personnel only. There are a limited number of spaces available on each hunting day. Yorktown personnel wishing to hunt turkey at WPNSTA Yorktown shall fill-out enclosure (2) and submit according to directions. A drawing to select participants for each hunt will be held and successful applicants notified. A State license and installation permit is also required.

4. Game Check-In. Upon return from the hunting area, all hunters shall check-in at the Hunt Station, Building 53. Successful hunters will then report kills and exchange their license tab for an official VDGIF Check Card.

5. Restrictions. Electric callers are prohibited, as are dogs and organized drives.

SPRING TURKEY (GOBBLER) SEASON ON CHEATHAM ANNEX

1. Season Dates/Hunting hours. Hunting is permitted on Cheatham Annex on Wednesdays and Saturdays during the established Virginia Spring Hunting Season for bearded birds only. All Virginia bag limits and regulations apply. The hunting day will be from 30 minutes before sunrise until 1200.

2. Indoctrination Brief. Selected hunters shall assemble at the WPNSTA Yorktown Hunt Station, Building 53, on their scheduled hunt day at a time directed by the Natural Resources staff. Hunters will be given an indoctrination brief, and be assigned a hunt area. Hunters will be issued a parking pass and map of their assigned hunt area showing the boundaries, and at that point, may proceed to Cheatham Annex.

3. Permits/Application Process. There are a limited number of spaces available on each hunting day. Anyone wishing to hunt turkey at Cheatham Annex shall fill out and submit enclosure (2). Drawings to select participants for each hunt will be held and successful applicants notified. A State license and installation permit is also required.

4. Game Check-In. Hunters must remain within their assigned area. Hunters must check-out in person at the conclusion of their hunt, no later than 1230 or as directed by the Natural Resources staff, or forfeit hunting privileges for the season. A hunter may not proceed to another hunting area without clearance from the Natural Resources staff.

5. Restrictions. Electric callers are prohibited, as are dogs and organized drives.

6. Scouting. Scouting will be permitted in advance of the spring gobbler season by contacting the Cheatham Annex, Security Department.

SMALL GAME HUNTING ON NAS OCEANA

1. Season Dates/Hunting Hours. The small game season includes squirrel, rabbit, quail, dove, woodcock, and other species as authorized by Virginia game regulations. Virginia regulations regarding bag limits, seasons, and hours will be followed.

2. Area Closures. Except for dove hunting, small game areas will be open on Saturdays only during the regular small game season. While open to small game hunting, all deer hunting areas within the small game area will be closed. Open small game hunting areas will be posted at NAS Oceana, Security, Building 320, and the NRC, Building 78. The Natural Resources Manager and/or Security Officer may close specific areas at any time. Such announcements will be posted at NAS Oceana, Security, Building 320, and outside the NRC, Building 78.

3. Indoctrination Brief. Although an indoctrination brief is not required for small game hunters, all hunters should be familiar with hunting area boundaries and parking areas prior to hunting.

4. Check-In Procedures. Each hunter shall sign-out at Security, Building 320, for a specific area immediately before going into the field for hunting. Hunters may sign-out for an area as early as sunrise. Only one hunting party, consisting of up to four hunters, shall be allowed in a small game hunting area at any one time. To reduce pressure on game species, only two hunting parties shall be allowed in any small game area per day. Reservation of hunting areas shall not be accepted. Hunters shall be issued parking maps and parking passes upon check-in for hunting areas. The parking pass must be displayed on the vehicle dashboard. Upon return from the hunting area, all hunters shall check-in at the Security Office by sunset of that hunting day, complete the log form, and turn in parking passes.

5. Permits/Application Process. No application other than purchase of the required State license and installation hunting permit.

SMALL GAME HUNTING ON NALF FENTRESS

1. Season Dates/Hunting Hours. The small game season includes squirrel, rabbit, quail, dove, woodcock, and other species as authorized by Virginia game regulations. Virginia regulations regarding bag limits and seasons will be followed.

2. Area Closures. Small game areas will be open only after the general Chesapeake firearm season for deer is over. Except for dove hunting, hunting is permitted on Saturdays only during the regular small game season. The Natural Resources Manager and/or Security Officer may close specific areas at any time. Such announcements will be posted at the Crash Captain's Watch Desk, Building 320. These announcements will also be posted outside the NRC, Building 78.

3. Indoctrination Brief. An indoctrination brief is not required for small game hunters although all hunters should be familiar with hunting area boundaries and parking areas.

4. Check-In Procedures. Each hunter shall sign-out at the Crash Captain's Watch Desk, Building 100, for a specific area immediately before going into the field for hunting. Hunters may sign-out for an area as early as sunrise. To reduce pressure on game species, only one hunting party, consisting of up to four hunters, shall be allowed in a small game hunting area per day. Reservation of hunting areas shall not be accepted. Hunters shall be issued parking maps and parking passes upon check-out of a hunting area. The parking pass must be displayed on the vehicle dashboard. Hunters may only hunt in the area in which they have signed-out. Prior to hunting in another area, hunters are required to report back to the Crash Captain, Building 100, and turn-in hunting and parking passes. Hunters must report to Building 100 by sunset of that hunting day or forfeit hunting privileges for the season. Log forms must be completed at the end of each day's hunt. This includes information on hours hunted, game seen and harvested, and hunter identification.

5. Application Process. No application other than purchase of the required State license and installation hunting permit.

SMALL GAME HUNTING ON NAVSUPPACT NORFOLK, NORTHWEST ANNEX

1. Season Dates/Hunting Hours. The small game season includes rabbit, quail, dove, woodcock, and other species as authorized by Virginia or North Carolina game regulations. Virginia and/or North Carolina regulations regarding bag limits and seasons will be followed.

2. Area Closures. Small game areas will be open only on Saturdays after the general Chesapeake and Currituck firearm seasons for deer are over. Except for dove hunting, hunting is permitted on Saturdays only during the regular small game season. The Natural Resources Manager and/or Security Officer may close specific areas at any time. Such announcements will be posted at Building 145, Security, and outside the NAVSUPPACT Norfolk, Northwest Annex, Environmental Office, Building 404.

3. Indoctrination Brief. An indoctrination brief is not required for small game hunters although all hunters should be familiar with hunting area boundaries and parking areas.

4. Check-In Procedures. Each hunter shall sign-out at Building 145, Security, for a specific area immediately before going into the field for hunting. Hunters may sign-out for an area as early as sunrise. To reduce pressure on game species, only one hunting party, consisting of up to four hunters, shall be allowed in a small game hunting area per day. Reservation of hunting areas shall not be accepted. Hunters shall be issued parking maps and parking passes upon check-out of a hunting area. The parking pass must be displayed on the vehicle dashboard. Hunters may only hunt in the area in which they have signed-out. Prior to hunting in another area, hunters are required to report back to Building 145, Security, and turn in hunting and parking passes. Hunters must report to Building 145 by sunset of that hunting day or forfeit hunting privileges for the season. Log forms must be completed at the end of each day's hunt. This includes information on hours hunted, game seen and harvested, and hunter identification.

5. Application Process. No application other than purchase of the required State license and installation hunting permit.

SMALL GAME HUNTING ON WPNSTA YORKTOWN

1. Season Dates/Hunting Hours. Hunting is permitted only on Saturdays or specified Holidays prior to and immediately after the general firearms season for deer, which fall within the established Virginia hunting seasons, or on other dates within the established seasons as authorized by the Commanding Officer.

The hunting day will be in accordance with reference (d), or as otherwise directed by the Natural Resources staff. The small game season includes squirrel, rabbit, quail, dove, woodcock, and other species as authorized by Virginia game regulations. Virginia regulations regarding bag limits and seasons will be followed. While dove hunting is permitted on scheduled small game hunt days on WPNSTA Yorktown during the regular dove season, organized hunts are not planned.

2. Area Closures. The Natural Resources Manager will determine open areas.

3. Indoctrination Brief. Small game hunters are to assemble at the Hunt Station, Building 53, of the WPNSTA Yorktown unit on scheduled hunting days at a time directed by the Natural Resources Manager. Hunters will be briefed and assigned a hunting area prior to going into the field.

4. Check-in Procedures. Hunters are to assemble at the Hunt Station at the WPNSTA Yorktown unit where they will be briefed and assigned an area in which to hunt.

5. Application Process. No application, other than purchase of the required State license and installation hunting permit, is required. All hunters planning to hunt doves or woodcock must have a HIP number in addition to their State hunting license and station permit.

6. Game Check-In. All hunters will check back in at the Hunt Station before leaving for the day.

DOVE HUNTING ON NAS OCEANA, NALF FENTRESS, AND NAVSUPPACT NORFOLK, NORTHWEST ANNEX

1. Season Dates/Hunting Hours. Dove may be hunted on NAS Oceana, NALF Fentress, and NAVSUPPACT Norfolk, Northwest Annex on Tuesdays, Thursdays, Saturdays, and designated Holidays during the open seasons. Bag limits, seasons, and times are subject to annual change.

2. Area Closures. Availability of open fields is dependent on various factors including weather, crop type, and maturity. The Natural Resources Manager will be responsible for determining field availability and rotation schedule. Dove field locations change from year to year. For NAS Oceana, locations shall be posted at Security, Building 320, and the NRC, Building 78. For NALF Fentress, locations shall be posted at the Crash Captain's Watch Desk, Building 100. For NAVSUPPACT Norfolk, Northwest Annex, locations will be posted at Buildings 145 and 404. Hunter quotas may be assigned to each area for dove hunting. These quotas shall be posted, if applicable, at the Hunter Check Station.

3. Indoctrination Brief. An indoctrination brief is not required for small game hunters although all hunters should be familiar with hunting area boundaries and parking areas.

4. Check-in Procedures. Due to high response for opening day of the season, all NAS Oceana check-in for that day will be conducted at the NRC, Building 78. Hunter quotas and areas will be assigned at this time. Hunting check-in after that day will be at Building 320. NALF Fentress hunters will check-in at Building 100, and NAVSUPPACT Norfolk, Northwest Annex hunters will check-in at Building 145. Upon return from the hunting area, all hunters shall check-in at the Security Office or the Crash Captain's Watch Desk, NALF Fentress to turn in parking passes and report harvest.

5. Permit/Application Process. All dove hunters must have a HIP number in addition to their State hunting license and station permit.

TRAPPING AT NAS OCEANA, NALF FENTRESS, DAM NECK, OR NAVSUPPACT NORFOLK, NORTHWEST ANNEX

1. Season Dates/Hunting Hours. Trappers must abide by State laws, this instruction, and any other special regulation announced by the Natural Resources Manager.

2. Area Closures. The Natural Resources Manager will designate trapping areas and, in coordination with the Security Officer, may restrict access to these areas.

3. Check-In Procedures. Prior to checking traps, trappers must check-in at the Security Watch Desk, Building 320, NAS Oceana, Building 551, Dam Neck Annex, or Crash Captain's Watch Desk, Building 100, NALF Fentress.

4. Permit/Application Process. Any person wishing to trap furbearers must register and submit a request for area assignment with the NAS Oceana Natural Resources Manager. Trappers may request trapping areas on or after 1 October of each year. Drawings for trapping areas shall be held when it is anticipated that the demand for areas exceeds quotas.

5. Restrictions

a. A nonferrous metal tag bearing the trapper's name and address must be attached to each trap. Traps not marked risk confiscation by the Conservation Officer or Natural Resources Manager.

b. Traps must be checked at least daily.

c. No steel trap or snare shall be set within 200 yards of a residence or within a designated Special Services area, such as the picnic area or Boy Scout camping area.

d. The use of body-gripping traps with a jawspread in excess of 7½" is prohibited except when such traps are completely covered by water.

e. It is prohibited to set above the ground any steel trap with teeth set upon the jaws or with a jaw spread exceeding 6½", or any body-gripping trap with a jaw spread in excess of 5", baited with any lure or scent likely to attract a dog.

f. No trap or snare may be set in hunting areas on days that rabbit, quail, or dove are hunted unless traps remain covered by at least 6" of water at all times.

g. Dens or houses of furbearers may not be disturbed.

h. Trappers must report weekly catch in writing during the season to the Natural Resources Manager. Trappers should provide information on sex, weight, and condition for each animal taken.

i. Animal carcasses shall be disposed of off station. Any trapper caught disposing of carcasses on station shall lose all trapping privileges.

NAS OCEANA/NASO DAM NECK ANNEX/NALF FENTRESS/NSAHR NORTHWEST ANNEX

DEER HUNTING RULES AND REGULATIONS

2015-2016 SEASON

SHOW SOMEONE THE JOY OF HUNTING THIS YEAR.
HAVE FUN, BE SAFE AND FOLLOW THE RULES!

TABLE OF CONTENTS

REMINDERs:

- *Private Firearms Registration REQUIRED for ALL Personal Weapons Brought on Installation including in association with Hunting, Trapping, Fishing and Archery Range Shooting.*
- *Hunters must follow all State and Base Hunting Regulations/Instructions. Base regulations cannot be more lenient than the State Regulations; however Base regulations can be and are stricter than State Regulations. Be sure to be in compliance with both sets of regulations.*
- *Dogs are not authorized for the use of hunting deer on base.*
- *Coyotes may be taken at NASO in accordance with State Laws.*
- *Sunday hunting has not been authorized for the 2015-2016 hunting seasons.*

CHANGES AND UPDATES:

- ***Private Firearms Registration REQUIRED for ALL Personal Firearms/Weapons Brought on Installation. See Section IV. of this document for details.***
- *Please be sure to obtain the most Current Version of the hunting area Maps, prior to commencing your hunt. Hunting areas/stands, parking locations and access roads are being updated.* ***Current Maps will be available at the Natural Resources Center on Oceana Blvd (Bldg 78) and will posted to the websites identified in section XVII. of this document as soon as possible.***
- ***NALFF Hunting areas 18, B-4, and B-5have been closed to hunting*** *until this area is no longer classified as an UXO area.*
- ***NASO DNA Hunting area 25 has been closed to hunting*** *until this area is no longer classified as an UXO area.*
- ***NALFF Hunting areas 10, 20, 21, and B-1 have been impacted due to Tree Removal Activities*** *and may no longer have trees available for establishing required safe tree stand heights and locations for elevated shooting requirements. Please scout these areas accordingly.*
- ***YOUTH Hunt, 26 Sept 2015. NSAHR NWA, Virginia Side ONLY****, will be participating in the VA Youth and Apprentice Deer Hunting Day. All State and Installation Regulations Apply.*

REFERENCES:

[Note: Some of these references are dated. This Deer Hunting Rules & Regulations (R&Rs) document has been prepared to help inform hunters of current processes that may have changed since the below documents were prepared. This R&Rs document does not include all detailed information contained within the below references.]

- COMNAVREGMIDLANTINST 11015.2A
- OPNAVINST 5090.1D and Manual 5090.1
- NASO/NALFF Integrated Natural Resources Management Plan (INRMP)
- NASO DNA INRMP
- NSAHR NWA INRMP
- COMNAVREGMIDLANTINST 5820.2
- NASOINST 8000.16B
- Code of Virginia (http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+TOC2901000)
- Game Department Regulation Manual (http://leg1state.va.us/000/reg/TOC04015.htm)
- Hunting & Trapping in Virginia July 2015 – June 2016 Digest (http://www.dgif.virginia.gov/hunting/regulations/)
- North Carolina Inland Fishing, Hunting and Trapping Regulations Digest August 2015 to July 2016 (http://www.ncwildlife.org/Hunting/LawsSafety.aspx)
- NASO,NASO DNA, NALFF, NSAHR NWA, JEBLC, JEBLC-FS Natural Resources Program Hunting, Fishing, Trapping, Archery Range Permit Application
- NASO/NALFF/NASO DNA/NSA NWA Hunting/Trapping/Archery Permit

I. CHECK OUT AND CHECK IN OF A HUNTING AREA:

- NAS Oceana (NASO) and NASO Dam Neck Annex (DNA) hunters must check out a hunting area from NASO Security, Bldg 320.
- NALF Fentress (NALFF) hunters must check out a hunting area from NALFF Quarterdeck, Bldg 100.
- NSAHR Northwest Annex (NWA) hunters must check out a tree stand from NWA Quarterdeck, Bldg 145. Hunting is by tree stand number and not area at NWA.
- Checking out an area or tree stand is allowed 1 ½ hours before sunrise and you must be checked back in 1 ½ hours after sunset. Check posted sunrise/sunset times.
- You can only check out an area if you intend to hunt.
- Scouting is authorized during preseason scouting, during hunting season, and on Sundays during hunting season. Must check in/out areas as if hunting.
- Checking areas out in the morning before work and then keeping it checked out all day for an evening hunt is not authorized.
- Random checks will be conducted by the Conservation Law-enforcement Officer (a.k.a. Game Warden).
- Check out process:
    1. Give your base hunting pass to Security or the Quarterdeck watch and tell them what area or tree stand you would like to hunt.
    2. Provided the area or tree stand is not checked out, you will receive a laminated parking pass, a laminated hunting pass (to be kept on your person while in the field) and a key if gate entry is required. Parking for areas 1-13 at DNA requires access via a gate that has a combination lock on it. Ask for the combination if you are hunting one of those areas. All locks must be "piggy backed" so that base contract workers, Security, Fire, etc. have access through the gates as well as hunters. This involves linking locks together to the chain in a manner that allows all locks to be opened and access granted through the gate. (Example: Chain end 1 connects to lock 1, lock 2 connects to lock 1 and chain end 2 connects to lock 2.)
    3. Security or the Quarterdeck watch will place your base hunting pass on the hunter check out board for accountability purposes.
    4. You must sign out the area or tree stand in the logbook provided and write down your name, base pass number, hunting area or tree stand and Deer Management Assistance Program (DMAP) or Deer Population Reduction Program (DPOP) tag number, if you requested one.
- If you get a DMAP or DPOP tag, and do not use it to tag an animal, you must turn it back in when you go to check in from your area. Do not keep it. DMAP and DPOP tags are for ANTLERLESS DEER ONLY.
- When you go to check back in from your area or tree stand, return the parking pass, hunting area pass, access key and DMAP or DPOP tag if you had one. Sign "in" in the logbook by writing down the time you returned and Security or the Quarterdeck watch will return your base hunting pass. Security may ask you for a form of identification to ensure you get the correct permit. **Verify that you receive your own hunting permit back from Security.**
- If you killed a deer, let Security or the Quarterdeck watch know and they will page the duty beeper/phone so you can go and check in your deer. If

you used a DMAP or DPOP tag to tag your animal, let Security or the Quarterdeck watch know so they don't expect you to turn the DMAP or DPOP tag back in. DMAP and DPOP tags are for Antlerless deer only. **If you harvest more than one doe you must be issued an additional DMAP or DPOP tag from Security. Every antlerless deer killed must be checked in with a DMAP or DPOP Tag until all base DMAP or DPOP tags have been exhausted.**

- For gun hunting, if more than one person is going to hunt in an area or tree stand, the area must be checked out at the same time to both hunters.

II. STAND AND BLIND REGULATIONS:

1. Lock on, chain on and ladder stands are authorized and must be stenciled clearly with your last name, base permit number and phone number.
2. Screw in steps and removable ladder steps are authorized. No large nails or spikes may be driven into the tree where your stand is located.
3. Tree stands may be hung during the scouting season or on the day that you hunt and can be left up all season.
4. Tree stands, screw in steps and ladder steps must be removed within 30 days after the season ends.
5. Tree stands must be placed at least 12' off the ground.
6. Ground blinds are authorized and may be used for bow hunting only.
7. All gun hunting (shotgun or muzzleloader) and crossbow hunting must be done from a tree stand. No shooting from the ground with any type of gun or crossbow.
8. Permanent tree stands may still be in place at NASO, DNA, and NALFF. These stands are not maintained, may be unsafe, and are not authorized for use. **Do Not USE these stands.**
9. NWA has permanent stands that are maintained on a regular basis. These stands **ARE** authorized for use. Stands are identified on the base hunting map for checkout. Stands that have been designated unsafe will not be authorized for check out regardless of if they are identified on the map. Before utilizing a permanent stand, ensure the tree stand ID number on the stand matches the tag issued to you at check-in and matches the current Hunt Stand Map. Do not use permanent tree stands that have not been issued to you.

III. PARKING AND SERVICE ROAD USE:

1. Park in designated areas only. Place parking pass in the front window of your vehicle. Parking areas are marked by a 12" by 12" yellow sign that will be attached in plain site on a tree, fence or post.
2. Locations of parking areas are designated on the base hunting maps. Do not park in front of any locked gates or park in such a fashion that will block access (i.e., to roads, buildings, etc.).
3. Service roads are not to be driven on, except to get to designated parking areas. Only authorized vehicles for Official Government Business are authorized to utilize these roads.
4. You may not drive on a service road with your vehicle to go pick up game that you may have harvested.
5. You may walk on service roads to get to and from your hunting area or tree stand.
6. Deer hauling carts are authorized for use on service roads.

IV. WEAPONS REGULATIONS:

- **REGISTRATION:**
  Starting 01 January 2015 no hunters will be allowed on the installations with a personal firearm/weapon that has not been registered with Navy Security.
  a. To register your weapon please fill out the registration paperwork found in the enclosures of COMNAVREGMIDLANTINST 5820.2 and take it to NAS Oceana Security, Bldg 320, for processing.
  b. Once Security has completed the review of the paperwork and you have met all of the requirements to be authorized to carry a weapon on the installation you will be issued a CNRMA Regional Security Directorate Authorization to Carry Private Firearms permit/card.
  c. You will need to have this card with you whenever you are carrying your weapon on the installation.
  d. You will need to present this card to Gate Guards when accessing an installation.
  e. You will need to present this card when approached by law enforcement officers.
  f. You will need to present this card at each weapons qualification event.
  g. If you do not have this card with you and you have your weapon on base you are subject to penalties as defined in COMNAVREGMIDLANTINST 5820.2, and NASOINST 8000.16B.
  h. There will not be a sign-up list to attend the 2015-2016 Hunting Weapons Qualifications that will allow you access with an Unregistered Weapon.
- **NASO (NAS Oceana):**
  a. ***No shotguns!***
  b. Muzzleloader, Bow and Crossbow only.
    i. Archery equipment must be hand-held and hand-drawn (release aids are permitted).
    ii. Muzzleloader must be .45 caliber or larger, loaded from the muzzle of the gun. Muzzleloader hunting is authorized 6 days a week during state approved seasons in **DESIGNATED AREAS ONLY**. Follow State Hunting Regulations regarding Authorized Muzzleloader weapon utilization.
- **DNA (NASO Dam Neck Annex):**
  a. Bow, Shotgun, Muzzleloader and Crossbow are authorized.
    i. Archery equipment must be hand-held and hand-drawn (release aids are permitted).
    ii. Shotguns must be 20-gauge or larger and used with buckshot (#1, 0, 00, and 000) only. **NO SLUGS!**
    iii. Muzzleloader must be .45 caliber or larger, loaded from the muzzle of the gun. Muzzleloader hunting is authorized 6 days a week during state approved seasons in **DESIGNATED AREAS ONLY**. Follow State Hunting Regulations regarding Authorized Muzzleloader weapon utilization.
- **NALFF (NALF Fentress):**
  a. Bow, Shotgun, Muzzleloader, and Crossbow are authorized.

i. Archery equipment must be hand-held and hand-drawn (release aids are permitted).
ii. Shotgun must be 20-gauge or larger and are authorized with buckshot (#1, 0, 00, and 000) or slugs **(must qualify with slugs).**
iii. Muzzleloader must be .45 caliber or larger, loaded from the muzzle of the gun. Muzzleloader hunting is authorized 6 days a week during state approved seasons in **DESIGNATED AREAS ONLY**. Follow State Hunting Regulations regarding Authorized Muzzleloader weapon utilization.

- **NWA (NSAHR Northwest Annex):**
  a. Bow, Shotguns, Muzzleloader and Crossbow are authorized.
    i. Archery equipment must be hand-held and hand-drawn (release aids are permitted).
    ii. Shotgun must be 20-gauge or larger and are authorized with buckshot (#1, 0, 00, and 000) or slugs **(must qualify with slugs).**
    iii. Muzzleloader must be .45 caliber or larger, loaded from the muzzle of the gun. Muzzleloader hunting is authorized 6 days a week during state approved seasons in **DESIGNATED AREAS ONLY**. Follow State Hunting Regulations regarding Authorized Muzzleloader weapon utilization.
- **The use of centerfire and rimfire rifles or handguns for hunting is prohibited on all bases.**
- Shotguns, muzzleloaders, bows and crossbows are allowed on base as long as you have your base hunting permit with you and the make, model and serial number of the weapon is written on the back of your base hunting permit.
- Extensions to increase shell holding capabilities of a weapon is **NOT** authorized. Weapon shell loading is limited to the weapon's original manufacturer's holding capacity, for deer hunting. The three shell rule still applies to migratory birds. Guns must be completely unloaded while transiting on and off base and walking to and from your hunting area. Load only after getting in your tree stand.
- **No smokeless powder authorized in any type of muzzleloader hunting!**
- Muzzleloaders must be uncapped but may be loaded with powder and a bullet while transiting on and off base. The cap/primer must be removed while going to and from your hunting area. Install the cap/primer only after you get into your tree stand.
- **All weapons when not in use must be secured inside of a locked vehicle or locked camper shell/truck bed cover and not left in plain sight.**

V. QUALIFICATIONS AND LICENSING REQUIREMENTS:

1. All hunters must attend base Hunter Indoctrination (INDOC) annually. This 45 minute indoctrination is normally held at the CNATTU auditorium three times before hunting season starts (August – September). 1 additional INDOC will be held at NWA. Attending this indoctrination will allow you to hear all changes to the rules and regulations during the past year. INDOC will allow you to hunt with a shotgun using buck shot at DNA, NALFF or NWA (once you have acquired the base hunting permit from MWR and the appropriate state permits). See the posted Annual Training and Qualifications Calendar for dates, times, and locations for all Base required training and weapons qualifying.
2. All muzzleloader hunters must qualify yearly at a 50 yard target.

- Muzzleloader qualifications are held at the DNA shooting range twice a year before the season starts.
- Each hunter must score 150 points and is allowed three shots. Each bull's eye shot is worth 75 points and each shot on the paper plate not in the bull's eye is worth 50 points.
- Once you qualify with a muzzleloader you will be able to hunt any base that allows muzzleloader hunting.

3. All bow hunters must qualify yearly.
   - Bow qualifications are held several times before the hunting season starts and once after the season starts.
   - Your equipment will have a safety inspection performed on it by a board member prior to qualification. Your arrows must be marked with the last four digits of your social Security number in permanent ink or etched on the shaft. The same applies during hunting season.
   - Four deer targets will be placed at different distances from the stand at the Natural Resource Center. Targets will range from a nearly straight down shot out to approximately 25 yards.
   - Each prospective bow hunter will get two shots at three of the deer targets and must put one arrow in the kill zone as determined by the board member present.
   - Three attempts are allowed to qualify.
   - You must have 6 arrows and 6 broad heads of the same type to attempt the bow qualification.
4. All crossbow hunters must qualify yearly.
   - Crossbow qualifications are held several times before the hunting season starts and one after the season starts.
   - Your equipment will have a safety inspection performed on it by a board member prior to qualification. Your arrows must be marked with the last four digits of your social Security number in permanent ink or etched on the shaft. The same applies during hunting season.
   - Four deer targets will be placed at different distances from the stand at the Natural Resource Center. Targets will range from a nearly straight down shot out to approximately 25 yards.
   - Each prospective crossbow hunter will get two shots at three of the deer targets and must put one arrow in the kill zone as determined by the board member present.
   - Three attempts are allowed to qualify.
   - You must have 6 arrows and 6 broad heads of the same type to attempt the crossbow qualification.
5. Shotgun slug hunters must qualify yearly at a 50 yard target.
   - Slug qualifications are held at the DNA shooting range twice a year before the season begins (completed at the same time as the Muzzleloader qualification).
   - Each hunter must score 150 points. Each bull's eye is worth 75 points and each shot on the paper plate not on the bull's eye is worth 50 points.
   - Each person is allowed three shots.
   - Once you qualify with a slug you will be able to hunt NWA and NALFF as these are the bases in the area that allow hunting with slugs.
6. Each hunter must purchase a base hunting pass from the ITT ticket Office at NASO or DNA, ($20), a license to hunt in VA (from an authorized state license vendor), and a state big game hunting license (from an authorized state license vendor) with the appropriate bow, crossbow and muzzleloader stamps if you intend to hunt with those types of weapons on base.

7. Every hunter must present a Hunter's Safety course card (any state will do, all bow and crossbow hunters must present a Bow Hunter safety course card, and after 01 Jan 2015 all hunters must present their CNRMA Regional Security Directorate Authorization to Carry Private Firearms card prior to having a board member stamp your base hunting pass. Before you can hunt, a board member must stamp the back of your base hunting pass with a "deer hunter", "archery", "muzzleloader," "slug" or "crossbow" stamp, depending on what weapon(s) you qualified and with which you intend to use for hunting. The "deer hunter" stamp is used if you are a shotgun hunter only, using buck shot only at NALFF, DNA or NWA.
8. On the back of your base hunting pass, you must write the make, model and serial number of each weapon with which you qualified. The hunting pass must be laminated with the lamination paper provided by the board member after your pass has been fully stamped and approved.
9. **You cannot qualify with more than one muzzleloader or one slug shotgun. You can only qualify with one compound bow. In addition to the one compound bow, you can qualify with one other type of bow i.e. recurve and can hunt with both during the season. You may qualify with only one crossbow.**

VI. TRACKING:

1. If you cannot find an animal after shooting it on an evening hunt and further tracking is required, you must contact Security or the Quarterdeck within 1 ½ hours after sunset.
2. If you are unable to find your animal within 2 hours after sunset inform Security you have wounded an animal and need to red tag the area. They will place a red tag on the area so it cannot be checked out the following morning by another hunter.
3. Once you red tag an area you must return the following morning, check out the area that was red tagged to continue tracking your animal.
4. No weapons are allowed back in your hunting area while tracking an injured animal.
5. Tracking time will be allowed until 1200 hours on the day you checked out the area for tracking purposes.
6. If the animal you are tracking goes outside of your area, you must red tag that area. Do not track into another area if you do not have it checked out.
7. You may retrieve a harvested animal that runs into any open field adjacent to the area you are hunting, except if it is part of an airfield/runway clearing or part of another hunting area.
8. Do NOT enter Airfield/Runway Clearings. If your deer runs out and drops in the airfield clearing area, notify the Security Office Immediately, so that the appropriate Natural Resources Staff can assist you with obtaining your animal.

VII. CHECKING IN GAME:

1. All area bases that allow hunting operate under the guidance of the Deer Management Assistance Program (DMAP) or the Deer Population Management Program/Damage Control Assistance Program (DPOP/DCAP); therefore, all deer killed on area bases must be checked in. NASO participates in DPOP/DCAP. DNA, NALFF, and NWA participate in DMAP.
2. If you killed a deer, let Security or the Quarterdeck watch know and they will page the duty beeper/phone so you can go and check in your deer. If you used a DMAP or DPOP tag to tag your animal, let Security or the Quarterdeck watch know so they don't expect you to turn the DMAP or DPOP

tag back in. DMAP and DPOP tags are for Antlerless deer only. **If you harvest more than one doe you must be issued an additional DMAP or DPOP tag from Security. Every antlerless deer killed must be checked in with a DMAP or DPOP Tag until all base DMAP or DPOP tags have been exhausted.**

3. All deer shot on NASO, DNA and NALFF will be checked in at the NASO Natural Resource Center (NRC), Bldg 78 (across from the horse stables).
4. All deer shot at NWA will be checked in at the Deer Check Station, Bldg 295.
5. The check-in process will consist of a SQMB member, Natural Resources authorized volunteer, a Conservation Law-enforcement Officer, or other Navy Natural Resources Program staff member (whoever is on duty at the time) removing the deer jaw bone, weighing the deer and taking down other information required in support of the DMAP program. Normally the process takes about 10 minutes.
6. To check your deer in with the state of Virginia, call 1-866-GOT-GAME prior to arriving at the NRC building to help expedite the process. Have your confirmation number available prior to checking in your animal, if possible. Remember to correctly select DMAP or DPOP as appropriate.
7. Whether a buck or doe, leave all genitals on the deer you shoot to ensure proper sex identification.

VIII. HUNTING SEASON DATES:

- **NASO and DNA, Regular Deer Hunting Season:** will be 01 OCT 2015 – 02 JAN 2016.
  - Hunting Only Occurs Monday-Saturday during authorized seasons.
    - Note: Small Game Hunting is authorized on Saturdays at NASO ONLY.
  - Archery Seasons are 03 Oct 2015 – 13 Nov 2015 and 01 Dec 2015 – 02 Jan 2016. Archery is also authorized during firearm and muzzleloader seasons. **A Bow Permit is required for later Archery season.**
  - General Firearms season is 01 Oct 2015 – 30 Nov 2015.
  - Late Muzzleloader Season is 12 Dec 2015 – 02 Jan 2016.
- **NASO ONLY, Extended Deer Hunting Season:** will be from 03 JAN 2016 – 28 FEB 2016. (Muzzleloader, bow and crossbow will be allowed six days a week (Mon-Sat) in designated areas for harvest of antlerless deer only.)
- **NALFF Deer Hunting Season:** will be 01 OCT 2015 – 02 JAN 2016.
  - Hunting Only Occurs Monday-Saturday during authorized seasons.
    - Note: During Late Muzzleloader Season Saturdays are reserved for Small Game Hunting ONLY.
      - **NO Squirrel Hunting at Anytime!**
  - Archery Seasons are 03 Oct 2015 – 13 Nov 2015 and 01 Dec 2015 – 02 Jan 2016. Archery is also authorized during firearm and muzzleloader seasons. **A Bow Permit is required for later Archery season.**
  - General Firearms season is 01 Oct 2015 – 30 Nov 2015.
  - Late Muzzleloader Season is 12 Dec 2015 – 02 Jan 2016.
    - During Late Muzzleloader Season, bow, crossbow, and muzzleloader will be allowed Monday-Friday ONLY.
    - **During Late Muzzleloader Season Saturdays are reserved for Small Game Hunting ONLY.**
- **NWA Deer Hunting Season:** will be 01 OCT 2015 – 02 JAN 2016 (VA side); 12 SEP 2015 - 01 JAN 2016 (NC side)
  - Hunting Only Occurs on Monday, Tuesday, Thursday, and Saturdays during authorized seasons.

        - Note: Small Game Hunting is only authorized after the deer hunting season, only on Saturdays, and only on VA side.
            - **NO Squirrel Hunting at Anytime!**
    - Virginia Side:
        - Archery Seasons are 03 Oct 2015 – 13 Nov 2015 and 01 Dec 2015 – 02 Jan 2016. Archery is also authorized during firearm and muzzleloader seasons. **A Bow Permit is required for later Archery season.**
        - General Firearms season is 01 Oct 2015 – 30 Nov 2015.
        - Late Muzzleloader Season is 12 Dec 2015 – 02 Jan 2016.
    - North Carolina Side:
        - Archery Season is 12 Sep 2015 – 02 Oct 2015.
            - Archery is authorized during both Muzzleloader and Gun Seasons.
        - Muzzleloader Season is 03 Oct 2015 to 16 Oct 2015.
        - Gun Season is 17 Oct 2015 – 01 Jan 2016.
- **NWA Youth Deer Hunt:** will be 26 Sep 2015 (VA side ONLY.)
- **Scheduled Hunting Closures During Authorized Seasons (NO Hunting, Unless Otherwise Authorized):**
    - Sundays (Scouting is authorized)
    - Thanksgiving Day (NWA may authorize until Noon)
    - Christmas Day

IX. HUNTING AREA LOCATIONS and RESTRICTIONS:

- NWA is the only base which utilizes permanent tree stands when assigning certain hunting locations.
- **Hunting area boundaries without assigned permanent tree stands** are identified by a red/white/red band marked with spray paint on a series of trees. This marked tree line defines your hunting area boundary.
- **#of Hunters Per Hunting Area:**
    - A maximum of 2 muzzleloader hunters per area is authorized. Check-in must be at the same time.
    - A maximum of 4 bow hunters per area is authorized.
    - 1 muzzleloader hunter and 1 bow hunter in the same area is authorized. Check in must be at the same time.
    - A maximum of 2 Shot-gun hunters per area is authorized. Check-in must be at the same time.
- Know your area boundaries and stay inside of it during your entire hunt.
- Ensure you are utilizing the most current Hunting Area Map to identify your Hunting Area, parking, and access-ways.
- Shoot only inside of your area. Shooting out into fields and/or other hunting areas that border the area is not authorized.
- Do not cut across farmer's fields, to get to your hunting area.
- Follow all State Regulation Fire Arm Ordinances regarding weapons discharge distances from buildings, dwellings, places of worship, roadways, streets, public land/public areas, etc. In addition to statewide requirements, ensure to comply with any locality (Virginia Beach, Chesapeake, and Currituck Co., as appropriate) requirements that are identified in the associated State Hunting Regulations.

X. SCOUTING:

1. Preseason scouting will follow the end of the previous hunting season and end two weeks prior to the pending hunting season.
2. During this time, you are allowed to scout any area that you would like to hunt.
3. You must use the exact same check out and check in process as is required during the normal hunting season.
4. This is the time to hang your lock on, chain on and ladder stands if you desire. Reminder, putting a stand in an area does NOT guarantee you being able to hunt that particular area. It is on a first come first served basis.
5. Scouting during the hunting season on Sundays is allowed. All area bases are closed to hunting on Sundays.
6. Scouting and Hunting can be secured at anytime (Sunrise to Sunset) during the preseason or regular season, depending on base operations. Secured areas will be marked with a black tag and access will NOT be authorized.

XI. QUALITY DEER MANAGEMENT (QDM):

1. QDM is voluntary and **HIGHLY encouraged** at NASO, DNA, NALFF, and NWA.
2. For those that would like to participate in QDM, the QDM program recommends criteria on Buck takes (mature buck takes only) and encourages the take of does or antlerless deer. If archery hunting, a Buck should have antlers outside the ears and be at least 6 points. If Black Powder hunting, a buck should have antlers outside the ears and be at least 8 points. Take as many does as possible (utilize all antlerless deer tags available).
3. NASO is part of the State Deer Population Control Program (DPOP). This program is an integral part of deer management on NASO. This program extends the hunting season for an additional two Months (Jan & Feb). This program emphasizes the take of does through the use of State issued tags to each base. These tags are 1st come 1st served. These tags allow you to save your State Issued tag for that special buck, while enabling you to collect deer meat. You are not limited to 1 DPOP tag. If you take a doe, but do not want the meat please obtain a DPOP tag for the doe & notify the Conservation Law-enforcement Officer (a.k.a. CLEO or Game Warden) for meat donation options (i.e., hunters for the hungry, other soldiers in need, etc.). Follow proper check in/out procedures. Do **NOT** put your personal State Issued Deer tag on a doe, as you are required to use the Base DPOP tags until they run out.
4. The Deer Management Assistance Program (DMAP) applies to DNA, NALFF, and NWA. This program stresses the take of does through the use of State issued tags to each base. These tags are 1st come 1st served. These tags allow you to save your State Issued tag for that special buck, while enabling you to collect deer meat. You are not limited to 1 DMAP tag. If you take a doe, but do not want the meat please obtain a DMAP tag for the doe & notify the CLEO/Game Warden for meat donation options (i.e., hunters for the hungry, other soldiers in need, etc.). Follow proper check in/out procedures. Do **NOT** put your personal State Issued Deer tag on a doe, as you are required to use the Base DMAP tags until they run out.

XII. DRESSING & STORAGE OF DEER:

1. Deer Temporary Storage: The NASO Natural Resources Center (NRC), Building 78, has a walk in cooler where hunters can hang their deer if they desire.
   - If there is room in the cooler, place your name, phone number and confirmation number on the label provided and secure it to the deer.
   - Cost is $1 a day and must be paid when you pick up your deer.
   - Deer may be hung for 10 days only and then must be removed for processing.
   - Call the NRC to arrange a time to pick up your deer from the cooler.
   - All deer must be field dressed prior to hanging in the cooler.
2. Deer cleaning/dressing and disposal: Facilities are available at the NASO NRC/Checkstation (Building 78) and NWA Checkstation (Building 295).
   - NWA hunters:
     a. May either field dress in the woods; or
        - (Note: No field-dressing is permitted within 200YDs of occupied buildings, roads, trails, or agricultural areas.)
     b. Bring their animals to the NWA checkstation (Building 295) for dressing. Remains must be disposed of properly in the Building 295 dumpster.
   - DNA hunters:
     a. May either field dress; or
        - (Note: No field-dressing is permitted within 200YDs of occupied buildings, roads, or trails.)
     b. Bring their animals to the NASO NRC (Building 78) for dressing. Remains must be disposed of properly in the Building 78 Parking lot dumpster.
   - NASO and NALFF Hunters:
     a. MUST either field dress and <u>bury the remains</u> in the woods; or
        - (Note: No field-dressing is permitted within 200YDs of occupied buildings, roads, trails, agricultural areas, or within Airfield Clear Zone Boundaries.)
     b. Haul out the entire deer and bring it to the NASO NRC (Building 78) to dress. Remains must be disposed of properly in the Building 78 Parking lot dumpster.
   - Disposal of Remains in authorized dumpsters (NASO Bldg 78 parking lot dumpster; NWA Bldg 295 dumpster):
     a. Remains should be bagged and secured in a black/non-transparent plastic/garbage bag and placed in the dumpster.
     b. Dumpster doors must be shut and secured after each deposit.
     c. Dumping of animal remains without bagging and securing is not authorized.
     d. Dumping of animal remains without proper permits and tags is not authorized.
     e. Dumping of animal remains harvested from a location other than NASO, DNA, NALFF, or NWA is not authorized.
     f. Violation of the dumpster rules can result in the issuance of a federal and/or state ticket and hunting privilege suspension.
3. Garden/Water Hose Utilization:
   - The water hose at NASO Building 78 comes from a non-potable well water source (do not drink water that comes from this hose).
   - The water hose at NWA Building 295 is potable water.
   - Anyone utilizing the hoses at either of these sites must roll the hoses back up and shut off the water after each use.

XIII. GUEST HUNTERS:

1. Guest hunters must go through the exact same qualification process as active duty, retired military or current DoD civilian hunting members.
2. Guest hunters must sign in and out with a sponsor and they must hunt the same area as their sponsor.

XIV. VIOLATIONS OF GAME LAWS AND BASE REGULATIONS:

1. A hunter who violates any State or Base regulation is subject to proper disciplinary action (see references for more details). Depending on the type of infraction the Sportsman's Quality Management Board (SQMB) may be requested to review and make disciplinary recommendations to the Conservation Law-enforcement Officer (CLEO). The CLEO will then submit these recommendations as appropriate for approval to the Natural Resources Manager and/or Base Commanding Officer. The SQMB is made up of active duty & retired military personnel assisting the Base Natural Resources Recreation Program.
2. Should a violation be committed, the CLEO has the authority to confiscate your base hunting pass and weaponry (depending on the violation). The CLEO will notify the SQMB if there is an infraction for them to review and provide their recommendation.
3. The SQMB will conduct Violation Assessments, as requested by the CLEO, every Saturday at 1200 hours throughout the season.
4. The SQMB will make disciplinary recommendations, as requested, to the CLEO for approval.
5. Discipline (in addition to any State or Federally issued tickets by the CLEO) ranges from 15 days of no hunting to a total loss of all base hunting privileges.
6. Major weapons violations i.e. hunting on base with a high-powered rifle, unauthorized weapons on base, etc. carry the same, if not harsher, consequences as breaking the law in the civilian sector.
   - Deer is the only Big Game allowed to be shot. No other big game can be harvested even if there is an open season for it.
   - Foxes are allowed to be taken during regular state fox hunting season.
   - Do not shoot bears.
   - Coyotes may be shot at NASO in accordance with State Laws.
   - Loss of an access key to a hunting area constitutes a breach of base security and the offense will be processed by the Federal CLEO.
   - In addition to Penalties Listed above and in the CNRMA Instruction:
     a. Parking in unauthorized areas = Lose hunting privileges for Ten-days.
     b. Leaving an animal in the cooler longer than 10 days = Lose hunting privileges for 30 days.
     c. Under certain conditions a Lifetime Hunting Banishment can be issued.

XV. BLAZE ORANGE REQUIREMENTS:

1. Blaze orange is required to be worn while transiting to and from your hunting area or tree stand.
2. 100 square inches (roughly the size of a baseball cap) of blaze orange is required to be worn. The Board recommends that you wear a blaze orange vest as well as a cap when transiting to and from your hunting area.
3. Once in your tree stand, you may remove your blaze orange but it must be within one arm length and visible from a 360 degree view for other hunters to see.

XVI. ARCHERY RANGE UTILIZATION:

1. Bow targets (hay bales) are for the use of all personnel that have purchased a base hunting pass and have appropriately registered their firearms with Security or placed their name and weapons information on the weapons qualification list (see section IV. of this document for details).
2. Safety is the number one priority while practicing archery and as such, no one is allowed down range while another member is shooting arrows at a target.
3. Field tips are authorized for use at the NRC bow range. **Broad Heads are not to be shot in the hay bales**.
4. You may bring your own targets and use broad heads from the A Platform **ONLY**.

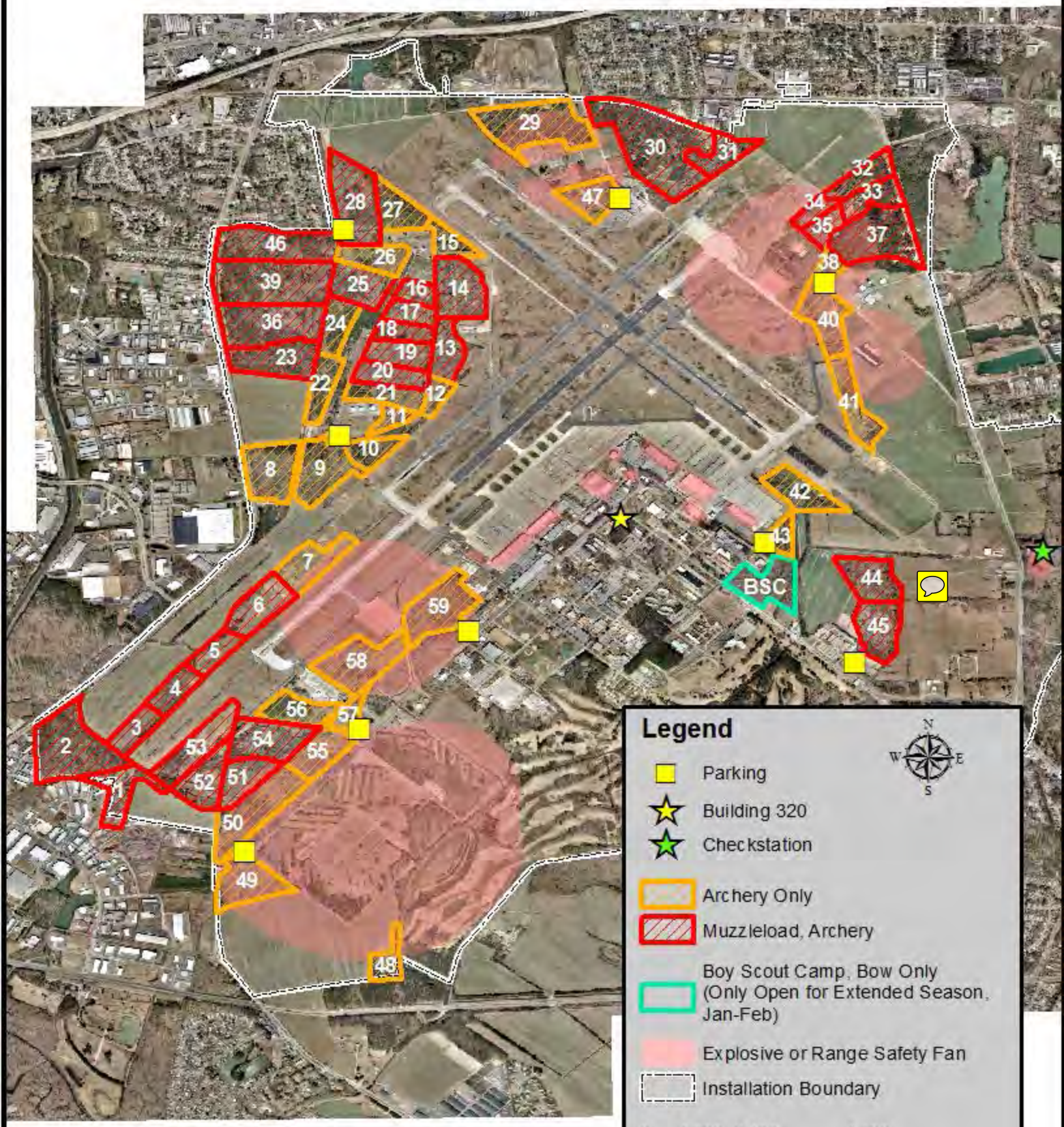
XVII. POINTS OF CONTACT AND WEBSITES:

- Conservation Law-enforcement Officer (Game Warden), NRC, Building 78: (757-433-2151)
- NASO/DNA Security/Game Check-in, Building 320: (757-433-3103)
- NALFF Quarterdeck, Building 100: (757-433-2259)
- NWA Security/Quarterdeck, Building 145: (757-421-8000)
- Websites:
    - https://www.navfac.navy.mil/navfac_worldwide/atlantic/fecs/mid-atlantic/about_us/environmental_norfolk/natural_resources.html
    - http://www.cnic.navy.mil/regions/cnrma/installations/nas_oceana/about/departments/natural_resources/hunting-information.html
    - http://cnic.navy.mil/regions/cnrma/installations/nsa_hampton_roads/nsa_northwest_annex/about/HuntingSeason0.html

NOTE: For other hunting program questions related to Small Game, Waterfowl, Furbearer, etc. contact the NRC.

Deer Hunting Location Map

Revised 30 September 2014

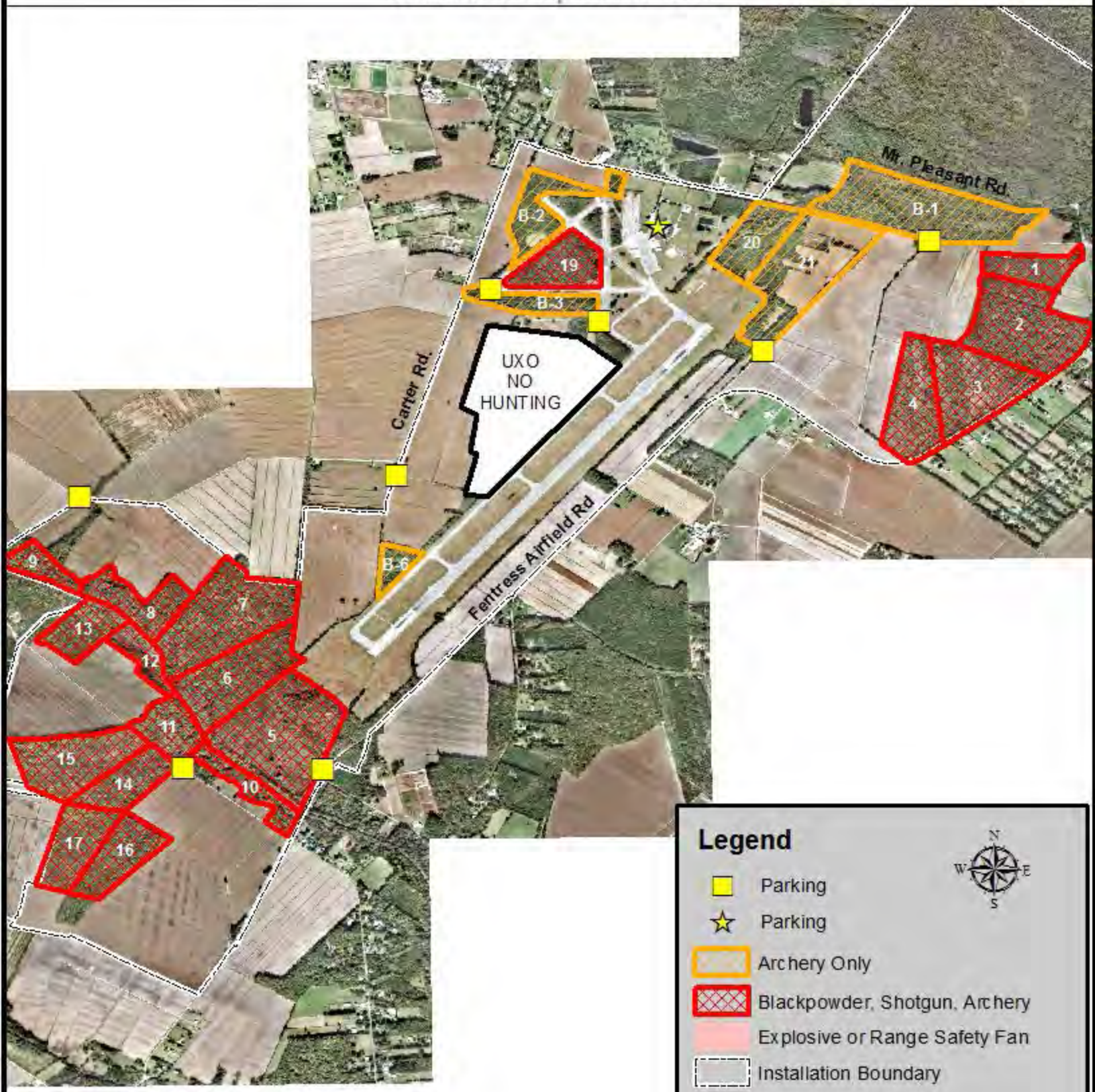


Naval Air Station Oceana

Virginia Beach, Virginia


NAS Oceana
Medical & Dental
Clinics
MWR Stables Horse Trails
NAS Oceana
Stables

Deer Hunting Location Map
Naval Auxiliary Landing Field Fentress
Chesapeake, Virginia
Revised 30 September 2014



Legend

- Parking
- Parking
- Archery Only
- Blackpowder, Shotgun, Archery
- Explosive or Range Safety Fan
- Installation Boundary

0 1,100 2,200 4,400 Feet

0 360 720 1,440 Meters

2015-2016 NAS Oceana,NASO Dam Neck Annex, NALF Fentress, and NSAHR Northwest Annex
Hunting Season Weapons Qualification and Training Schedule
******Must Have Weapons Registered with NASO Base Security Prior to Bringing on Installation******

AUGUST 2015

SUN	MON	TUE	WED	THU	FRI	SAT
						1 **Bow Qual** 0800-0900 Bldg 78 NASO NRC
	3	4	5 **Bow Qual** 1700-1800 Bldg 78 NASO NRC	6	7	8 **BP & Slug Qual** 0800-? Dam Neck Range NASO DNA
9	10	11	12	13 **Bow Qual** 1700-1800 Bldg 78 NASO NRC	14	15 **IBEP** 0800-1700 Bldg 78 NASO NRC
16	17	18 **Bow Qual** 1700-1800 Bldg 78 NASO NRC	19 **INDOC** 1700-1830 Bldg 223 NASO CNATTU	20	21	22
23	24 **Bow Qual** 1700-1800 **IBEP(part 1)** 1800-2200 Bldg 78 NASO NRC	25 **IBEP(part 2)** 1800-2200 Bldg 78 NASO NRC	26	27	28	29
30	31					

2015-2016 NAS Oceana,NASO Dam Neck Annex, NALF Fentress, and NSAHR Northwest Annex
Hunting Season Weapons Qualification and Training Schedule
******Must Have Weapons Registered with NASO Base Security Prior to Bringing on Installation******

SEPTEMBER 2015 (*Updated 01 Sep 2015*)

SUN	MON	TUE	WED	THU	FRI	SAT
		1 **Bow Qual** 1700-1800 Bldg 78 NASO NRC	2 **INDOC** 1700-1830 Bldg 223 NASO CNATTU	3	4	5
6	7 **Labor Day**	8 **Bow Qual** 1700-1800 Bldg 78 NASO NRC	9	10 **Bow Qual** 1700-1800 Bldg 78 NASO NRC	11	12 RESCHDULED FOR 13 SEP 2015
13 **Bow Qual** 0800-0900 Bldg 78 NASO NRC **BP & Slug Qual** 0800-? Dam Neck Range NASO DNA	14	15	16 **INDOC** 1700-1830 Bldg 223 NASO CNATTU	17	18 **Bow Qual** 1700-1800 Bldg 78 NASO NRC	19
20 **IBEP** 0800-1700 Bldg 78 NASO NRC	21	22	23 **INDOC** 1700-1830 Bldg 7 NSAHR NWA Galley	24 **Bow Qual** 1700-1800 Bldg 78 NASO NRC	25	26
27	28	29	30			

2015-2016 NAS Oceana,NASO Dam Neck Annex, NALF Fentress, and NSAHR Northwest Annex
Hunting Season Weapons Qualification and Training Schedule
******Must Have Weapons Registered with NASO Base Security Prior to Bringing on Installation******

OCTOBER 2015

SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18 **IBEP** 0800-1700 **INDOC** 1100-1200 **Bow Qual** 1130-1300 Bldg 78 NASO NRC	19	20	21	22	23	24
25	26	27	28	29	30	31

Requirements to Validate Hunting and Fishing Permits

1. **Hunting Permits** for NAS Oceana, NALF Fentress, NASO Dam Neck Annex and NSA Hampton Roads, Northwest Annex can be purchased from NAS Oceana MWR ITT Bldg 430. Permits are $20 and can be purchased on Monday-Friday 0900-1700. **THERE ARE NO REFUNDS – PURCHASING A PERMIT AND SUBSEQUENT FAILURE TO COMPLETE A PROFICIENCY QUALIFICATION OR ATTEND REQUIRED INDOCTRINATION WILL RESULT IN YOUR INABILITY TO HUNT.**

2. Purchase of permit **does not** give authority to hunt until you complete the following in accordance with COMNAVREG MIDLANT INSTRUCTION 11015.2:
   - Hunter Indoctrination
   - Bow, Black Powder or Shotgun Slug Qualifications
   - Approved Hunter Safety Course and IBEP(for bowhunters)

3. The NAS Oceana Natural Resources Bldg. 78 at 800 Oceana Boulevard has a calendar of event times/dates posted. Additional information may be obtained from: the NASO Natural Resources Website, http://www.cnic.navy.mil/Oceana/About/Departments/NaturalResources/index.htm; or the NAVFAC Regional Website, https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_navfacmidlant_pp/midlant_ps/environmental_norfolk/tabnr.

4. DO **NOT** FILL IN PERMIT! LEAVE PERMIT BLANK UNTIL YOU COMPLETE A HUNTING APPLICATION! Applications may be obtained at any scheduled required event (qualification, indoctrination, IBEP) or by setting up an appointment with Natural Resources personnel at the Natural Resources Bldg. 78:

5. In order to validate your permit at the above location you must provide the following items:
   A. Appropriate VA State hunting or fishing licenses
   B. Approved State Hunter Safety Card
   C. IBEP Card (Bowhunters only)
   D. Identification
   E. Proof of completion of NAS Oceana Hunter Indoctrination and Qualification

4. If you have any questions about the hunting program, please call the Natural Resource Center (NRC) Building 78 @ (757) 433-2151. MWR personnel do not have information on the hunting or fishing programs.

Fishing Permits for NAS Oceana, NASO Dam Neck Annex, JEB Little Creek and Fort Story, and WPNSTA Yorktown can be purchased from: NAS Oceana MWR ITT Bldg 430, Monday-Friday 0900-1700. Permits are $8. Fishing must be in accordance with COMNAVREG MIDLANT INSTRUCTION 11015.1. **THERE ARE NO REFUNDS!**

1. Call Natural Resource Center (NRC) Building 78 @ (757) 433-2151 to complete an application. **This MUST be done before fishing!**
2. Provide valid VA State fishing license.

APPLICATION FOR: ***NAS OCEANA / NASO DAM NECK ANNEX / NALF FENTRESS / NSAHR NORTHWEST ANNEX / JEB LITTLE CREEK / JEBLC FORT STORY***

NATURAL RESOURCES PROGRAM

HUNTING - FISHING - TRAPPING - ARCHERY RANGE PERMIT

(Circle All that Apply)

DATE:_____ FEDERAL PERMIT NO:_____

AMOUNT RECEIVED: $_____ DAILY / SEASONAL (Circle one)

1. Personal Data.

Name: _____ Phone: (Work) _____
Rank/Rate: _____ (Home) _____
Address: _____
_____ Vehicle Lic#: _____
SSN#:(Last four) _____ Driver's Lic#:_____

State/County Hunting License Number:_____
Big Game License Number:_____
Fishing License Number:_____
Trapping License Number:_____

2. Person to Contact in Case of Emergency.

Name: _____ Telephone: _____
Address: _____
_____

I, the undersigned understand that hunting, fishing, trapping, and archery are inherently dangerous sports and I voluntarily assume the risks associated with hunting, fishing, trapping or archery onboard: Naval Air Station Oceana (NASO), Virginia Beach, Virginia; NASO Dam Neck Annex, Virginia Beach, Virginia; Joint Expeditionary Base Little Creek (JEBLC), Virginia Beach, Virginia; and JEBLC Fort Story, Virginia Beach, Virginia; Naval Auxiliary Landing Field (NALF) Fentress, Chesapeake, Virginia; and Naval Support Activity Hampton Roads (NSAHR) Northwest Annex, Chesapeake, Virginia and Currituck County, North Carolina. I hereby release, indemnify and will hold harmless, acquit, and discharge, the United States of America, the United States Navy, all officers, organizations, military and civilian personnel, and activities of the United States or the United States Navy and any other individual or organization connected with the United States or the United States Navy from any and all cause or causes of action, including personal injury, illness, death, property damage, costs charges, claims, demands and liabilities of whatever kind, name, or nature in any manner arising out of use or enjoyment of said permit or any control exercised over said use, participation, property, facilities, equipment, or individual in the use of enjoyment of any permit. I have read and I understand the provisions of COMNAVREG MIDLANT INST 11015.2 and 11015.1. I am aware that a violation of the above notice will result in revocation of my permit and civil prosecution.

_____ _____ _____ _____

APPLICANT SIGNATURE ***DATE*** ***OFFICIAL SIGNATURE*** ***DATE***

PRIVACY ACT STATEMENT

This statement is provided in compliance with the provisions of the Privacy Act of 1974 (Public Law 93-579) which requires that Federal agencies must inform individuals who are requested to furnish personal information about themselves as to certain facts regarding the information requested below.

1. Authority. 5 U.S.C. § 301; 10 U.S.C. §§ 972 (5), 1201-1222, 2733, 2734-2734b, 2737, 5947, 6148, 7205, 7622-7623; 28 U.S.C. §§ 1346, 2671-2680; 31 U.S.C. §§ 71-75, 82a, 89-92, 95a, 240-243, 951-953; 37 U.S.C. § 802; 38 U.S.C. § 105; 42 U.S.C. §§ 2651-2653; 44 U.S.C. § 3101; 49 U.S.C. § 1901.

2. Principal Purposes. The primary use of this information is personal identification verification and to approve and record licensing data.

3. Mandatory/Voluntary Disclosure, Consequences of Disclosure. Disclosure is voluntary. Failure to provide information may result in denial of base fishing/boating privileges.

4. COMNAVREG MIDLANT INST 11015.2 ; COMNAVREG MIDLANT INST 11015.1

Comment [WMFCNMPO1]: Recommend to updating this form to include: a check box indicating if this is a Guest Application, and if so need to provide sponsor information and signature line; and checkboxes to tell us what type of hunting or trapping will be conducted.

This document was first vetted and approved 10/95 and has received minimal changes since then, except to update Installation Name Changes and the addition of the Recreation Fishing and Archery Activities.

Comment [WMFCNMPO2]: Why doesn't this include the following statement: "I consent to inspection at any time by duly authorized personnel (Navy, Federal, and State), for purposes of safety, security, or compliance with said instruction. Subject to penalties provided by law, I attest that I am not prohibited by Chapter 44 of title 18, U.S. Code, from possessing firearms or ammunition; and that the possession of firearms or ammunition will not violate a statute of the Commonwealth of Virginia or an ordinance applicable to the locality in which I reside. I agree that this release not only binds me, but also my family, heirs, assigns, administrators, and executors."

Recommend adding this information to this form.

Comment [WMFCNMPO3]: Need to add hunting, trapping, and archery (not just fishing/boating).

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Enclosure 10. Commander, Navy Region Mid-Atlantic Instruction (COMNAVREG MIDLANT INST) 11015.1 (Fishing)

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DEPARTMENT OF THE NAVY
COMMANDER
NAVY REGION, MID-ATLANTIC
1510 GILBERT ST.
NORFOLK, VA 23511-2737

IN REPLY REFER TO:
COMNAVREGMIDLANTINST 11015.1
N45
29 JUL 2005

COMNAVREG MIDLANT INSTRUCTION 11015.1

From: Commander, Navy Region, Mid-Atlantic

Subj: FISHING

Ref: (a) 32 C.F.R. Section 190
(b) DODINST 4715.3
(c) OPNAVINST 5090.1B
(d) P.L. 105-85 (Sikes Act Improvement Amendments of 1997)
(e) NAVFAC P-73, Vol. II
(f) E.O. 12962
(g) Virginia Freshwater and Saltwater Fishing (Current) Regulations
(h) COMNAVREGMIDLANT/SOPA(ADMIN) HRINST 5400.1

Encl: (1) Station Permit Suspension/Revocation
(2) COMNAVREG MIDLANT Fresh Water Fishing Areas

1. Purpose. To establish procedures for fishing on board COMNAVREG MIDLANT installations including: Naval Weapons Station (WPNSTA), Yorktown, including Cheatham Annex; Naval Amphibious Base (NAVPHIBASE), Little Creek; Naval Air Station (NAS), Oceana, including Dam Neck Annex; and Naval Support Activity (NAVSUPPACT), Norfolk, Northwest Annex. No freshwater fishing is permitted on Pennsylvania installations. References (a) through (h) pertain.

2. Cancellation. COMNAVBASENORVAINST 11015.1; CAXINST 11015.20; NAVPHIBASELCREEKINST 10570.1I; DAMNECKBASEINST 11015.1G; WPNSTAYORKTOWNINST 1710.3; and NASOCEANAINST 11015.3B. Due to numerous changes, instruction should be read in its entirety.

3. Policy

a. References (b) through (e) allow for recreational fisheries management on military installations, consistent with mission requirements.

b. Violations of reference (g) and this instruction may result in suspension or revocation of fishing privileges. See enclosure (1).

c. The Regional Comptroller Office will prescribe operating and accounting procedures for handling funds. Permit fees will be expended solely for management, protection, and harvesting of fish and wildlife resources per reference (a).

4. Definitions

a. Tidal Waters (Saltwater). Tidal waters include the shorelines of the Atlantic Ocean and the York and James Rivers and their tributaries.

b. Non-tidal Waters (Freshwater). Non-tidal waters include all freshwater ponds and lakes open to fishing, as noted in this instruction. This does not include closed bodies of water located on certain golf courses or within sensitive or restricted areas.

c. Fishing. Fishing refers to the harvest or attempted harvest of finfish species for sport or self-consumption.

5. Responsibilities

a. Environmental Program Director. The Regional Environmental Program Director is responsible for managing the fishing program at the installations to which this instruction applies. This authority may be delegated to a properly trained Regional Natural Resources Program Manager.

(1) Natural Resources Managers. Natural Resources Managers, under the direction of the Regional Natural Resources Program Manager, manage fishing and freshwater fish resources at NAS Oceana, NAVPHIBASE Little Creek, and WPNSTA Yorktown. Natural Resources Managers enforce fish and wildlife laws and regulations, and this instruction.

(2) Conservation Officers. Under the direction of the Regional Natural Resources Program Manager, Conservation Officers enforce fish and wildlife laws and regulations and this instruction. Conservation Officers are authorized to conduct creel inspections.

b. Installation Security Officers. Security Officers also enforce fish and wildlife laws, regulations, and this instruction, and review and make recommendations to Installation Commanders on proposals to conduct fishing tournaments and other special events. Security Officers are an after-hours emergency contact point for Natural Resources Managers and Conservation Officers.

c. Fishermen. Fishermen shall comply with this instruction and applicable fish and wildlife laws and regulations.

6. Authorized Patrons

a. Authorized Patrons. The following persons are authorized to fish at the installations to which this instruction applies:

(1) Active duty military personnel and their dependents are given priority access to all fishing programs, activities, and events.

(2) Retired military personnel and their dependents.

(3) Federal civilian employees of COMNAVREG MIDLANT installations and their dependents.

(4) Reservists and their dependents.

(5) If allowable under existing Force Protection Condition (FPCON) constraints, authorized patrons may be accompanied by two guests. All guests must adhere to applicable fish and wildlife laws and regulations, and this instruction. Sponsors are responsible for their guests and must accompany them at all times.

7. Licenses/Permits

a. Fishing Licenses. Authorized patrons and guests between the ages 16 and 65 must obtain, if they do not already possess, Virginia (state or county) freshwater fishing licenses and station fishing permits. Reference (g) exempts persons who are legally blind. Virginia Saltwater fishing licenses are required for anyone attempting saltwater fishing except when fishing from MWR piers that maintain pier licenses (see enclosure (2)).

(1) Dependents and guests under the age of 12 must be directly supervised by an adult, 18 years of age or older, who holds valid fishing licenses and station permits.

b. Station Permits. Station fishing permits are valid at all installations to which this instruction applies. Annual permits are valid concurrent with the Virginia fishing licenses (1 January - 31 December). A full season permit costs $8; a one-week permit costs $4. Saltwater fishing does not require a station permit.

(1) WPNSTA Yorktown and Cheatham Annex. Fishing permits are available at the Morale, Welfare and Recreation (MWR), Building 2006 and Cheatham Annex MWR, Building 284.

(2) NAVPHIBASE Little Creek. Fishing permits are available at the Environmental Compliance Department, Building 3165.

(3) NAS Oceana and Dam Neck Annex. Freshwater fishing permits are available at the NAS Oceana Natural Resources Center, Building 78.

(4) Station permits are issued upon assumption of risk, and authorized patrons and guests shall be required to sign a statement acknowledging risk. The statement shall also release the United States of liability, in case of accident or injury, to the extent allowed by law.

(5) Possession of a station fishing permit does not authorize access to an installation, grant permission to use other MWR facilities, or convey or bestow any other rights or privileges.

8. Regulations

a. General

(1) Unless approved under reference (h) consumption of alcoholic beverages is prohibited during any fishing activity or event to which this instruction applies.

(2) Fish may be taken only within the limits, seasons, and times, and by the methods prescribed by Federal and State regulation.

(3) No more than two treble hooks are permitted on any fishing lure. In catch-and-release waters, barbed hooks are discouraged and treble hooks are prohibited.

(4) Fishing shall be conducted only by angling with a hook and line or rod and reel, held in hand. A hand-held landing net may also be used to remove legally hooked fish.

(5) Use of live bait fish (minnows, eels, etc.) is discussed in enclosure (2). Use of crickets, grubs, worms, and other non-fish baits is permitted as noted.

(6) Unless otherwise specified, fishing hours are sunrise to sunset.

(7) Use of trotlines, fish traps, or chemicals in ponds are prohibited except under direction of the Natural Resources Manager.

(8) Boats and canoes are permitted on certain freshwater ponds and lakes as discussed in specific regulations. To prevent introduction or spread of invasive aquatic species, the following precautions should be taken:

(a) Drain water from live wells, bilges, and other containers before leaving the launch area;

(b) Remove plant parts and animals from the boat, trailer, and accessory equipment. Dispose of the removed materials in the garbage at the launch area or at home;

(c) Do not release live bait or aquarium pets into any waters; and

(d) Wash boat and trailer thoroughly at home. Flush water through the motor's cooling system, live wells, and other areas that hold water or dry your boat and equipment for five days in a sunny location before transferring it to a new body of water.

(9) If boat use is permitted at an approved fishing location, boats and canoes may not be stored on ponds or surrounding banks. A life jacket is required for each person fishing from boats. Additionally, persons under the age of 10 years shall wear life jackets while on boats.

(10) Littering on station is prohibited. All refuse shall be placed in designated trash containers. This includes all refuse generated from fishing activities (i.e., monofilament line, hooks, etc.).

(12) Natural Resources Managers or Security Officers may close specific fishing areas at any time. Such announcements will be posted at the respective Security Command Building or Natural Resources Office. Personnel may not use freshwater areas not listed in enclosure (2) of this instruction without specific authorization by the appropriate Natural Resources Manager.

(13) The Installation Natural Resources Manager, the Installation Security Officer and the Installation Commander must approve fishing tournaments and other special events.

9. Enforcement. Fish and wildlife laws and regulations, and this instruction, are enforced at the installations to which this instruction applies by Conservation Officers and Installation Security Officers by authority of Installation Commanders. Fully-trained, properly-qualified, and duly-certified Conservation Officers have power to apprehend and arrest violators for violations occurring at places over which the Navy may exercise law enforcement jurisdiction. Military and civilian personnel who observe or acquire credible information concerning violations of fish and wildlife laws and regulations, and this instruction, shall report same to Natural Resources Managers, Conservation Officers, or Installation Security Officers at the installation where the violation allegedly occurred.

10. Review Authority. The Regional Natural Resources Program Manager is responsible for review and update of this instruction.

S. A. TURCOTTE

Distribution: www.cnrma.navy.mil

STATION PERMIT SUSPENSION/REVOCATION

1. Policy. Access to, and fishing at, the installations to which this instruction applies is a privilege granted by the Installation Commander.

2. Authority. The authority of Installation Security Officers, Natural Resources Managers, and Conservation Officers to enforce this instruction includes the power to summarily suspend or revoke fishing privileges, for good cause.

3. Violations. The following is a list, for illustrative purposes only, of common violations and administrative actions that may be taken, independently or in connection with other administrative or judicial remedies, against persons who violate fish and wildlife laws and regulations, and this instruction. Repeat offenders are likely to suffer permanent revocation of fishing privileges.

SUSPENSION	VIOLATION
30 Days	Violation of any state statute.
30 Days	Patron does not hold a station fishing permit.
30 Days	Operation of gasoline motor or boat in unauthorized area.
30 Days	Digging for bait in the vicinity of ponds.
60 Days	Fishing with live bait fish in unauthorized area.
30 Days	Unauthorized vehicle parking.
1 Year	Fishing with trotlines, fish traps or chemicals.
60 Days	Violation of station limit, but not state limit.
Reinstatement of Fishing Privileges at discretion of Installation Commanding Officer.	Defacing or destroying government property and littering.
Reinstatement of fishing privileges at discretion of Installation Commanding Officer.	Alcoholic Beverages

COMNAVREG MIDLANT FISHING AREAS

1. NAS Oceana/Dam Neck Annex

a. Oceana Pond:

(1) Size/Location. Approximately 9 acres. Located on NAS Oceana, approximately one-half mile southeast of the intersection of Oceana Boulevard and Bells Road. Access restricted to a maintained gravel road bisecting an agricultural field.

(2) Parking. Parking permitted in designated cul-de-sac area between inner and outer gates.

(3) Facilities. Picnic facilities available. No open fires without permission of Natural Resources Manager. A boat launch is available. An interpretive nature trail loops the lake.

(4) License/Permit. In addition to the Virginia license and station permit, a parking permit will be issued with the station fishing permit and must be displayed on the vehicle dashboard in plain view.

(5) Size/Possession Limits. Catch and release encouraged.

(a) Largemouth Bass. Possession authorized from 16 June to 28 February only. Between 9 to 11 inches total length: two per day per person during season. Greater than 15 inches total length: one per day per person during season. For all other sizes, possession is prohibited.

(b) Catfish. Daily limit of three per person with a 10-inch minimum size.

(c) Panfish and Other Species. Virginia limits apply.

(6) Boats. Hand-propelled or electric motor boats and canoes are permitted. Gasoline motors are prohibited.

(7) Bait. No live bait fish.

(8) Special Regulations. Daytime use only unless approved by Natural Resources Manager. No other restrictions unless previously stated.

b. Lake Tecumseh:

(1) Size/Location. Located on Dam Neck Annex, south of Dam Neck Road and west of Regulus Avenue.

(2) Parking. Limited parking is available off Dove Street.

(3) Facilities. Bank-fishing only. A fishing pier is located at the end of Dove Street.

(4) License/Permit. In addition to the Virginia license and station permit, a parking permit will be issued with the station fishing permit and must be displayed on the vehicle dashboard in plain view.

(5) Size/Possession Limits. Virginia limits apply for all species.

(6) Boats. None permitted.

(7) Bait. Must adhere to state regulations.

(8) Special Regulations. The Navy does not own Lake Tecumseh, only portions of the land around it. Therefore, the Navy does not authorize fishing from boats launched from Navy property. Anglers encouraged to catch and remove all carp, shad, and other rough fish.

c. Saltwater Fishing - Dam Neck Fishing Beach:

(1) Location. Located on Atlantic Ocean across the dune from Seamist RV Park off Regulus Avenue.

(2) Parking. Limited parking is available after hours and on weekends in the Naval Marine Intelligence Center parking lot.

(3) Facilities. None. Trash cans are located at the walkovers.

(4) License/Permit. Virginia Saltwater fishing license.

(5) Size/Possession Limits. Virginia or Federal regulations apply.

(6) Boats. Boats are not permitted to be launched or retrieved on any recreational beaches.

(7) Bait. Virginia or Federal regulations apply.

(8) Special Regulations. Fishing may occur on the beach 24 hours a day. During dusk and evening hours, fishermen are required to have a light or lantern at their fishing location.

2. NAVPHIBASE Little Creek

a. Lake Bradford and Chubb Lake:

(1) Size/Location. Approximately 134 acres. Located on NAVPHIBASE Little Creek, off D Street.

(2) Parking. Seal Park, off D Street.

(3) Facilities. Boat ramp and picnic facilities are available.

(4) License/Permit. Virginia license and station permit.

(5) Size/Possession Limits. Catch and release encouraged.

(a) Largemouth Bass. Possession authorized from 16 June to 28 February only. Between 9 to 11 inches total length: two per day, per person, during season. Greater than 15 inches total length: one per day, per person, during season. For all other sizes, possession is prohibited.

(b) Walleye. Daily limit of two per person.

(c) Pan fish and other Species. Virginia limits apply.

(6) Boats. Boats with gasoline engines (10-hp limit) or electric motors are allowed. "No wake" limitations are in effect over the entire lake.

(7) Bait. Must adhere to Virginia regulations.

(8) Special Regulations. The eastern shoreline of Lake Bradford is privately owned. Anglers encouraged to catch and remove all carp, shad, and other rough fish.

b. Lake Varian and Bigelow Hall Lake:

(1) Size/Location. Located on NAVPHIBASE Little Creek. Small ponds located at end of D Street near Rifle Range and at the intersection of 10th and 11th Streets, respectively.

(2) Parking. For Lake Varian, use parking area for Lake Bradford. For Bigelow Hall Lake use barracks parking.

(3) Facilities. None.

(4) License/Permit. Virginia license and station permit.

(5) Size/Possession Limits. Catch and release encouraged.

(a) Largemouth Bass. Possession authorized from 16 June to 28 February only. Between 9 to 11 inches total length: two per day per person during season. Greater than 15 inches total length: one per day per person during season. For all other sizes, possession is prohibited.

(b) Catfish. Daily limit of three per person with a 10-inch minimum size limit.

(c) Panfish and other Species. Virginia limits apply.

(6) Boats. None permitted.

(7) Bait. No live bait fish.

(8) Special regulations. None.

c. Saltwater Fishing Areas:

(1) Location. Fishing is only allowed on the beaches of the all hands beach.

(2) Parking. Parking available at end of Hewitt Drive.

(3) Facilities. Bathhouse available on site.

(4) License/Permit. Virginia Saltwater Fishing License.

(5) Size/Possession Limits. Virginia or Federal regulations apply.

(6) Boats. Boats are not allowed to be launched or retrieved at any time from the beach.

(7) Bait. Virginia or Federal regulations apply.

(8) Special Regulations. Fishing is permitted from after Labor Day until Memorial Day from sunrise to sunset.

3. WPNSTA Yorktown/Cheatham Annex

a. Jones Pond:

(1) Size/Location. 63 acres on WPNSTA Yorktown, Cheatham Annex.

(2) Parking. Designated parking lot only.

(3) Facilities. Floating pier and picnic area.

(4) License/Permit. Virginia license and station permit.

(5) Size/Possession Limits. Catch and release encouraged.

(a) Striped Bass. One fish per day, minimum 20 inches.

(b) All Other Species. Virginia limits apply.

(6) Boats. To prevent introduction of invasive or exotic species, all boats used on this lake must be rented from MWR.

(7) Bait. To prevent introduction of invasive or exotic species, any live bait fish must be purchased from MWR.

(8) Special Regulations. No bank fishing permitted.

b. Cheatham Pond:

(1) Size/Location. 108 acres on WPNSTA Yorktown, Cheatham Annex.

(2) Parking. Designated parking at boat landing area.

(3) Facilities. Boat pier.

(4) License/Permit. Virginia license and station permit.

(5) Size/Possession Limits. Catch and release encouraged.

(a) Striped Bass. One fish per day, minimum 20 inches.

(b) All Other Species. Virginia limits apply.

(6) Boats. To prevent introduction of invasive or exotic species, all boats used on this lake must be rented from MWR.

(7) Bait. To prevent introduction of invasive or exotic species, any live bait fish must be purchased from MWR.

(8) Special Regulations. No bank fishing permitted.

c. Penniman Lake:

(1) Size/Location. 48 acres on WPNSTA Yorktown, Cheatham Annex.

(2) Parking. Designated parking lot at boat landing, behind Galley.

(3) Facilities. Picnic facilities located on lake.

(4) License/Permit. Virginia license and station permit.

(5) Size/Possession Limits. Catch and release only.

(6) Boats. To prevent introduction of invasive or exotic species, all boats used on this lake must be rented from MWR.

(7) Bait. To prevent introduction of invasive or exotic species, any live bait fish must be purchased from MWR.

(8) Special Regulations. Bank fishing permitted from two designated areas.

d. Feurer Youth Pond:

(1) Size/Location. 2 acres on WPNSTA Yorktown, Cheatham Annex.

(2) Parking. Designated parking lot only.

(3) Facilities. Fishing pier, restrooms, and picnic area available.

(4) License/Permit. None required.

(5) Size/Possession Limits. Catch and release only.

(6) Boats. None permitted.

(7) Bait. To prevent introduction of invasive or exotic species, any live bait fish must be purchased from MWR.

(8) Special Regulations. Youth only, 15 years of age and younger. Bank and pier fishing only.

e. Roosevelt Pond:

(1) Size/Location. 21 acres on WPNSTA Yorktown.

(2) Parking. Designated parking area at boat landing.

(3) Facilities. Pier and shoreline boardwalk.

(4) License/Permit. Virginia license and station permit.

(5) Size/Possession Limits. Virginia limits apply for all species.

(6) Boats. To prevent introduction of invasive or exotic species, all boats used on this lake must be rented from MWR.

(7) Bait. No live bait fish.

(8) Special Regulations. Bank fishing permitted from two locations. Pond closed to fishing during explosive loading operations at ordnance pier.

f. WPNSTA Yorktown Ponds 10, 11, and 12:

(1) Size/Location. Pond 10 (4.5 acres), Pond 11 (23 acres), and Pond 12 (15 acres) on WPNSTA Yorktown.

(2) Parking. Designated parking adjacent to boat pier.

(3) Facilities. Floating pier.

(4) License/Permit. Virginia license and station permit.

(5) Size/Possession Limits. Virginia limits apply for all species.

(6) Boats. To prevent introduction of invasive or exotic species, all boats used on this lake must be rented from MWR.

(7) Bait. No live bait fish.

(8) Special Regulations. Must possess a valid WPNSTA Yorktown Restricted Area ID. Must check in at MWR Outdoor Recreation/Rental Equipment office and receive a daily fishing pass before entering Restricted Area. The fishing pass shall be prominently displayed in the front window of vehicle. Ponds 11 and 12 may at times be closed due to Explosive Ordnance Detachment (EOD) operations.

g. Saltwater Fishing: Only authorized saltwater fishing is from the Cheatham Annex Pier.

(1) Location. Cheatham Annex Pier at the end of Sanda Avenue.

(2) Parking. Limited parking available at the pier.

(3) Facilities. None.

(4) Licenses/Permits. A current Virginia Saltwater License is required. A pier pass is required and available for purchase from MWR, Building 284. Military fee is $10 per year, civilian fee is $20 per year.

(5) Size/Possession Limits. Virginia and Federal regulations apply.

(6) Boats. None authorized.

(7) Bait. Virginia and Federal regulations apply.

(8) Special Regulations. Times: 1600-0600 Monday - Friday; 24 hours a day Saturdays, Sundays, and Holidays.

4. NAVSTA Norfolk

a. Naval Station Fishing Pier:

(1) Location. Located next to Salt Marsh Park, next to the Q Area ballfields off Admiral Massey Hughes Drive.

(2) Parking. Adequate parking is available at pier.

(3) Facilities. Port-a-toilet available.

(4) License/Permit. None required.

(5) Size/Possession Limits. Virginia and Federal regulations apply.

(6) Boats. Boats may not be launched or retrieved at this location.

(7) Bait. Virginia and Federal regulations apply.

(8) Special Regulations. Times: 24 hours a day; 7 days a week.

b. Other areas:

(1) Size/Location. Fishing is authorized from the following locations:

(a) The bulkhead extending eastward from the Deperming Station tower along the waters edge parallel to Admiral Massey Hughes Drive to the first picnic gazebo at Salt Marsh Park.

(b) From the westward end of Salt Marsh park to Iowa Point just west of the Sailing Center.

(c) Along the sea wall from the eastern side of the Bousch Creek culvert to the Mason Creek bridge.

(d) From the Mason Creek outfall on the sea wall (Building SP-263) along the sea wall not further than 10th Avenue.

(e) In the waters of Mason Creek.

(f) For Willoughby Bay Housing residents only: along the sand beach to the fence at the dredge spoil deposit site.

(2) Parking. Limited at all areas.

(3) Facilities. None.

(4) License/Permit. Virginia Saltwater Fishing License.

(5) Size/Possession Limits. Virginia and Federal regulations apply.

(6) Boats. None allowed.

(7) Bait. Virginia and Federal regulations apply.

(8) Special Regulations. None.

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Enclosure 11. Pollinator Management

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

SEP 0 5 2014

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY
(INSTALLATIONS, ENERGY AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE NAVY
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STAFF DIRECTOR, DEFENSE LOGISTICS AGENCY (DSS-E)

SUBJECT: Department of Defense (DoD) Policy to Use Pollinator-Friendly Management Prescriptions

This memorandum expands DoD policy to use current best management practices, as appropriate, specifically to protect pollinators (e.g., bees, birds, bats, butterflies, moths) and their habitats, and establishes policy to coordinate with partners on pollinator issues.

In accordance with DoD Instruction 4150.07 "DoD Pest Management Program" (May 2008) and DoD Instruction 4715.03 "Natural Resources Conservation Program" (March 2011), it is DoD policy to, when possible and to the extent practicable, use native landscaping and minimize the use of pesticides, to include herbicides, in sensitive habitats (e.g., in wetlands or where listed species may occur).

Further, it is DoD policy for Military Departments to coordinate, when appropriate and to the extent feasible, with other agencies (e.g., U.S. Fish and Wildlife Service, Bureau of Land Management, and Environmental Protection Agency) and non-governmental organizations (e.g., Bat Conservation International, and Pollinator Partnership) on habitat and pollinator issues. This policy is not intended to, and does not create, expand, or diminish any legally enforceable substantive or procedural responsibilities.

My point of contact is Mr. Peter Boice at 571-372-6905 or l.p.boice.civ@mail.mil.

John Conger
Acting Deputy Under Secretary of Defense
(Installations and Environment)

Pollinator Friendly Pesticide Applicator Best Management Practices

October 2014

Background

Pollinators, such as bees, bats, birds, and butterflies, are essential to the majority of the flowering plants in our environment and to the production of more than 130 different food crops. Pollinators are highly sensitive to many pesticides, especially insecticides. Your help as pest management personnel is critical to the continued safety of our food supply and environment. Proper pesticide use avoids harm to pollinators and their food sources, water, and habitats.

Use an integrated pest management (IPM) approach:

- Monitor and assess pest populations to determine if levels warrant control.
- Select the best combination of pest control options that minimizes risks to pollinators.

Read and Follow the Pesticide Label

On pesticide labels, look under the "Environmental Hazards" and "Directions for Use" headings for important information on protecting pollinators. Some labels warn against use of the product on blooming crops by stating, "Do not apply to blooming crops or weeds if bees are visiting in the treatment area." Some labels limit at-bloom applications to times when bees are not actively visiting, such as late evening. Apply the product in a manner consistent with the label directions.

Be Alert to Bloom

Presence of bloom is the key factor in pollinator exposure to pesticides. Honey bees and other pollinators are most at risk of poisoning when bee-toxic pesticides are applied to weeds or other vegetation that is blooming. Avoid applying any bee-toxic pesticides on blooming plants that attract bees. Keep pesticide drift from nearby blooming weeds that are attracting bees.

Timing of Pesticide Application

The time of pesticide application is very important. Apply pesticides that are toxic to bees in the evening when most honeybees have stopped foraging and returned to their hives. This allows the maximum time for the pesticide to decompose before the bees come into contact with it the next day.

Avoid Residual Toxicity

Use insecticides with short residuals. Do not apply insecticides having a long residual to blooming crops.

Check the Weather

Environmental conditions affect pesticide persistence. Daytime applications at low temperatures may cause some classes of pesticides to remain toxic much longer than during warm weather. Cloud cover also may prolong toxicity due to lower levels of ultraviolet light which breaks down many pesticides. Do not apply bee-toxic pesticides with extended residual toxicity on nights when dew is forecast. Dew may re-wet pesticides and increase bee exposure. Environmental conditions also affect bee activity. When high daytime temperatures encourage bees to begin foraging earlier or continue later than usual, adjust application times of bee-toxic pesticides accordingly. Experience shows that when bee-toxic pesticides are applied before or during cold nights, followed by warm summer days, the incidence of bee kills greatly increases.

Use Less Hazardous Pesticides

Neonicotinoid pesticides (i.e. pesticides with the active ingredient clothianidin, dinotefuron, imidacloprid, and thiamethoxam) may potentially cause adverse effects to pollinators. The EPA is taking steps to change these pesticide labels so they better protect bees by being clearer and more precise in their directions for pesticide application.

Use of neonicotinoid pesticides should be avoided in areas where pollinators may be present. Also avoid using them on any flowering plants. Use on flowering plants may result in exposure to bees even if applied when the plant is not flowering because they are taken up systemically and have a long residual.

Use the Least Hazardous Pesticide Formulation

Granular formulations are the least hazardous when bees are present because they are the least likely to drift. Dust and microencapsulated formulations are most hazardous to bees because they are similar in size to pollen and tend to stick to bee hairs. Dusts almost always drift more than other formulations. Emulsifiable concentrate formulations are usually less hazardous to bees than wettable powders because the powders remain toxic in the field longer. Spray formulations are usually safer to bees than dusts, but there are differences among spray types. Generally, water soluble formulations are safer than emulsifiable formulations, and fine sprays are less dangerous than coarse sprays. Sprays of undiluted pesticides may be more dangerous than diluted sprays.

Minimize Drift

Honey bees will visit the blooms of crops and/or weeds near target crops and be unintentionally impacted there by drift and pesticide residues. Keep the product on the intended area and apply pesticides with equipment that has been calibrated for the particular application. When appropriate, use ground applications instead of aerial applications to reduce risk of drift out of the target area.

Communicate with Beekeepers

Cooperation and communication among applicators and beekeepers greatly increases the likelihood of success in protecting pollinators and their habitats. Take the initiative to establish good relations and communication with commercial and local beekeepers. Notify beekeepers of future pesticide applications planned in the area so that they may attempt to protect their bees.

Learn about Local Regulations/Programs

Check for specific local ordinances pertaining to pollinators, especially beehive locations or designated preserves (if applicable). Some regions require that commercial beehive operations register the location where hives are being kept. Many states have regulations intended to reduce the hazard of insecticide applications to bees.

References

- The Center for Integrated Pest Management's Pollinator Protection: http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx
- EPA Pollinator Protection: http://www2.epa.gov/pollinator-protection

Contact Information

For more information regarding integrated pest management approaches, contact the installation Applied Biology Professional Pest Management Consultant. A list of Applied Biology contacts can be found at http://www.afpmb.org/content/navfac-applied-biology-center.

Enclosure 12 Avian Protection Recommendations

REDUCING BIRD COLLISIONS WITH BUILDINGS AND BUILDING GLASS BEST PRACTICES

US FISH AND WILDLIFE SERVICE
DIVISION OF MIGRATORY BIRD MANAGEMENT
FALLS CHURCH, VIRGINIA

JANUARY 2016

A Special Thanks to Our Contributors!

U.S. Fish & Wildlife Service would like to extend a special note of appreciation to the number of highly knowledgeable experts and authorities on bird interactions with building, glass and lighting infrastructure that contributed to the content and review of this document. This product is a true representation of the power of partnerships and coordination across agencies and institutions. This document will continue to be updated with the best available information, and our partnerships with experts in the field will be critical in making that happen. Thanks to all of you for the important work you do for bird conservation!

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OVERVIEW

The U.S. Fish and Wildlife Service (Service) has responsibility to protect and conserve migratory birds as part of four international treaties (Mexico, Japan, Canada, and Russia) and the Migratory Bird Treaty Act. As part of this mission, the Service is working to address human-caused sources of mortality by developing and providing information on options for reducing hazards to migratory birds. Bird collisions associated with building glass and building lighting are hazards where a variety of potential avoidance and minimization options exist. This document is intended to provide straight-forward options for reducing bird collisions with buildings by offering recommendations for simple, no cost building occupant best practices; low cost avoidance and minimization actions; and strategies for new buildings, building renovations, and building retro-fits.

THE ISSUE

Birds generally do not see clear or reflective glass (Klem and Saenger 2013). Glass reflectivity and transparency create a lethal illusion of clear airspace that birds do not see as a barrier. During the daytime, birds collide with windows because they see reflections of the landscape in the glass (e.g., clouds, sky, vegetation, or the ground); or they see through glass to perceived habitat (including potted plants or vegetation inside buildings) or to the sky on the other side. At night, during spring and fall bird migrations when inclement weather occurs, birds can be attracted to lighted structures resulting in collisions, entrapment, excess energy expenditure, and exhaustion (Manville 2009). This phenomenon has resulted in a number of concentrated avian mortality events. These mass events are less common at city, office or residential buildings, but still a possibility under the right weather and lighting conditions. The majority of collisions with both residential and urban buildings happen during the day, as birds fly around looking for food. Large avian mortalities at night more frequently occur at communication towers, offshore drilling platforms and in other situations where there is a bright light source in a dark area, especially during inclement weather.

Annual bird mortality resulting from window collisions in the U.S. is estimated to be between 365-988 million birds (Loss et al. 2014). While most people consider bird/glass collisions an urban phenomenon involving tall, mirrored-glass skyscrapers, the reality is that 56% of collision mortality occurs at low-rise (i.e., one to three story) buildings, 44% at urban and rural residences, and <1% at high-rises (Loss et al. 2014).

In an effort to reduce bird collisions with building glass, the Service's Division of Migratory Bird Management has compiled the following list of best practices and best available technologies. These best practices are grouped into measures that can be implemented at residences and office buildings, and provides options for both new buildings, and for existing building renovations and retro-fits. Many of these measures not only provide protection to birds, but also provide energy and cost savings to building owners.

THE AVOIDANCE/MINIMIZATION OPTIONS

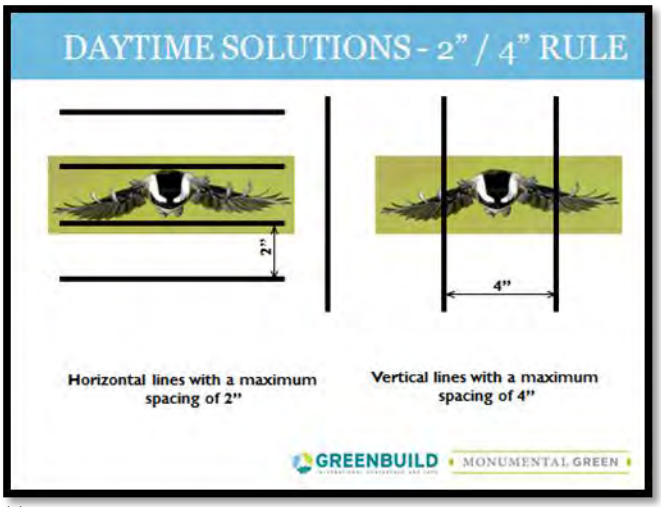
The Service recommends the following options to avoid and minimize bird/glass collisions. Any mention of trade names or commercial products in this document or the documents or websites referenced within does not constitute endorsement or recommendation by the Federal government. Readers should be aware that each product has benefits and limitations. Users of these products should work with technical experts to determine which specific product may work best for a particular application.

GLASS OPTIONS

There are a variety of glass and window design options that can be integrated into building designs to reduce mortality from bird collisions. The goal of these glass options is to create a visual signal or cue to help birds detect and avoid glass. To make an effective virtual cue, all window treatment should be applied to at least the first two to three stories or the height of the adjacent vegetation. However, applying treatments to just the first story windows or known problem windows can be helpful as well.

Create Your Own Pattern

The key to creating bird-friendly glass is to increase visual noise on the surface of the glass. Visual noise is a visible pattern that breaks up transparent or reflective areas of glass enough that birds perceive they cannot fit through the transparent or reflective areas. There is still research needed to determine the most effective dimensions of various visual patterns on glass for bird strike prevention. However, in general, vertical stripes that are at least ¼ inch wide with a maximum spacing of 4 inches, and horizontal stripes that are at least ¼ inch wide with a maximum spacing of 2 inches have been effective at preventing strikes of most birds (Sheppard 2011; Klem 2009). Because hummingbirds are so much smaller than other birds, closer spacing of the elements of any pattern (striped or otherwise) will be necessary. Also, when using patterns other than stripes, closer spacing of elements is recommended because a series of smaller images like dots will not break up the glass as much as stripes using the 2" X 4" spacing rules.



The image shows how pattern spacing on glass can work to deter birds. Images by ABC and Roy Hancliff

Pattern color contrast is important as well. Use colors that contrast well against the background or reflections (e.g., white stripes may be more effective than black stripes if there is a consistent reflection of dark color on the glass surface). The image to the right depicts the importance of the contrast between the color of the window pattern and the background. Notice that the white stripes are significantly more visible than the black stripes with the dark reflections on this window.

Photos by Christine Sheppard, ABC

Applying a product to the outer surface (surface #1) of the glass is always most effective. Applying a product to surface #2 or #3 (inner surfaces) can be effective if surface #1 is not so reflective that the pattern beneath is not visible to birds(see Fig. 1).

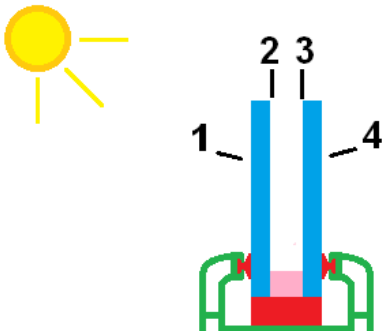


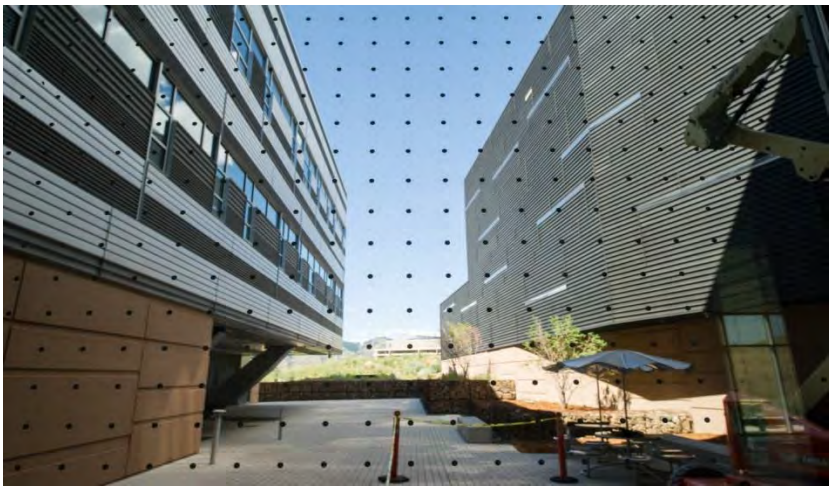
Image by NcLean/CC BY

Fig 1: Window Surface Diagram – Depicts surface #1 (outside facing pane), surface #2 (inside of outside facing pane), surface #3 (inside of inside facing pane and) and surface #4 (inside facing pane).

This image shows an example of a striped glass pattern that can be effective for preventing strikes of most birds (smaller spacing may be needed for hummingbirds). This particular pattern has been applied to the exterior surface (surface #1) of the window.

Striped glass pattern. Photo by Christine Sheppard, ABC

This image shows an example of non-striped pattern that can be effective for preventing strikes of most birds (smaller spacing may be needed for hummingbirds). This pattern has also been applied to the exterior surface (surface #1) of the window.



Dot pattern applied to the exterior of a National Renewable Energy Laboratory (NREL) building to help prevent bird collisions. Dots are approximately 1/2" in diameter spaced 2" vertically and horizontally. Photo by Dennis Schroeder, NREL 31193

There are several ways you can create your own patterns on glass. To see recommendations for creating your own patterns on glass, visit the ***Solutions and Materials*** section of the Bird-Safe Glass Foundation resources webpage (http://www.birdsafeglassfoundation.org/contact-us/resources/).

Install a Special Film, Glass or Covering

External Films and Coverings

There are several effective external film and glass covering options. Some options are more expensive, but are highly effective. Films are good for retrofit applications. A drawback, however, is that they only have a guarantee lifetime of 5 to 7 years, although they may last longer. To see a list of the latest recommendations in external films and covering products, visit the ***Solutions and Materials*** section of the Bird-Safe Glass Foundation resources webpage (http://www.birdsafeglassfoundation.org/contact-us/resources/).

A bird friendly film was applied at the entrance of the Ding Darling Education Center at the J. N. "Ding" Darling National Wildlife Refuge. Photo shows entrance before (left) and after (right) application. Photos by USFWS

Fritted Glass

Fritting is the use of ceramic lines, dots or patterns that are most often placed on the #1 surface (outside-facing pane) or #2 or #3 (interior panes) (see Fig. 1) of insulated glass. Fritting is a commonly used measure, but is more expensive than other types of window coverings. This technique allows humans to see through the glass while reducing the transparency of the glass. It also provides energy savings by reducing heat gain, while still allowing day-lighting of buildings (Sheppard 2011). To see a list of the latest recommendations in fritted glass products, visit the ***Solutions and Materials*** section of the Bird-Safe Glass Foundation resources webpage

Fritted glass on window. Photo by Christine Sheppard, ABC

(http://www.birdsafeglassfoundation.org/contact-us/resources/).

Ultraviolet Patterned Glass

Birds see in the ultraviolet (UV) spectrum so using glass that reflects UV light in a pattern can reduce bird collisions. While this glass is typically more expensive than other treatments, it is comparable in price to other energy-efficient glass (Eisenberg 2010). As of 2015, few UV patterned products are available. However, this option may be desired when seeking a product that is generally not visible to humans, but provides some benefit to birds. To see a list of the latest recommendations in ultraviolet patterned glass products, visit the ***Solutions and Materials*** section of the Bird-Safe Glass Foundation resources webpage (http://www.birdsafeglassfoundation.org/contact-us/resources/).

Screens and Netting

Installing external screens or netting on windows is an effective and relatively inexpensive treatment. Screens reduce reflection and injury by providing a cushion between the bird and the window. This treatment can be installed on individual panes or attached to a façade. To be effective, the netting must be placed far enough in front of the window that a bird hitting it will not collide into the glass behind. The netting should have openings no larger than ½ inch. Several companies sell screens or other barriers that can be attached with suction cups or eye hooks. These treatments can be used on new construction, renovations, and retro-fits. To see a list of the latest recommendations in screen and netting products, visit the ***Solutions and Materials*** section of the Bird-Safe Glass Foundation resources webpage (http://www.birdsafeglassfoundation.org/contact-us/resources/).

Basic home window screen. Photo by Christine Sheppard, ABC

Window netting installed feet from window on slanted wooden beams. Photo by USFWS

Architectural Features

Building designers can use features such as overhangs, shutters, louvers, mesh and awnings to reduce glass reflections or reduce visibility into transparent areas.

Shading was applied around the windows on the exterior of the Research Support Facility (RSF) at the National Renewable Energy Laboratory (NREL) to reduce glare and overheating of the building interior. These windows are also bird friendly. Photo by Dennis Schroeder, NREL 19798

Shutters overhang windows at a facility at the San Diego Zoo. Photo by Christine Sheppard, ABC

LIGHTING OPTIONS

Eliminating or reducing unnecessary lighting is one of the easiest ways to reduce collisions while also saving energy and reducing costs to building owners. Note that these measures will not eliminate collisions, and their effectiveness is highly dependent on local conditions, including the degree of bird friendly design and practices of neighboring buildings.

Photo by Eddypoon/CC BY

Lighting Design

a. Avoid unnecessary lighting, including perimeter lighting.
b. Install motion sensors on all lights (both interior and exterior) that activate only when people are present. Motion sensors are fairly inexpensive and save energy. This is especially important during the bird migration periods (early April through late May and mid-August through early November), and periods of inclement weather.
c. Ensure all exterior lighting is "fully shielded" so that light is prevented from being directed skyward. "Fully shielded" light fixtures are defined as those with an opaque shield so that all light is emitted below the lowest light emitting part of the fixture. "Fully shielded" is the same as "zero up light" and "dark sky compliant". See Appendix A for examples of acceptable fixtures.
d. Comply with all Federal Aviation Administration obstruction and marking guidelines by ensuring that required obstruction lighting is comprised of only L-864 strobe lights with appropriate flash rates and extinguish all steady burning L-810 lights (FAA 2007, Patterson 2012).

Lighting Operation

a. Ensure that any lights that are not motion-activated are turned off at night; especially architectural lighting, upper story interior lighting, and lobby or atrium lighting.
b. Eliminate the use of decorative/vanity lighting during the bird migration periods (early-April through late May and mid-August through early November). This includes upward directed spot- and flood-lights, and roof-top lighting.
c. "Lights Out" programs exist throughout major cities across the country to encourage buildings to reduce light pollution during migration. For more information visit Audubon's Existing Lights Outs Programs webpage (https://www.audubon.org/conservation/existing-lights-out-programs).
d. Install window coverings to prevent light spill.

LANDSCAPING OPTIONS

Exterior

- Where habitat is adjacent to, seen through or reflected in any glass structures (e.g., windows, bus shelters, guard rails, glass walls, etc.), treat the glass using one of the Glass Options listed above. Avoid creating an effect where landscaping funnels birds towards glass panes (e.g., walkways, passageways, edges) or where approaches to a building (vehicles or people) flush birds towards windows.

An example of where trees and shrubs are reflected in the glass and create a type of funnel effect near the entrance of a building. Photo by USFWS

- Avoid using glass in supplemental structures (e.g., bus shelters, guard rails, glass walls, etc.). When it is not possible to avoid using glass for these structures, use only highly effective Glass Options to treat these structures (see the Birdsafe Glass Foundation website's (http://www.birdsafeglassfoundation.org/contact-us/resources/) list of tested materials for information on product effectiveness).

Interior

- If you have indoor plants, trees or shrubs, either treat the adjacent glass or move all plants away from clear glass windows far enough that they can't be seen from the outside by birds. If you were at window level looking in, could you see the plant? If the answer is "yes", then birds can probably see it too.

An example of where a potential bird hazard has been created by placing plants inside of a building near the window. Photo by USFWS

Measures for a Residence

Assess your home's risk for bird collisions

Not all windows are equally hazardous. The most hazardous windows are likely those that are most reflective of bird habitat (e.g., trees, shrubs, flowers, sky), and closest to areas where you see birds when they are active.

Professional assistance is available to assess your home's risk for bird impacts, and to identify specific problem areas and apply avoidance/minimization measures. However, these services are likely at a cost to the homeowner. One example of this type of service is the Fatal Light Awareness Program (FLAP), which offers a risk assessment service for this purpose. To learn more about this service, visit the FLAP BirdSafe Building Risk Assessment website (http://www.flap.org/bird-safe-consulting.php) and contact their assessment team to see if a local assessment can be arranged. You can also pinpoint problem areas by conducting regular monitoring around your home for dead or injured birds, or noting where you observe collisions.

You can also do your own assessment by conducting regular monitoring around your home, especially in areas that are potentially problematic. Monitoring can identify problem areas and tell you how frequent collisions occur. Monitoring is recommended even after collision prevention measures have been applied to ensure treatments are working. To monitor around your house, follow these basic steps in the early morning (around 8am or before) at least a few times a week and daily, if possible, during bird migration periods (early April through late May and mid-August through early November):

1. Walk around your house looking at the ground below windows for dead birds;
2. Inspect each window for feather spots or bird imprints; inspect windows daily when bird feeders are in use;
3. If you find a dead or injured bird, per 50CFR 21.31(a), you may pick it up only if you intent to take it immediately to a rehabilitator. If you do not intend to take the bird to a rehabilitator, you should not attempt to handle the bird, unless you are permitted to do so. If the bird is still alive and you would like to try to help it and/or you need to move the bird, locate a licensed wildlife rehabilitator where you can take the bird, or contact a wildlife official or agency or local licensed wildlife pest control company that is permitted for the possession, handling, transport, and disposal of migratory birds.
4. If helpful, maintain a personal log of information about any dead or injured birds you find during your searches including the species and locations were the birds were found. Logs can be useful for helping you remember where collisions occur and revealing recurring problem areas over time.

Basic guidance for monitoring can be found in the ***Monitoring*** section of the Bird Safe Glass Foundation resources webpage (http://www.birdsafeglassfoundation.org/contact-us/resources/).

Implement Measures

After you have identified which windows may be causing bird collisions, you should follow the steps below to reduce the risk of collision.

1. Ensure proper operation of window covers

Proper operation of window covers can help reduce bird collisions, but should be paired with a window treatment using one of the Glass Options listed above for optimal results.

- **If you have blinds**, keep them partially opened during the daytime when birds are concentrated, especially during bird migration periods (early April through late May and mid-August through early November), and closed completely at night. A partially open blind during the day will appear as a striped pattern that can break up reflections.
- If, during the day, you notice birds are still colliding, it may mean a reflection is still occurring, and you should consider an exterior window treatment.

Photo by Elf/ WC PD

- **If you have shades,** apply a pattern to the shade on the window side and keep them closed as much as possible during the day, particularly when the room is not in use. Use strong contrasting colors in the design so the bird can see it through the window and any reflection. At night, close them completely to keep the escape of indoor lighting to a minimum.

2. Apply a window treatment

Exterior treatments applied on the outside of see-through windows and reflective glass is the most effective action to prevent bird-glass collisions. However, applying treatments on the inside can also be helpful. If you can see the markings from the outside of the window from window level, birds probably can too. Check this several times during the day, as reflections may only occur during certain light conditions. See options under Glass Options for a list of window treatment options for existing structures.

3. Distance bird feeders appropriately

Once you have treated your glass, be sure to place your bird feeder 3-feet or less from your windows; the closer, the better. If your feeders cannot be placed within 3 feet of a window, they should be placed at least 30 feet away.

4. Reduce light trespass

You can reduce light trespass into the environment with appropriate lighting structures and operation (refer to items under Lighting Options).

5. Follow landscaping best practices

Following landscaping best practices will ensure a hazardous condition is not created (refer to items under Landscaping Options).

Measures for Commercial and Institutional Buildings

Avoiding or reducing bird collisions with windows for commercial and institutional buildings can be challenging. First, office buildings have a wide range of architectural styles, floor levels, size, type and configuration of windows. All of these factors influence the risk of bird collisions. Second, occupants of commercial and institutional buildings may not own the building, making actions to reduce collisions more difficult. However, whether you own the building or are simply a building occupant, there are a number of measures you can take to make your building more bird friendly.

The following measures will help reduce bird attraction to your building, and many of them will save in overall building maintenance and energy costs.

Assess your building's risk for bird collisions

Professional assessments are available to assess your building's risk for bird impacts and for identifying specific problem areas (note: this is likely at a cost). The Fatal Light Awareness Program (FLAP) offers a risk assessment service for this purpose. To learn more about this service, visit the FLAP BirdSafe Building Risk Assessment website (http://www.flap.org/bird-safe-consulting.php) and contact their assessment team to see if a local assessment can be arranged. There are also several ways to conduct your own assessment to identify potential problem areas. Not all windows are equally hazardous. Check to see which of your windows are most reflective of bird habitat (e.g., trees, shrubs, flowers, sky), and closest to areas where you see birds when they are active. You can also use direct observations of collisions (e.g., dead birds, feather prints on windows, etc.) to pinpoint problem areas.

An effective and recommended way to identify and verify problem areas is by monitoring regularly around your building for dead or injured birds, especially in areas that are potentially problematic. Monitoring can help you track and confirm where regular collisions are occurring and help you influence changes in these areas (e.g., moving plants away from windows) or open a dialogue with building management for where collision prevention measures may be necessary. Monitoring is recommended even after collision prevention measures are applied to ensure treatments are working properly. When establishing your monitoring program, follow these basics steps:

- Consider establishing a standardized monitoring plan that all employees helping with the monitoring effort can follow. Assign people to certain days and times, and map out the route to follow. It is suggested monitoring be done at least once in the early morning (around 8am or before) a few times a week and daily, if possible, during bird migration periods (early April through late May and mid-August through early November).

- Collect information about any dead or injured birds that employees report or find during building searches in a personal log. Logs can be useful for revealing recurring problem areas over time, and can help communicate and support why and where avoidance and minimization measures may be necessary to those who will need to assist in implementing these measures (e.g. building managers, building tenants).

- If you find a dead or injured bird, per 50CFR 21.31(a), you may pick it up only if you intent to take it immediately to a rehabilitator. If you do not intent to take the bird to a rehabilitator, you should not attempt to handle the bird, unless you are permitted to do s. If the bird is still alive and you would like to try to help it and/or you need to move the bird, locate a licensed wildlife rehabilitator where you can take the bird, or contact a wildlife official or agency or local licensed wildlife pest control company that is permitted for the possession, handling, transport, and disposal of migratory birds.

Basic guidance for monitoring, including suggested fields to be included in a tracking spreadsheet can be found in the ***Monitoring*** section of the Bird Safe Glass Foundation resources webpage (http://www.birdsafeglassfoundation.org/contact-us/resources/).

Implement Measures

After you have identified which windows may be causing bird collisions, you should follow the steps below to reduce the risk of collision.

Use Window Covers (Blinds and Shades)

Window covers should be paired with a window treatment using one of the Glass Options listed above for optimal results in helping reduce bird collisions.

- **If you have blinds**, keep them partially opened during the daytime when birds are concentrated, especially during bird migration periods (early April through late May and mid-August through early November), and close them completely at night. A partially open blind during the day will appear as a striped pattern that can break up reflections. If, during the day you notice birds are still colliding, it may mean reflection is still occurring, and you should consider an outside window treatment.
- **If you have shades (and it is OK with building management to do so),** apply a pattern to the shade on the window side and keep them closed as much as possible during the day, particularly when the room is not in use. Use strong contrasting colors in the design so the bird can see it through the window and any reflection. At night, close them completely to keep the escape of indoor lighting to a minimum.

Avoid or Minimize Evening Lighting

- **Building Occupants –** If the lights are on when you are leaving for the evening, turn the lights off, especially in windowed offices, and encourage others to do the same.
- **Building Owners –** Conduct building cleaning during the daytime. This will reduce bird incidents at night and provide energy and cost savings. Daytime cleaning may also result in salary savings by eliminating nighttime overtime cleaning costs.

Avoid or Minimize Interior Landscaping

If you have indoor plants, trees and shrubs, move them away from clear glass windows far enough that they can't be seen from outside by birds. If you can see the plant standing at window level and looking in, then birds can probably see it too.

Apply a Window Treatment or Barrier
If you are a building occupant, this is something you will likely have to work with building management to approve and implement since it requires modification of the building windows. However, if it is an option, exterior treatments applied on the outside of see-through windows and reflective glass is the most effective action to prevent bird-glass collisions. If exterior treatments are not an option, applying treatments on the inside can also be helpful. If you can see the markings from the outside of the window at window level, birds probably can too. Check this several times during the day, as reflections may only occur during certain light conditions See items under Glass Options for a list of window treatment options for existing structures.

Educate Others
Take steps to educate building owners and occupants about the risk of bird collisions and the simple steps that can be taken to reduce collisions such as turning off lights and closing window coverings at night.

Measures for New Buildings, Building Renovations and Retro-fits

Building Design
- Follow the LEED Pilot Credit 55: Bird Collision Deterrence recommendations for new construction (http://www.usgbc.org/Docs/Archive/General/Docs10402.pdf).
- Minimize the number of, or co-locate roof-top antennas. Make all antennas free standing (i.e., no guy wires).
- Use architectural features to reduce the amount, reflectivity, and transparency of glass.
- If clear glass corridors, skyways, walkways, or courtyards are proposed it is imperative to use bird collision mitigation measures.

Glass Design/Pattern
- Avoid over-use of glass: keep the percentage of total glass below American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) standard of 40% of surface area (ANSI/ASHRAE/IES Standard 90.1 2013).
- Use smaller pane sizes – less than 2.5 square meters - when possible.
- Do not use reflective glass. Use opaque, etched, or patterned glass that meets the suggested pattern dimensions, or has a Materials Threat Score of less than 30 (see LEED Pilot Credit 55: Bird Collision Deterrence; U.S. Green Building Council 2011). Refer to items 1-6 under Glass Options for glass and window design and treatment recommendations.

Lighting
- Refer to items under Lighting Options for best practice recommendations for lighting design and operation.

Landscaping
- Refer to items under Landscaping Options for landscaping best practices.

REFERENCES

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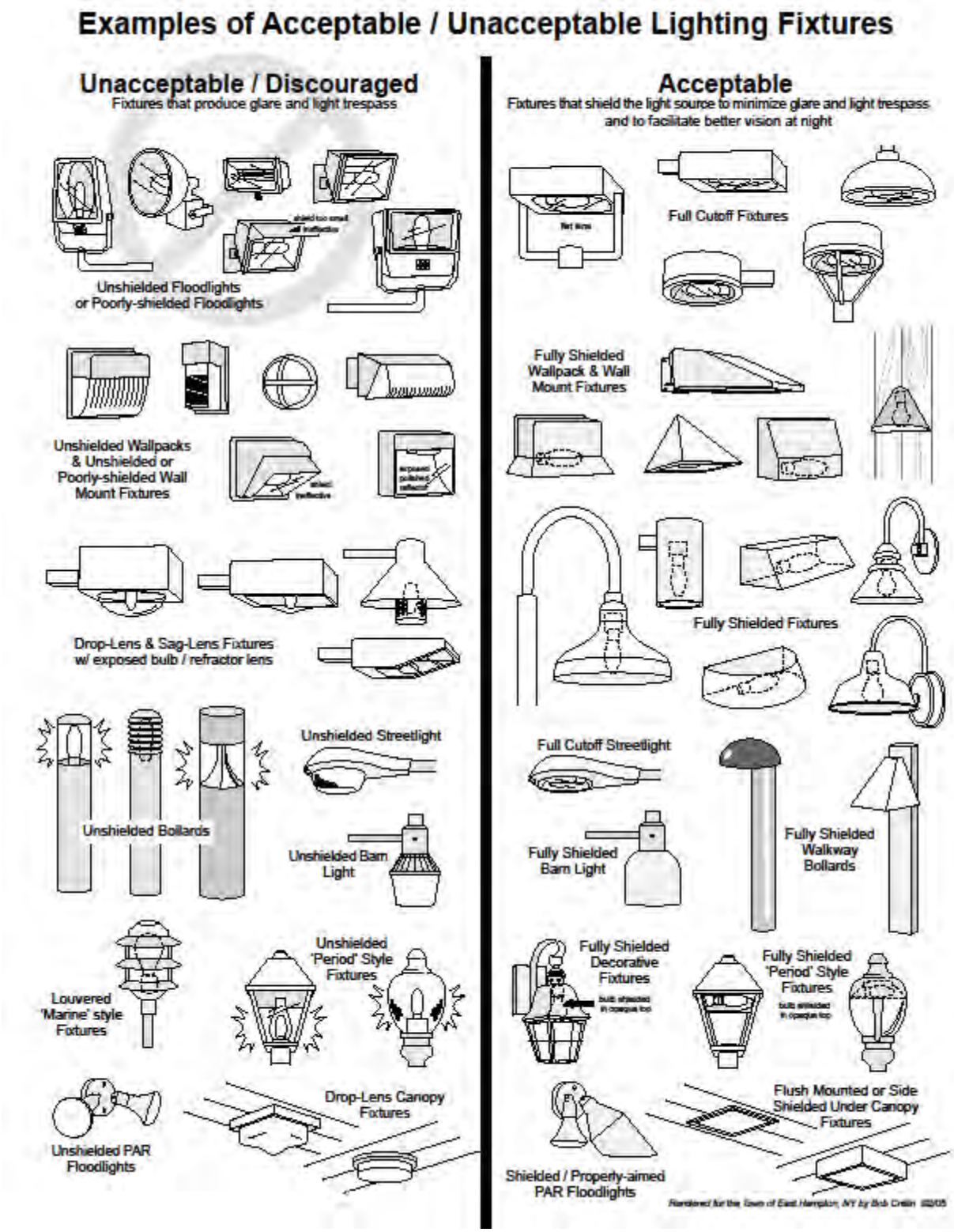
APPENDIX A. Examples of lighting fixtures.



Avian collision with powerline reduction/avoidance guidelines/procedures. These documents can be obtained from the following websites: <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/guidance-documents.php>; <http://www.aplic.org/>; and <http://www.dodpif.org/plans/app.php>.

Appendix L

Cross-Reference of Integrated Natural Resources Management Plan Guidance for Navy Installations to DoD INRMP Template

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Table L-1. Cross-Reference of Integrated Natural Resources Management Plan Guidance for Navy Installations to DoD INRMP Template

DoD *Integrated Natural Resources Management Plan* Template	Cross-Reference to Naval Air Station Oceana and Naval Auxiliary Landing Field Fentress 2014 INRMP Update Table of Contents
Title Page	**Title Page (see front matter)**
Signature Page	**Signature Page (see front matter)**
Executive Summary	**Executive Summary (see front matter)**
Table of Contents	**Table of Contents (see front matter)**
1. Overview	**Section 1.0 Introduction**
a. Purpose	Section 1.1 Purpose and Authority
b. Scope	Section 1.2 Scope
c. Goals and Objectives	Section 1.3 Objectives
d. Responsibilities	Section 1.4 Responsibilities
(1) Installation stakeholders	Section 1.4.1 Installation Stakeholders
(2) External stakeholders	Section 1.4.2 External Stakeholders
e. Authority	Section 1.1 Purpose and Authority
f. Stewardship and Compliance	Section 1.5 Compliance and Stewardship
g. Review and Revision Process	Plan Updates (see front matter)
h. Management Strategy	Section 1.8 Overview of the Natural Resources Program
2. Current Conditions and Use	**Section 2.0 Existing Conditions**
a. Installation Information	Section 1.6 Location and Regional Setting and Section 1.7 Historical Overview and Military Mission
(1) General Description	Section 1.6 Location and Regional Setting and Section 1.7 Historical Overview and Military Mission
(2) Regional Land Uses	Section 1.6 Location and Regional Setting and Section 1.11 Encroachment and Adjacent Land Use
(3) Abbreviated History and Pre-Military Land Use	Section 1.7 Historical Overview and Military Mission
(4) Military Mission	Section 1.7 Historical Overview and Military Mission and Section 1.7.1 Mission Impacts on the Environment
(5) Operations and Activities	Section 1.7 Historical Overview and Military Mission, Section 1.7.1 Mission Impacts on the Environment, and Section 1.9 Constraints and Opportunities
(6) Constraints Map	Figure 1-8, Figure 1-9, and Section 1.9 Constraints and Opportunities
(7) Opportunities	Figure 1-8, Figure 1-9, and Section 1.9 Constraints and Opportunities

b. General Physical Environment	Section 2.0 Existing Conditions
(1) Climate	Section 2.1 Climate Section 2.1.1 Climate Change
(2) Physiography and Soils	Section 2.2 Physiography and Soils
(3) Hydrology	Section 2.3 Hydrology
c. General Biotic Environment	Section 2.0 Existing Conditions
(4) T & E Species and Species of Concern	Section 2.6 Rare, Threatened and Endangered Species and Significant Ecological Communities
(5) Wetlands and Deep Water Habitats	Section 2.3.5 Wetlands
(6) N/A	Section 2.3.6 Nearshore Environment
(7) Fauna	Section 2.5 Fauna
(8) Flora	Section 2.4 Flora
3. Environmental Management Strategy and Mission Sustainability	Section 1.7.2 Integration of Military Mission and Sustainable Use
a. Supporting Sustainability of the Military Mission and the Natural Environment	Section 1.7.2 Integration of Military Mission and Sustainable Use
(1) Integrate Military Mission and Sustainable Land Use	Section 1.7.2 Integration of Military Mission and Sustainable Use
(2) Define Impact to the Military Mission	Section 1.7.2 Integration of Military Mission and Sustainable Use
(3) Describe Relationship to Range Complex Management Plan or other operation area plan	Section 1.10 INRMP Integration with Other Installation Plans
b. Natural Resources Consultation Requirements	Section 5.1 Natural Resources Consultation Requirements
c. NEPA Compliance	Section 5.3 NEPA Compliance
d. Beneficial Partnerships and Collaborative Resource Planning	Section 1.12 Partnerships and Education Outreach
e. Public Access and Outreach	Section 3.5.1 Public Access and Section 3.5.2 Education Outreach
(1) Public Access and Outdoor Recreation	Section 3.4 Outdoor Recreation Management and Environmental Awareness, Section 3.5.1 Public Access, and Section 3.5.2 Education Outreach
(2) Public Outreach	Section 3.5.2 Educational Outreach
f. Encroachment Partnering	Section 1.11 Encroachment and Adjacent Land Use
g. State Comprehensive Wildlife Plans	Section 3.2.1 General Wildlife Management
4. Program Elements	**Section 4.0 Program Elements**
a. T & E Species Management and Species benefit, Critical Habitat, and Species of Concern Management	Section 4.10 Rare, Threatened, and Endangered Species Management
b. Wetlands and Deep Water Habitats Management	Section 4.2 Wetlands, Water Quality, Watershed, and Floodplains Management

c. Law Enforcement of Natural Resources Laws and Regulations	Section 4.13 Conservation Law Enforcement
d. Fish and Wildlife Management	Section 4.7 Fish and Wildlife Management
e. Forestry Management	Section 4.11 Forest Management
f. Vegetation Management	Section 4.3 Vegetation Management
g. N/A	Section 3.1.3.2 Pollinators
h. Migratory Birds Management	Section 4.8 Migratory Bird Management
i. Invasive Species Management	Section 4.4 Invasive Plants and Noxious Weeds Management
j. Pest Management	Section 3.2.8 Integrated Pest Management – Nuisance and Invasive Wildlife
k. Land Management	Section 4.1 Coastal Zone Protection, Section 4.2 Wetlands, Water Quality, Watershed, and Floodplains Management, Section 4.3 Vegetation Management, Section 4.4 Invasive Plants and Noxious Weeds Management, Section 4.5 Agricultural Outleasing, Section 4.7.1 Habitat Management, and Section 4.1 Forest Management
l. Agricultural Outleasing	Section 4.5 Agricultural Outleasing
m. Geographical Information Systems (GIS) Management, Data Integration, Access, and Reporting	Section 1.14 Geographic Information Systems
n. Outdoor Recreation	Section 4.12 Outdoor Recreation and Environmental Awareness
o. Bird Aircraft Strike Hazard	Section 4.8 Bird Aircraft Strike Hazard (BASH)
p. Wildland Fire Management	Section 3.3.6 Wildland Fire and Controlled Burning
q. Training of Natural Resource Personnel	Section 1.13 Training of Natural Resources Personnel
r. Coastal/Marine Management	Section 4.1 Coastal Zone Protection
s. Floodplains Management	Section 4.2 Wetlands, Water Quality, Watershed, and Floodplains Management
t. Other Leases	N/A
5. Implementation	**5.0 Implementation**
a. Summarize Process of Preparing Prescriptions that Drive the Projects	Section 5.4 Project Development and Classification
b. Achieving No-Net-Loss	Section 5.2 Achieving No Net Loss
c. Use of Cooperative Agreements	Section 5.6 Use of Cooperative Agreements
d. Funding	Section 5.5 Funding Sources

N/A = Not Applicable

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Appendix M

NAS Oceana–NALF Fentress Natural Resources Project Implementation Schedule

Enclosure 1 **NAS Oceana–NALF Fentress Environmental Program Requirements Project Updates/Budget Execution Plans**

Enclosure 2 **Project Justification and Cost Estimate Information**

Enclosure 3 **INRMP Updates and Annual Metrics**

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Enclosure 1. NAS Oceana–NALF Fentress Environmental Program Requirements Project Updates/Budget Execution Plans

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EPR Project Updates/Budget Execution Plans (CNIC EV Programmatic Funding)

(*Projects NOT APPROVED by CNO FM, are APPROVED projects, but FUNDS were NOT available*):

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191 (NASO)	POM-08	FY08	60191NR012	FISH AND WILDLIFE CONSERVATION - MAINTENANCE	4.7	E, F			CNO FM Review (APPROVED) (FUNDED-FY08)	Activity Scheduled All Funds to be Executed
N60191	POM-08	FY08	60191NR013	SOIL AND WATER CONSERVATION-EQUIPMENT & SUPPLIES	3.1.2.5, 4.2.3	G, H, I, K			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY08)	Pursuing Ag Funds.
N60191	POM-08	FY08	60191NR018	REG 90, CONSERVATION TRAINING (REQUIRED BY STATUTE	1.13 and Table 1-2	A, J			CNO FM Review (APPROVED) (NOT FUNDED-FY08)	
N60191	POM-08	FY08	60191NR021	SOIL & WATER CONSERVATION (ECOLOGICAL RESTORATION)	3.1.2.5, 4.2.3	G, H, I, K			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY08)	
N60191	POM-08	FY08	60191NR022	LEADERSHIP AGREEMENTS (COOL COMMUNITIES)	Not applicable				Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY08)	
N60191	POM-08	FY08	60191NR029	FOREST MANAGEMENT HAZARD TREE REMOVAL	3.1.6.4, 4.3.2	W			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY08)	Pursing station/facilities funding.
N60191	POM-08	FY08	60191NR039	FOREST MANAGEMENT - MAINTENANCE	3.1.6, 3.3.3, 4.3.2, 4.3.3, 4.11	E, I , W			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY08)	Pursing forestry funds.
N60191	POM-08	FY08	60191NR043	Soil and Water Conservation - CONTROL INVASIVE SPECIES	2.4.5, 3.1.8, 3.3.6, 4.2.2, 4.2.4, 4.4, 4.11	H, I, M, X			CNO FM Review (APPROVED) (FUNDED-FY08)	Activity Scheduled All Funds to be Executed
N60191	POM-08	FY08	60191NR045	FOREST QUALITY ANNUAL SURVEY	3.3, 4.11	E, W			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY08)	Pursing forestry funds.
N60191	POM-08	FY08	60191NR046	FOREST MGMT - ARBORICULTURAL TREATMENTS	3.1.6, 3.3.3, 4.3.2, 4.3.3, 4.11	E, I , S, W			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY08)	Pursing forestry funds.
N60191	POM-08	FY08	60191NR051	UPDATE INTEGRATED NATURAL RESOURCES MGMT PLAN	Plan Updates, 1.2, 1.4.1, 5.2	E, F, G			CNO FM Review (APPROVED) (FUNDED-FY08)	
N60191	POM-08	FY08	60191NR054	REG 90, TRAVEL FOR CONSERVATION TRAINING Consolida	Not applicable	A, E			CNO FM Review (APPROVED) (NOT FUNDED-FY08)	Appears to duplicate 60191NR018, which also was not funded.

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-08	FY08	60191PE01F	RECREATIONAL FISHERIES IMPROVEMENTS	3.2.2, 3.4.2, 4.7.2.2, 4.15	G, Y			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY08)	
N60191	POM-08	FY08	60191PE014	Soil & Water Conservation - Erosion Control	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	G, I, K			CNO FM Review (APPROVED) (FUNDED-FY08)	Activity Scheduled All Funds to be Executed
N60191	POM-08	FY08	60191WD001	Wetlands Delineation	2.3.5, 4.2.3, 4.15.1	G, H, K			BSO Originate/Review (PENDING APPROVAL) (FUNDED-FY08)	Work started in FY07 and was completed in FY2011.
N60191	POM-08	FY09	60191NR012	FISH AND WILDLIFE CONSERVATION - MAINTENANCE	4.7	A, E			CNO FM Review (APPROVED) (FUNDED-FY09)	Activity Scheduled All Funds to be Executed
N60191	POM-08	FY09	60191NR013	SOIL AND WATER CONSERVATION-EQUIPMENT & SUPPLIES	3.1.2.5, 4.2.3	G, H, I			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY09)	Pursuing Ag Funds.
N60191	POM-08	FY09	60191NR018	REG 90, CONSERVATION TRAINING (REQUIRED BY STATUTE	1.13 and Table 1-2	A, E			CNO FM Review (APPROVED) (NOT FUNDED-FY09)	
N60191	POM-08	FY09	60191NR021	SOIL & WATER CONSERVATION (ECOLOGICAL RESTORATION)	3.1.2.5, 4.2.3	G, H, I, K			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY09)	
N60191	POM-08	FY09	60191NR022	LEADERSHIP AGREEMENTS (COOL COMMUNITIES)	Not applicable				Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY09)	
N60191	POM-08	FY09	60191NR029	FOREST MANAGEMENT HAZARD TREE REMOVAL	3.1.6.4, 4.3.2	W			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY09)	Pursing station/facilities funding.
N60191	POM-08	FY09	60191NR039	FOREST MANAGEMENT - MAINTENANCE	3.1.6, 3.3.3, 4.3.2, 4.3.3, 4.11	E, W			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY09)	Pursing forestry funds.
N60191	POM-08	FY09	60191NR043	Soil and Water Conservation - CONTROL INVASIVE SPECIES	2.4.5, 3.1.8, 3.3.6, 4.2.2, 4.2.4, 4.4, 4.11	H, I, M, X			CNO FM Review (APPROVED) (FUNDED-FY09)	Activity Scheduled All Funds to be Executed
N60191	POM-08	FY09	60191NR045	FOREST QUALITY ANNUAL SURVEY	3.3, 4.11	W			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY09)	Pursing forestry funds.
N60191	POM-08	FY09	60191NR046	FOREST MGMT - ARBORICULTURAL TREATMENTS	3.1.6, 3.3.3, 4.3.2, 4.3.3, 4.11	E, I, S, W			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY09)	Pursing forestry funds.
N60191	POM-08	FY09	60191NR049	SPECIES SURVEY - Threatened & Endangered	2.6, 4.10, 4.15.2	D, E, F			CNO FM Review (APPROVED) (NOT FUNDED-FY09)	

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-08	FY09	60191NR054	REG 90, TRAVEL FOR CONSERVATION TRAINING Consolida	Not applicable	A, E			CNO FM Review (APPROVED) (NOT FUNDED-FY09)	Appears to duplicate 60191NR018, which also was not funded.
N60191	POM-08	FY09	60191PE01F	RECREATIONAL FISHERIES IMPROVEMENTS	3.2.2, 3.4.2, 4.7.2.2, 4.15	G, Y			Activity FM Review (PENDING APPROVAL) (NOT FUNDED-FY09)	
N60191	POM-08	FY09	60191PE014	Soil & Water Conservation - Erosion Control	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	G, I, K			CNO FM Review (APPROVED) (NOT FUNDED-FY09)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY10	601919NR043	Soil and Water Conservation - CONTROL INVASIVE SPECIES	2.4.5, 3.1.8, 3.3.6, 4.2.2, 4.2.4, 4.4, 4.11	H, I, M, X			CNO FM Review (APPROVED) (FUNDED-FY10)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY10	60191NR012	FISH AND WILDLIFE CONSERVATION - MAINTENANCE	4.7	A, E			CNO FM Review (APPROVED) (FUNDED-FY10)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY10	60191NR016	REG 90, NEPA TRAINING (REQ BY POLICY/REG CHANGE) C	1.13	A, J			CNO FM Review (APPROVED) (FUNDED-FY10)	Archived. Identical to approved projects 018 and 054. Activity Scheduled All Funds to be Executed
N60191	POM-10	FY10	601919NR101	POM 10 Oceana Runway Electric Fence	3.2.7				CNO Review (NOT APPROVED) (NOT FUNDED-FY10)	BASH is currently not an N45 requirement; therefore, this project is being rejected. Seek funding from N46.
N60191	POM-10	FY10	601919NR103	Soil & Water CONSERVATION Equip & supplies	3.1.2.5, 4.2.3	G, H, I			CNO FM Review (APPROVED) (FUNDED-FY10)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY10	60191NR104	POM 10 Conservation Law Training	1.13, 3.4, 3.4.3, 4.12, 4.13	A, J			BSO Originate/Review (NOT APPROVED) (NOT FUNDED-FY10)	Rejected.
N60191	POM-10	FY10	60191NR110	POM 10 Soil and Water Conservation - Erosion Control	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	G, I, K			CNO FM Review (NOT APPROVED) (NOT FUNDED-FY10)	Rejected. Considered Duplicate of 60191NR103.
N60191	POM-10	FY10	601919NR111	POM 10 SOIL & WATER CONSERVATION-NATURAL RESOURCES PLAN TASKS IMPLEMENTATION	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	G, H, I, K			CNO FM Review (APPROVED) (FUNDED-FY10)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY10	601919NR112	POM 10 OUTDOOR RECREATION WILDLIFE HABITAT AREAS	Not applicable	A, E			CNO FM Review (APPROVED) (FUNDED-FY10)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY10	601919NR113	POM 10 REQUIRED WETLANDS MONITORING	4.2.4	G, H, K			CNO FM Review (APPROVED) (FUNDED-FY10)	Activity Scheduled All Funds to be Executed

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-10	FY10	601919NR115	Soil & Water CONSERVATION INVASIVE SPECIES	2.4.5, 3.1.8, 3.3.6, 4.2.2, 4.2.4, 4.4, 4.11	H, I, M, X			CNO FM Review (APPROVED) (FUNDED-FY10)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY10	601919PE014	Soil & Water CONSERVATION EROSION CONTROL	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	G, I, K			CNO FM Review (APPROVED) (FUNDED-FY10)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY11	60191NR005	CONSERVATION MAPPING (UPDATES)	2.4, Figure 2-7, Figure 2-8	A, E			CNO FM Review (APPROVED) (NOT FUNDED-FY11)	Archived.
N60191	POM-10	FY11	60191NR012	FISH AND WILDLIFE CONSERVATION - MAINTENANCE	4.7	E, F			CNO FM Review (APPROVED) (FUNDED-FY11)	Activity Scheduled All Funds to be Executed
N60191	POM-10	FY11	60191NR016	REG 90, NEPA TRAINING (REQ BY POLICY/REG CHANGE) C	1.13	A, J			CNO FM Review (APPROVED) (FUNDED-FY11)	Archived. Activity Scheduled All Funds to be Executed.
N60191	POM-10	FY11	60191NR028	OUTDOOR RECREATION NATURAL RESOURCES CTR PROGRAMS	3.4, 4.6	A, E			CNO FM Review (APPROVED) (NOT FUNDED-FY11)	Archived. Funded via Sikes Act Funds.
N60191	POM-10	FY11	60191NR043	Soil and Water Conservation - CONTROL INVASIVE SPECIES	2.4.5, 3.1.8, 3.3.6, 4.2.2, 4.2.4, 4.4, 4.11	H, I, M, X			CNO FM Review (APPROVED) (FUNDED-FY11)	Region to execute Aerial Spraying Contract.
N60191	POM-10	FY11	60191NR049	SPECIES SURVEY - Threatened & Endangered	2.6, 4.10, 4.15.2	D, E, F			CNO FM Review (APPROVED) (NOT FUNDED-FY11)	Archived.
N60191	POM-10	FY11	60191NR051	UPDATE INTEGRATED NATURAL RESOURCES MGMT PLAN	Plan Updates, 1.2, 1.4.1, 5.2	E, F, G			CNO FM Review (APPROVED) (FUNDED-FY08)	Completed in 2008
N60191	POM-10	FY11	60191NR101	POM 10 Oceana Runway Electric Fence	3.2.7				CNO Review (NOT APPROVED) (NOT FUNDED-FY11)	Rejected. To be funded by N46.
N60191	POM-10	FY11	60191NR103	POM 10 Soil and Water Conservation Equipment and Supplies	3.1.2.5, 4.2.3	G, H, I, K			CNO FM Review (APPROVED) (FUNDED-FY11)	Region to execute wetlands work.
N60191	POM-10	FY11	60191NR104	POM 10 Conservation Law Training	1.13, 3.4, 3.4.3, 4.12, 4.13	A, J			BSO Originate/Review (NOT APPROVED) (NOT FUNDED-FY11)	Rejected.
N60191	POM-10	FY11	60191NR105	POM 10 Soil and Water Conservation Ecological Restoration	3.1.2.5, 4.2.3	G, H, I, K			BSO Originate/Review (NOT APPROVED) (NOT FUNDED-FY11)	Flagged for Correction.

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-10	FY11	60191NR106	POM 10 Forest Management Hazard Tree Removal	3.1.6.4, 4.3.2	W			BSO Originate/Review (NOT APPROVED) (NOT FUNDED-FY11)	Rejected. Hazard Tree Removal is Facility Function.
N60191	POM-10	FY11	60191NR108	POM 10 Forest Management Urban Forest Inventory	3.3, 4.11	E, I, W			BSO Originate/Review (NOT APPROVED) (NOT FUNDED-FY11)	Flagged for Correction.
N60191	POM-10	FY11	60191NR110	POM 10 Soil and Water Conservation - Erosion Control	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	G, I, K			CNO FM Review (NOT APPROVED) (NOT FUNDED-FY11)	Rejected. Considered Duplicate of 60191NR103.
N60191	POM-10	FY11	60191NR111	POM 10 Soil and Water Conservation - Natural Resources Plan Tasks Implementation	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	H, I			CNO FM Review (APPROVED) (FUNDED-FY11)	Activity Scheduled All Funds to be Executed.
N60191	POM-10	FY11	60191NR112	POM 10 Outdoor Recreation Wildlife Habitat Areas	Not applicable	A, E			CNO FM Review (APPROVED) (NOT FUNDED-FY11)	
N60191	POM-10	FY11	60191NR113	POM 10 - Required Wetlands Monitoring	4.2.4	G, H, K			CNO FM Review (APPROVED) (FUNDED-FY11)	Region to execute wetlands work.
N60191	POM-10	FY11	60191NR115	POM 10 Soil and Water Conservation Control Invasive Species	2.4.5, 3.1.8, 3.3.6, 4.2.2, 4.2.4, 4.4, 4.11	H, I, M, X			CNO FM Review (APPROVED) (FUNDED-FY11)	Region to execute Aerial Spraying Contract.
N60191	POM-10	FY11	60191PE014	Soil & Water Conservation - Erosion Control	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	G, I, K			CNO FM Review (APPROVED) (FUNDED-FY11)	Region to execute wetlands work.
N60191	POM-12	FY12	60191NR201	4 MA-NAS Oceana-Threatened & Endangered Species Inventory (NASO & NALFF)	2.6, 4.10, 4.15.2	D, E, F	$260,274		CNO FM Review (APPROVED) (FUNDED-FY12)	Contract Awarded.
N60191	POM-12	FY12	60191NR202	MA-NAS OCEANA Wetland Mapping Inventory (NASO & NALFF)	2.3.5, 4.2.3, 4.15.1	G, H, K	NASO: $31,383 NALFF: $14,511		CNO FM Review (APPROVED) (FUNDED-FY12)	Contract Awarded. Preliminary USACE JD received Oct 2012.
N60191	POM-12	FY12	60191NR203	MA-NAS OCEANA Mitigation Site Monitoring (NASO)	4.2.4	G, H, K	$2,000		CNO FM Review (APPROVED) (FUNDED-FY12)	Completed Inhouse.
N60191	POM-12	FY12-17	60191NR204	MA-NAS OCEANA - Migratory & Breeding Bird Surveys (NASO & NALFF)	2.5.2, 4.8	D, E, V	$99,505		CNO FM Review (APPROVED) (FUNDED-FY12)	Contract Awarded.
N60191	POM-12	FY12-17	60191NR205	3 Species & Habitats of Concern Protection (NASO & NALFF)	3.1.7, 3.1.7.1, 3.2.9, 4.2.4	D, F, G	$23,072.12		CNO FM Review (APPROVED) (FUNDED-FY12)	Completed Inhouse.

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-12	FY12-17	60191NR206	MA NAS OCEANA - Forest Inventory (NASO & NALFF)-Natural & Urban	3.3, 4.11	E, I, W	$45,099.92		CNO FM Review (NOT APPROVED) (NOT FUNDED-FY12)	DARLENE GAUTHIER has been set NOT APPROVED for project at CNO FM REVIEW for the following reason: During Round 2 of POM-12 SPP, the decision was made to accept additional "manageable risk" within the conservation program. All ERL3 requirements are considered as manageable or acceptable risk and therefore are not approved for POM-12. Regions should first execute ERL4 requirements and then accommodate ERL3 requirements with any remaining funds. Update: Going to request development of a contract SOW or Cooperative Agreement and request FY13 EOY funds.
N60191	POM-12	FY12-17	60191NR207	Timber Harvests (NASO & NALFF) - Silviculture	3.3.3, 3.3.3.1, 4.2, 4.7.1.1, 4.11, 4.15.3	E, I, W			Region Originate/Review (NOT APPROVED) (NOT FUNDED-FY12)	Per phone conversation with NAVFAC MidLANT Core (Region) NR representative (18 Sept 2009), they have decided not to provide the requested cost estimate in this EPR submission, but to pursue the funds for this project through alternative funding methods. I re-reminded them that the guidance out of NAVFAC HQ was to submit costs into the EPRweb, and that both the agricultural & forestry pots of money most-likely will not have funds available for projects.
N60191	POM-12	FY12-17	60191NR209	Soil & Water Conservation (NASO & NALFF) - Erosion Control	3.1.1, 3.1.2, 3.1.2.5, 4.2.3, 4.3.1	G, I, K	$412,422		CNO FM Review (APPROVED) (FUNDED-FY12)	
N60191	POM-12	FY12	60191NR211	3 MA-NAS OCEANA- Landcover Mapping (Species)-NASO & NALFF	2.4, Figure 2-7, Figure 2-8	D, E, M	$191,698		CNO FM Review (NOT APPROVED) (NOT FUNDED-FY12) (FUNDED FY12)	DARLENE GAUTHIER has been set NOT APPROVED for project at CNO FM REVIEW for the following reason: During Round 2 of POM-12 SPP, the decision was made to accept additional "manageable risk" within the conservation program. All ERL3 requirements are considered as manageable or acceptable risk and therefore are not approved for POM-12. Regions should first execute ERL4 requirements and then accommodate ERL3 requirements with any remaining funds. FY12 Update: Funded & Contracted an Erosion Control Assessment in FY12 to identify future potential project needs with EOY funds.
N60191	POM-12	FY12-17	60191NR212	Soils Verification Study (NASO & NALFF)	2.2	E, I			Region Originate/Review (NOT APPROVED) (NOT FUNDED-FY12)	Per phone conversation with NAVFAC MidLANT Core (Region) NR representative (18 Sept 2009), they do not think that this project is needed at this time.
N60191	POM-12	FY12-17	60191NR213	Soil & Water Conservation (NASO & NALFF) - Ag Property Quality Assessment	4.2.3, 4.5	E, G, H	$98,789.96		Region Originate/Review (NOT APPROVED) (NOT FUNDED-FY12)	Per phone conversation with NAVFAC MidLANT Core (Region) NR representative (18 Sept 2009), they do not think that this project is needed at this time.
N60191	POM-12	FY12-17	60191NR214	Soil & Water Conservation (NASO & NALFF) - Ag ditch Buffering & Planting	4.2.3, 4.5	E, G, H	$230,520		Region Originate/Review (NOT APPROVED) (NOT FUNDED-FY12)	Per phone conversation with NAVFAC MidLANT Core (Region) NR representative (18 Sept 2009), they do not think that this project is needed at this time.
N60191	POM-12	FY12-17	60191NR215	Soil & Water Conservation (NASO & NALFF) - Ag-lease Inspections	4.2.3, 4.5	F, H, I			Region Originate/Review (NOT APPROVED) (NOT FUNDED-FY12)	Per phone conversation with NAVFAC MidLANT Core (Region) NR representative (18 Sept 2009), they do not think that this project is needed at this time.
N60191	POM-12	FY12-17	60191NR216	MA-NAS Oceana-Prescribed Burning Agreement (NASO & NALFF) - Establish & Maintain	3.3.6, 4.11	D, F, M	$70,774.65		CNO FM Review (APPROVED) (NOT FUNDED-FY12)	Update: Going to request development of a contract SOW or Cooperative Agreement and request FY13 EOY funds.
N60191	POM-12	FY12-17	60191NR218	Invasive Species (NASO & NALFF) - Inventory, Map, Assess & Control	2.4.5, 3.1.8, 3.3.6, 4.2.2, 4.2.4, 4.4, 4.11	H, I, M, X	$88,381.95		CNO FM Review (APPROVED) (FUNDED-FY12)	Contract Awarded.

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-12	FY12-17	60191NR219	MA-NAS Oceana-Emergency Wildlife Calls (NASO & NALFF) - NR Staff Response	3.2.8	D, E, F	$2,675.35		CNO FM Review (NOT APPROVED) (NOT FUNDED-FY12)	DARLENE GAUTHIER has been set NOT APPROVED for project at CNO FM REVIEW for the following reason: During Round 2 of POM-12 SPP, the decision was made to accept additional "manageable risk" within the conservation program. All ERL3 requirements are considered as manageable or acceptable risk and therefore are not approved for POM-12. Regions should first execute ERL4 requirements and then accommodate ERL3 requirements with any remaining funds.
N60191	POM-12	FY12-17	60191NR220	3 MA-NAS Oceana - Nuisance Wildlife (NASO & NALFF) - Inventory, Assess & Remove	3.2.8, 3.4.1, 4.15.2	D, E, F	$60,522.04		CNO FM Review (APPROVED) (FUNDED-FY12)	Contract Awarded.
N60191	POM-12	FY12-17	60191NR221	MA-NAS OCEANA Fisheries (NASO) - Test, Assess & Stock	3.4.2, 4.12	G, Y	$17,411.65		CNO FM Review (NOT APPROVED) (NOT FUNDED-FY12)	DARLENE GAUTHIER has been set NOT APPROVED for project at CNO FM REVIEW for the following reason: During Round 2 of POM-12 SPP, the decision was made to accept additional "manageable risk" within the conservation program. All ERL3 requirements are considered as manageable or acceptable risk and therefore are not approved for POM-12. Regions should first execute ERL4 requirements and then accommodate ERL3 requirements with any remaining funds. Update: Going to request development of a contract SOW or Cooperative Agreement and request FY13 EOY funds.
N60191	POM-12	FY12-17	60191NR222	MA-NAS OCEANA Outdoor Recreation Program Requirements (NASO & NALFF)	3.4, 4.12	A, E, Y	$4,626.93		CNO FM Review (APPROVED) (NOT FUNDED-FY12) (PARTIAL FUNDING FY12)	Partially funded with funds left over from projects negotiated under GCE.
N60191	POM-12	FY12-17	60191NR223	MA Oceana - Equipment Storage Structures (NASO) - Construction & Maintenance	1.4.1, 3.2.8	E, G, I	$46,074.67		CNO FM Review (NOT APPROVED) (NOT FUNDED-FY12)	DARLENE GAUTHIER has been set NOT APPROVED for project at CNO FM REVIEW for the following reason: During Round 2 of POM-12 SPP, the decision was made to accept additional "manageable risk" within the conservation program. All ERL3 requirements are considered as manageable or acceptable risk and therefore are not approved for POM-12. Regions should first execute ERL4 requirements and then accommodate ERL3 requirements with any remaining funds.
N60191	POM-12	FY12-17	60191NR224	MA Oceana - Equipment Maintenance & Repair	1.4.1	E, I, M	$12,288.12		CNO FM Review (NOT APPROVED) (NOT FUNDED-FY12)	DARLENE GAUTHIER has been set NOT APPROVED for project at CNO FM REVIEW for the following reason: During Round 2 of POM-12 SPP, the decision was made to accept additional "manageable risk" within the conservation program. All ERL3 requirements are considered as manageable or acceptable risk and therefore are not approved for POM-12. Regions should first execute ERL4 requirements and then accommodate ERL3 requirements with any remaining funds. Update: Going to request development of a contract SOW and request FY13 EOY funds.
N60191	POM-12	FY12-17	60191NR226	MA NAS Oceana - INRMP Updates and Planning	Plan Updates, 1.2, 1.4.1, 5.2	E, F, G	$8,464.72		CNO FM Review (APPROVED) (FUNDED-FY12)	Contract Awarded.
N60191	POM-12	FY12-17	60191NR227	MA Oceana - Resources Protection Agreement (NASO & NALFF)- Establish & Maintain	1.4.2	D, E, F			CNO FM Review (APPROVED) (NOT FUNDED-FY12)	Moved from NR Chapter 12 to CR Chapter 14, since the project supports both programs. Awaiting Updated Navy Instructions related to CLEO support. Develop agreement with either Installation Security, USFWS, or VDGIF and request EOY funding. Notes: USFWS LE in 2009 indicated that they may not be able to provide assistance; initial discussion with VDGIF in FY2009 indicated that they were interested, but FY12 discussions indicated that they are apprehensive about development of such an agreement; and discussions with Base security is pending Naval Instruction Updates. Need to reengage USFWS, and VDGIF after discussions with Base Security. Going to request development of a MOA or Cooperative Agreement and request FY13 EOY funds.

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N60191	POM-12	FY12-17	60191NR228	MA-NAS OCEANA-Natural Resources Staff Certification Requirements	1.13	E, F, Z	$6,333.86		CNO FM Review (APPROVED) (FUNDED-FY12)	Completed Inhouse.
N60191	POM-14	FY15	60191NR202	CWA MA NASO/NALFF - Wetland Mapping Inventory	2.3.5, 4.2.3, 4.15.1	G, H, K	NASO: $31,383 NALFF: $14,511		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY15	60191NR203	CWA MA NASO/NALFF - Mitigation Site Monitoring	4.2.4	G, H, K	$2,000		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR204	MBTA MA NASO/NALFF - Migratory & Breeding Bird Surveys	2.5.2, 4.8	D, E, V	$99,505		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR205	4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection	3.1.7, 3.1.7.1, 3.2.9, 4.2.4	D, F, G	$23,072.12		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR206	MA NASO/NALFF - Forest Management	3.1.6, 3.3.3, 4.3.2, 4.3.3, 4.11	E, I , W	$45,099.92		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14	60191NR211	MA NASO/NALFF - Landcover Mapping	2.4, Figure 2-7, Figure 2-8	D, E, M	$191,698		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR213	CWA MA NASO/NALFF - Agricultural Monitoring	4.5	E, G, H			Activity FM Review (NOT APPROVED)	NAVFAC MIDLANT Core (Region) decided not to promote project for funding during this POM cycle.
N60191	POM-14	FY15	60191NR214	CWA MA NASO/NALFF - Agricultural Run-off Control Structures	4.5	E, G, H			Activity FM Review (NOT APPROVED)	NAVFAC MIDLANT Core (Region) decided not to promote project for funding during this POM cycle.
N60191	POM-14	FY14-18	60191NR216	MA NASO/NALFF - Habitat Management - Prescribed Fire	3.3.6, 4.11	D, F, M	$70,774.65		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR218	MA NASO/NALFF - Invasive Species	2.4.5, 3.1.8, 3.3.6, 4.2.2, 4.2.4, 4.4, 4.11	M, I, X	$88,381.95		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR219	MA NASO/NALFF - Wildlife Emergency Response	3.2.8	D, E, F	$2,675.35		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR220	4 SAR MA NASO/NALFF - Nuisance Wildlife Inventory, Assess & Remove	3.2.8, 3.4.1, 4.15.2	D, E, F	$60,522.04		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR221	EFH MA NASO/NALFF - Fisheries, Ditches & Streams	4.7.2.2	G, Y	$17,411.65		CNO FM Review (PENDING APPROVAL)	

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-14	FY14-18	60191NR222	MA NASO/NALFF - Outdoor Recreation Program Requirements	3.4, 4.12	A, E, Y	$4,626.93		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR223	MA NASO/NALFF - Equipment Storage Structures	1.4.1, 3.2.8	E, G, I	$46,074.67		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR224	MA NASO/NALFF - Equipment Maintenance & Repair	1.4.1	E, I, M	$12,288.12		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR226	MA NASO/NALFF - INRMP Updates and Planning	Plan Updates, 1.2, 1.4.1, 5.2	E, F, G	$8,464.72		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR227	MA NASO/NALFF - Resource Protection Agreement	1.4.2	D, E, F			CNO Review (PENDING APPROVAL)	Cultural Resources Guidebook
N60191	POM-14	FY14-18	60191NR228	MA NASO/NALFF - Natural Resources Staff Certification Requirements	1.13	E, F, Z	$6,333.86		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR231	MA NASO/NALFF - Nearshore Environment and Climate Change Assessments	2.3.6, 3.1.1, 4.1.1	D, E, F, J, T, Y	$109,007.90		CNO FM Review (PENDING APPROVAL)	
N60191	POM-14	FY14-18	60191NR232	MA NASO/NALFF - Resource Protection Agreement	3.1.5	D, E, F	$99,355.56		CNO FM Review (PENDING APPROVAL)	Natural Resources Guidebook
	POM-16		60161NR225	SIKES MA NASO/NALFF-Conservation Law-enforcement Vehicle	4.13	E, F, G	$5,827.96			

Legal Divers and Initiatives:

A Chief of Naval Operations Instruction (OPNAVINST) 5090.1C Change Transmittal (Ch-1)
B Department of Defense Instruction (DoDI) 4715.03, Natural Resources Conservation Program
C 32 Code of Federal Regulations (CFR) 190, Natural Resources Management Program
D Migratory Bird Treaty Act
E Sikes Act Amendment Act
F Endangered Species Act
G Clean Water Act
H Coastal Zone Management Act
I Soil and Water Conservation Act
J National Environmental Policy Act
K Executive Order (EO) 11990, *Protection of Wetlands*
L EO 11988, *Floodplain Management*
M EO 13751, *Invasive Species*
N EO 12962, *Recreational Fisheries*
O EO 11989, *Use of Off-Road Vehicles on the Public Lands*
P EO 13148, *Greening the Government through Leadership in Environmental Management*
Q Conservation Plan for the Southern Watershed Area (2001)
R CNO Guidance of Feral Cats and Dogs
S Draft Regional Tree Preservation and Replacement Instruction
T Marine Mammal Protection Act
U National Historic Preservation Act
V Bald and Golden Eagle Protection Act
W Forest and Rangeland Renewable Resources Planning Act
X National Invasive Species Act
Y Magnuson-Stevens Fishery Conservation and Management Act
Z Federal Insecticide, Fungicide, and Rodenticide Act

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-16	FY16-20	60191NR201	1 S MA NASO/ NALFF - Threatened & Endangered Species Inventory		D, E, F	$285,000			Non-Annual Recurring
N60191	POM-16	FY16-20	60191NR202	CWA MA NASO/ NALFF - Wetland Mapping Inventory		G, H, K	NASO: $648,002 NALFF: $14,511			Non-Annual Recurring
N60191	POM-16	FY16-20	60191NR203	CWA MA NASO/ NALFF - Mitigation Site Monitoring		G, H, K	$2,000			Annual Recurring
N60191	POM-16	FY16-20	60191NR204	MBTA MA NASO/ NALFF - Migratory & Breeding Bird Surveys		D, E, V	$99,505			Non-Annual Recurring (Annual Recurring Surveys are being conducted via AirOps BASH Agreement with USDA, data is provide to Installation NRM).
N60191	POM-16	FY16-20	60191NR205	4 SAR MA NASO/ NALFF - Species and Habitat of Concern Protection		D, F, G	$23,072.12			Annual Recurring
N60191	POM-16	FY16-20	60191NR206	SIKES MA NASO/ NALFF - Forest Management		E, I , W	$45,099.92 - $104,376			Non-Annual and Annual Recurring Components
N60191	POM-16	FY16-20	60191NR209	CWA MA NASO/ NALFF - Soil & Water Conservation - Erosion Control		E, I , W	$70,074 - $412,422			Non-Annual Recurring, Annual Recurring, and Non-Recurring Components
N60191	POM-16	FY16-20	60191NR211	CHS MA NASO/ NALFF - Landcover Mapping		D, E, M	$191,698			Non-Annual Recurring
N60191	POM-16	FY16-20	60191NR213	CWA MA NASO/ NALFF – Agricultural Monitoring		E, G, H	$4,500 - $98,790			NAVFAC MIDLANT Core (Region) decided not to promote project for funding during this POM cycle. Non-Annual Recurring and Annual Recurring Components
N60191	POM-16	FY16-20	60191NR214	CWA MA NASO/ NALFF – Agricultural Run-off Control Structures		E, G, H	$230,520			NAVFAC MIDLANT Core (Region) decided not to promote project for funding during this POM cycle. Non-Recurring (with future potential projects)
N60191	POM-16	FY16-20	60191NR216	EO 13751 MA NASO/ NALFF - Habitat Management - Prescribed Fire		D, F, M	$70,775			Non-Annual and Annual Recurring Components
N60191	POM-16	FY16-20	60191NR218	EO 13751 MA NASO/ NALFF - Invasive Species		M, I, X	$88,381.95 - $132,036			Non-Annual and Annual Recurring Components
N60191	POM-16	FY16-20	60191NR219	SIKES MA NASO/ NALFF - Wildlife Emergency Response		D, E, F	$2,675.35			Annual Recurring
N60191	POM-16	FY16-20	60191NR220	4 SAR MA NASO/ NALFF – Nuisance Wildlife Inventory, Assess & Remove		D, E, F	$60,522 - $84,523.77			Non-Annual and Annual Recurring Components

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N60191	POM-16	FY16-20	60191NR221	EFH MA NASO/ NALFF - Fisheries, Ditches & Streams		G, Y	$17,412 - $133,534			Non-Annual and Annual Recurring Components
N60191	POM-16	FY16-20	60191NR222	MSFCA MA NASO/ NALFF - Outdoor Recreation Program Requirements		A, E, Y	$1,577 - $4,627			Non-Annual and Annual Recurring Components
N60191	POM-16	FY16-20	60191NR223	SIKES MA NASO/ NALFF - Equipment Storage Structures		E, G, I	$919 - $46,075			Non-Annual and Annual Recurring Components
N60191	POM-16	FY16-20	60191NR224	SIKES MA NASO/ NALFF - Equipment Maintenance & Repair		E, I, M	$12,288			Annual Recurring
N60191	POM-16	FY16-20	60161NR225	SIKES MA NASO/ NALFF - Conservation Law-enforcement Vehicle		E, F, G	$5,828			Annual Recurring Components
N60191	POM-16	FY16-20	60191NR226	CHS MA NASO/ NALFF - INRMP Updates and Planning		E, F, G	$8,465 - $83,311			Non-Annual and Annual Recurring Components
N60191	POM-16	FY16-20	60191NR228	SIKES MA NASO/ NALFF - Natural Resources Staff Certification Requirements		E, F, Z	$6,334			Annual Recurring
N60191	POM-16	FY16-20	60191NR231	CHS MA NASO/ NALFF – Nearshore Environment and Climate Change Assessments		D, E, F, J, T, Y	$109,008			Non-Annual Recurring
N60191	POM-16	FY16-20	60191NR232	SIKES MA NASO/ NALFF - Resource Protection Agreement		D, E, F	$99,356			Non-Annual and Annual Recurring Components

Legal Divers and Initiatives:

A Chief of Naval Operations Instruction (OPNAVINST) 5090.1C Change Transmittal (Ch-1)
B Department of Defense Instruction (DoDI) 4715.03, Natural Resources Conservation Program
C 32 Code of Federal Regulations (CFR) 190, Natural Resources Management Program
D Migratory Bird Treaty Act
E Sikes Act Amendment Act
F Endangered Species Act
G Clean Water Act
H Coastal Zone Management Act
I Soil and Water Conservation Act
J National Environmental Policy Act
K Executive Order (EO) 11990, *Protection of Wetlands*
L EO 11988, *Floodplain Management*
M EO 13751, *Invasive Species*
N EO 12962, *Recreational Fisheries*
O EO 11989, *Use of Off-Road Vehicles on the Public Lands*
P EO 13148, *Greening the Government through Leadership in Environmental Management*
Q Conservation Plan for the Southern Watershed Area (2001)
R CNO Guidance of Feral Cats and Dogs
S Draft Regional Tree Preservation and Replacement Instruction
T Marine Mammal Protection Act
U National Historic Preservation Act
V Bald and Golden Eagle Protection Act
W Forest and Rangeland Renewable Resources Planning Act
X National Invasive Species Act
Y Magnuson-Stevens Fishery Conservation and Management Act
Z Federal Insecticide, Fungicide, and Rodenticide Act

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-18	FY18-22	60191NR201	1 S MA NASO/ NALFF - Threatened & Endangered Species Inventory		D, E, F	$313,832			Non-Annual Recurring
N60191	POM-18	FY18-22	60191NR202	CWA MA NASO/ NALFF - Wetland Mapping Inventory		G, H, K	$297,972 - $643,786			Non-Annual Recurring (Every 5-10 Years Per Installation)
N60191	POM-18	FY18-22	60191NR203	CWA MA NASO/ NALFF - Mitigation Site Monitoring		G, H, K	$2,080			Annual Recurring
N60191	POM-18	FY18-22	60191NR204	MBTA MA NASO/ NALFF - Migratory & Breeding Bird Surveys		D, E, V	$73,000			Non-Annual Recurring (Annual Recurring Surveys are being conducted via AirOps BASH Agreement with USDA, data is provide to Installation NRM). (Every 5 Years)
N60191	POM-18	FY18-22	60191NR205	4 SAR MA NASO/ NALFF - Species and Habitat of Concern Protection		D, F, G	$46,568 - $130,922			Non-Annuall Recurring and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR206	FRC MA NASO/ NALFF - Forest Management		E, I , W	$150,426			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR209	CWA MA NASO/ NALFF - Soil & Water Conservation - Erosion Control		E, I , W	$41,100 - $447,144			Non-Annual Recurring, Annual Recurring, and Non-Recurring Components
N60191	POM-18	FY18-22	60191NR211	CHS MA NASO/ NALFF - Landcover Mapping		D, E, M	$264,482			Non-Annual Recurring
N60191	POM-18	FY18-22	60191NR213	CWA MA NASO/ NALFF – Agricultural Management		E, G, H	$18,939 - $119,369			NAVFAC MIDLANT Core (Region) decided not to promote project for funding during this POM cycle. Non-Annual Recurring and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR216	EO 13751 MA NASO/ NALFF - Habitat Management - Prescribed Fire		D, F, M	$104,827 - $190,282			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR218	EO 13751 MA NASO/ NALFF - Invasive Species		M, I, X	$87,940 - $219,157			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR219	SIKES MA NASO/ NALFF - Wildlife Emergency Response		D, E, F	$2,783			Annual Recurring
N60191	POM-18	FY18-22	60191NR220	4 SAR MA NASO/ NALFF – Nuisance Wildlife Inventory, Assess & Remove		D, E, F	$77,729 - $85,981			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR221	EFH MA NASO/ NALFF - Fisheries, Ditches & Streams		G, Y	$8,938 - $159,339			Non-Annual and Annual Recurring Components

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP Section Reference	Prime Legal Drive/Initiative[1]	Estimate of Need	Actual Spent/Executed	Status	Comments
N60191	POM-18	FY18-22	60191NR222	MSFCA MA NASO/ NALFF - Outdoor Recreation Program Requirements		A, E, Y	$3,079 - $5,019			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR223	SIKES MA NASO/ NALFF - Equipment Storage Structures		E, G, I	$3,302 - $59,504			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR224	SIKES MA NASO/ NALFF - Equipment Maintenance & Repair		E, I, M	$15,252			Annual Recurring
N60191	POM-18	FY18-22	60191NR226	CHS MA NASO/ NALFF - INRMP Updates and Planning		E, F, G	$8,826 - $37,057			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR228	SIKES MA NASO/ NALFF - Natural Resources Staff Certification Requirements		E, F, Z	$9,956			Annual Recurring
N60191	POM-18	FY18-22	60191NR231	MSFCA MA NASO – Nearshore Environment Assessment		D, E, F, J, T, Y	$73,058			Non-Annual Recurring (Every 5 Years)
N60191	POM-18	FY18-22	60191NR232	SIKES MA NASO/ NALFF - Resource Protection Agreement		D, E, F	$207,441			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR233	BAGEPA MA NASO / NALFF – Nesting Bald Eagle Surveys and Habitat Suitability Assessment		D, E, V	$37,094			Annual Recurring
N60191	POM-18	FY18-22	60191NR234	1 S MA NASO/NALFF - Listed and SAR Bat Species Surveys and Tracking - NLEB		E, F	$180,364			Non-Annual Recurring (Every 3 Years)
N60191	POM-18	FY18-22	60191NR235	3 S MA NASO/NALFF - Threatened & Endangered Species Survey – Monarch Butterfly Habitat		A, E, F	$59,311			Non-Annual and Annual Recurring Components
N60191	POM-18	FY18-22	60191NR238	MSFCA MA NASO/ NALFF – Climate Change Assessments		A, B, E, F	$80,759			Non-Annual and Annual Recurring Components

Legal Divers and Initiatives:

A Chief of Naval Operations Instruction (OPNAVINST) M-5090.1
B Department of Defense Instruction (DoDI) 4715.03,
C Natural Resources Conservation Program 32 Code of Federal Regulations (CFR) 190, Natural Resources
D Management Program Migratory Bird Treaty Act
E Sikes Act Amendment Act
F Endangered Species Act
G Clean Water Act
H Coastal Zone Management Act
I Soil and Water Conservation Act
J National Environmental Policy Act
K Executive Order (EO) 11990, *Protection of Wetlands*
L EO 11988, *Floodplain Management*
M EO 13751, *Invasive Species*
N EO 12962, Recreational Fisheries
O EO 11989, Use of Off-Road Vehicles on the Public Lands
P EO 13148, Greening the Government through Leadership in Environmental Management
Q Conservation Plan for the Southern Watershed Area (2001)
R CNO Guidance of Feral Cats and Dogs
S Tree Preservation and Replacement Guidance
T Marine Mammal Protection Act
U National Historic Preservation Act
V Bald and Golden Eagle Protection Act
W Forest and Rangeland Renewable Resources Planning Act
X National Invasive Species Act
Y Magnuson-Stevens Fishery Conservation and Management Act
Z Federal Insecticide, Fungicide, and Rodenticide Act

EPR Project Updates/Budget Execution Plans (Other Funding):

UIC	POM Cycle	Execution Year(s)	EPR #	Project Title	INRMP[1] Section Reference	Prime Legal Driver/ Initiative[2]	Estimate of Need	Actual Spent/ Executed	Status	Comments
N32442; N60191; N4275A	NA	FY08	Ag Funds, 3LLSV0	Ag-Equipment Support and Maintenance	4.5	E, I, M			(AWARDED)	Funding not specifically tied to an existing EPR, but was identified in INRMP. Activity Scheduled All Funds Executed
N32442; N60191; N4275A	NA	FY08	Ag Funds, 3LLSX0	Ag-Wildlife Habitat Enforcement	4.5, 4.9	D, E, F			(AWARDED)	Activity Scheduled All Funds Executed
N32442; N60191; N4275A	NA	FY08	Ag Funds	Ag-Travel & Training	1.13, 4.5	A, E			(AWARDED)	Region Executed
N32442; N60191; N4275A	NA	FY08	SIKES Act Acct	SIKES Act Approved Appropriations Projects	1.1, 5.6	E			(AVAILABLE)	Activity Scheduled Funds Executed as needed
N32442; N60191; N4275A	POM 08	FY08	Regional Overhead	Misc.	Not applicable	N/A			(APPROVED)	Activity Scheduled All Funds allotted by the region to be Executed
N60191	NA	FY08	QRP (Recycle Funds)	Oceana Pond Upgrades	3.4.2, 4.12, 5.5.6				(AWARDED)	Activity Scheduled All Funds Executed
N32442; N60191; N4275A	POM 08	FY08	61414A9512	Arbor Day Trees	3.4.4, 3.5.2, 4.3.2	A, E			(APPROVED)	Activity Scheduled All Funds allotted by the region and Executed
N32442; N60191; N4275A	POM 08	FY09	Regional Overhead	Misc.	Not applicable	N/A			(APPROVED)	Activity Scheduled All Funds allotted by the region and Executed
N32442; N60191; N4275A	POM 08	FY09	61414A9512	Arbor Day Trees & NWA Wetland Mitigation.	3.4.4, 3.5.2, 4.2.4, 4.3.2	K, S			(APPROVED)	Activity Scheduled All Funds allotted by the region and Executed
N32442; N60191; N4275A	NA	FY09	Ag Funds	Nuisance Wildlife Control: Agricultural Fields	3.2.7, 3.2.8, 3.4.1, 4.5	D, E, F			(NOT AWARDED)	Applied for but not received.
N32442; N60191; N4275A	NA	FY09	Ag Funds	Habitat Conservation	3.1.7, 4.7.1, 4.8, 4.10	D, F, G			(NOT AWARDED)	Applied for but not received.
N32442; N60191; N4275A	NA	FY09	Ag Funds	Training & Travel	1.13	A, E			(NOT AWARDED)	Applied for but not received.
N32442; N60191; N4275A	NA	FY09	Ag Funds	Equipment Support & Maintenance	1.4.1	E, I, M			(NOT AWARDED)	Applied for but not received.
N60191; N4275A	NA	FY09	Ag Funds	Regional Ag Program Mngt.	4.5				(AWARDED)	Region Executed
N32442; N60191; N4275A	NA	FY09	SIKES Act Acct	SIKES Act Approved Appropriations Projects	1.1, 5.6	E			(AVAILABLE)	Activity Scheduled Funds Executed as needed
N32442; N60191; N4275A	POM 10	FY10	Regional Overhead	Misc.	Not applicable	N/A			(APPROVED)	Activity Scheduled All Funds allotted by the region Executed
N60191	NA	FY09	AIR OPS	BASH Supplies	4.9				(APPROVED) (FUNDED-FY09)	Region Scheduled All Funds to be Executed. Funded by AirOps.

N60191	NA	FY10	Legacy Funds	Oceana Pond Nature Trail NPLD Event	3.4.4, 3.5.2, 4.12				(AWARDED)	Activity Scheduled All Funds Executed
N60191; N4275A	NA	FY10	Ag Funds	Regional Ag Program Mngt.	4.5				(AWARDED)	Region Executed
N32442; N60191; N4275A	NA	FY10	SIKES Act Acct	SIKES Act Approved Appropriations Projects	1.1, 5.6	E			(AVAILABLE)	Activity Scheduled Funds Executed as needed
N60191; N4275A	NA	FY11	Ag Funds	Regional Ag Program Mngt.	4.5				(AWARDED)	Region Executed
N32442; N60191; N4275A	POM 10	FY11	Regional Overhead	Misc.	Not applicable	N/A			(APPROVED)	Activity Scheduled All Funds allotted by the region Executed
N32442; N60191; N4275A	NA	FY11	SIKES Act Acct	SIKES Act Approved Appropriations Projects	1.1, 5.6	E			(AVAILABLE)	Activity Scheduled Funds Executed as needed
N60191; N4275A	NA	FY12	Ag Funds	Regional Ag Program Mngt.	4.5				(PENDING)	Planned.
N32442; N60191; N4275A	POM 12	FY12	Regional Overhead	Misc.	Not applicable	N/A			(APPROVED)	As needed.
N32442; N60191; N4275A	NA	FY12	SIKES Act Acct	SIKES Act Approved Appropriations Projects	1.1, 5.6	E			(AVAILABLE)	As needed.

Enclosure 2. Project Justification and Cost Estimate Information

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POM 18 Project Justification and Cost Estimates

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 15 July 2015

Project Number: 60191NR238; 32442NR238; 4275ANR238
Project Title: MSFCA MA NASO/NALFF – Climate Change Assessments; MSFCA MA NASO DNA – Climate Change Assessments; MSFCA MA NSA NWA –Climate Change Assessments
Guidebook & Chapter: 12101
Legal Drivers:
Primary: MSFCM
Secondary: ESA
Tertiary: SIKES
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2018-FY2022, Split Quarters 2nd (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana – Dam Neck Annex (NASO DNA); and Naval Support Activity Hampton Roads – Northwest Annex (NSA NWA).

Project Duration: *(Estimated length of time and Start & End Dates)* ~1 year, 5 months for each 10 year assessment. Time estimates are subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys) and will be handled on a case by case basis. Frequency of assessments may be increased due to mission changes or major landscape changes (man-made or natural).

Project Description: *(What does this project entail?)* Conduct research and analyses to produce a report to be incorporated into the INRMP on the history of climate change, the predictions for future climate change, and the associated impacts of this climate change in association with installation properties. Produce maps, timeline, etc., to depict the predicted climate change impacts. Identify military mission vulnerabilities and recommendations associated with predicted planning for climate change impacts (include, changes in property boundaries, sea level rise and impacts to infrastructure, etc.). Identify potential habitat and species of concern impacts associated with predicted planning for climate change impacts. Work/Coordinate with the South and Mid/North Atlantic Landscape Conservation Cooperative (SALCC, MALCC), USGS, and other Navy partners working on Climate Change initiatives to ensure consistency amongst climate change terminology and estimations. Indentify potential climate change initiatives the Navy can support within the installation's contributing ecosystems (e.g., watersheds, joint venture boundaries, SALCC, bird conservation regions, etc.). Climate change assessment should be completed every 10 years, sooner if a major land alteration or climatic condition change occurs.

Project Purpose: *(Why is this project needed?)*
Project need was identified in 2010 via the INRMP metrics annual review, indicating that the INRMP does not sufficiently address climate change. INRMP update list and project lists were updated to include this need.

Currently, these bases do not have a climate change assessment that will allow them to plan for future climate change concerns. This lack of information puts the Navy at risk for violating several federal and state laws. In addition to federally mandated requirements, Navy and State Policies and Plans dictate that we should have a working knowledge of our impacts to wildlife. This EPR exhibit works to get the Navy in compliance with these requirements.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Assessments of Climate Change associated with bases are necessary to understand how mission requirements will affect species and habitats of concern and vice versa (how impact to species, habitats, and landscapes will impact the military mission). Various laws and regulations will be impacted by climate change (endangered species act, soil conservation act, clean water act, marine mammal protection act, essential fish habitat, etc.). The Sikes Act, National Environmental Policy Act, and Navy & DoD Policy (OPNAVINS M-5090.1, 4715.03, etc.) requires installations with INRMPs to have a working knowledge of climate change and near shore environments, which are to be included in the INRMPs. Knowing in advance what potential concerns there are would allow the command to plan around avoiding potential impacts and to plan for permitting and mitigation requirements, which may be needed to meet military training requirements.

Not having sufficient biological information related to Climate Change leaves the Navy vulnerable to lawsuits when this insufficient information is produced in NEPA documentation associated with military action projects. Obtaining sufficient information will help to avoid these situations or at least help the Navy to win or have such accusations overturned in a court of law.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* Project need was identified in 2010 via the INRMP metrics annual review, indicating that the INRMP does not sufficiently address climate change. INRMP update list and project lists were updated to include this need. Exhibit was approved without funding for FYs 2014 & 2015. No Climate change assessments have been funded to date. POM 16/17 Acceptable Risk, approved without funding. Project was originally part of the associated installation's NR231EPR; however in POM18 a request was made to split it out for better tracking purposes.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report and Geodatabase
5	PreFinal Report and Geodatabase
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs, etc.)
9	Maps
10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA/Contract. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. In general the data will be utilized to identify any trends in impact to bird species of concern given the various military missions, it will be used to identify potential habitat modification requirements to minimize bird strikes, it will be used to

update Bird Depredation Permits where required, and it will be used to help in conducting planning level reviews of proposed projects and activities with consideration for impacts to wildlife and the mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimation was derived utilizing the FY2015 Negotiated Nearshore Assessment Projects since this type of information and surveys are utilized in developing climate change assessments with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%.
  - If similar projects for 60191NR238, 32442NR238 and 4275ANR238 are not funded at the same time the overall cost will likely be more expensive due to additional coordination, inhouse fees, and equipment mobilization requirements.
  - Project was originally part of the associated installation's NR231EPRs; however in POM18 a request was made to split it out for better tracking purposes.

BASE	2015 Near Shore Contract Award	2015 Near Shore Inhouse Fees	~2015 Climate Change (Inhouse Fees included)
NASO DNA	$404,904.84	3,277.71	$76,250.00
NSA NWA	$0.00	0.00	$51,250.00
NASO/NALFF	$65,000.00	0.00	$76,250.00

Project Requested Funding: (Non-Annual Recurring Funds Project within a given POM Cycle)

- FY18 is for the Initial/Baseline Climate Change Assessments (Recurring assessment due every 10 years after initial baseline).

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$80,758.45	$0.00	$0.00	$0.00	$0.00
NSA NWA	$54,280.27	$0.00	$0.00	$0.00	$0.00
NASO/NALFF	$80,758.45	$0.00	$0.00	$0.00	$0.00

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 07 July 2015

Project Number: 60191NR235; 32442NR236; 4275ANR235
Project Title: 3 S MA NASO/NALFF - Threatened & Endangered Species Survey – Monarch Butterfly Habitat; 3 S MA NASO DNA - Threatened & Endangered Species Survey – Monarch Butterfly Habitat; 3 S MA NSA NWA - Threatened & Endangered Species Survey – Monarch Butterfly Habitat;
Guidebook & Chapter: 12104
Legal Drivers:
Primary: Endangered Species Act
Secondary: Sikes Act
Tertiary: Fish & Wildlife Conservation Act, 16 USC 2901-2911
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Non-Annual Recurring, FY2018-2022 Split Quarters 1st (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO)/ Naval Auxiliary Landing Field (NALFF); NASO Dam Neck Annex (DNA); and Naval Support Activity Hampton Roads Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* 1 year, 6 months… subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys).

Project Description: *(What does this project entail?)* Conduct a mapping effort of stands of milkweed, a plant directly linked to the livelihood of Monarch Butterflies, on the installation. In 2015, a petition was submitted to USFW to list Monarch butterflies under the Endangered Species Act. USFWS has not yet made a determination if the petition is warranted. Monarch butterflies and milkweed are known to occur on the installation. Of the mapped milkweed locations, identify potentially significant stands of the plant for proper management to support the conservation of the butterfly. Survey effort will utilize a combination of desktop analysis to focus efforts based off of existing installation GIS data and meandering in-field surveys. Once a milkweed stand is identified the stand is to be mapped utilizing GPS technology that meets or exceeds Navy GIS EV-Model established requirements. Mapped stands will be characterized and ranked based on potential significance to local/migrant monarch butterfly populations. Enhancement/restoration recommendations will be provided for stands of milkweed that would provide an elevated benefit to the local/migrant monarch butterfly populations.

Project Purpose, Project Impact/Benefit to Military Mission: *(Why is this project needed?)* Monarch butterflies are known to migrate through SE VA/NE NC. Migrating butterfly swarms have been documented at NALF Fentress (a Naval Facility in Chesapeake, VA) through the use of radar and field observation (Natural Resources Staff assisting with the operation of radar for BASH survey work confirmed the observation). Monarch butterflies have been observed on most Naval installations in SE VA/NE NC, as has milkweed. Literature research indicates that there is a direct tie to monarch survival and milkweed populations. Research also indicates that pesticide utilization is killing milkweed, which in turn is negatively impacting the reproductive success of Monarch butterflies.

Funding of this project would show a proactive effort to conserving habitat for the monarch butterfly and could be utilized to avoid receiving a critical habitat designation on the installation. Not properly managing for species of concern could: open the Navy and the Base to Lawsuits from the public; result in very costly mitigation and permitting requirements; and could stop or at least restrict military mission operations (resulting in loss of required military training and the associated costs with such a situation).

Ensuring that critical habitat designation does not occur on the installation helps to reduce potential restrictions and regulatory oversight that could be placed on the installation which could greatly reduce military mission and training activities, and increase costs to general operations on the installation.

Also, Data from this project can be utilized to support listing comment period datacall taskers. It is recommended that this project receive funding in either 2016 or 2017 and not wait until 2018 in order to help with such datacall requests.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* NA. Project is Non-Annual Recurring, every 5 years. However, project may be required more frequently if laws change, species are added to the Endangered Species List, or if a catastrophic event causes major change on base or within the habitat.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Monthly Project Status Reports
4	Draft Final Report and Geodatabase
5	PreFinal Report and Geodatabase
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
7	Draft and Final GIS Data Layers/Geodatabase (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs, etc.)
9	Maps
10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA or conduct contract proposal bidding process. Grantee will provide monthly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports and GIS data will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS geodatabase, photographs, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. (Grantee will also notify the Navy immediately if a species of concern is identified providing species name, GPS location, installation name, and photograph, if a camera is available and authorized for use.)

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Estimate was derived from other habitat mapping efforts awarded in 2012 for installations in SE VA/NE NC and their requested Inhouse fees with the following applied annual inflation rates and rounded up to the nearest dollar: years prior-2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% .

Project Requested Funding: (Non-Annual Recurring Funds Project)*...highlighted column is the requested funding year for POM18, out years are shown in the event that project is funded earlier or later than scheduled.*

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$37,069.45	$37,810.84	$38,567.06	$39,338.40	$40,125.17
NSA NWA	$47,078.20	$48,019.77	$48,980.16	$49,959.77	$50,958.96
NASO/NALFF	$59,311.12	$60,497.35	$61,707.29	$62,941.44	$64,200.27

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 07 July 2015

Project Number: 60191NR234; 32442NR235; 4275ANR234
Project Title: 1 S MA NASO/NALFF - Listed and SAR Bat Species Surveys and Tracking - NLEB; 1 S MA NASO DNA - Listed and SAR Bat Species Surveys and Tracking - NLEB t; 1 S MA NSA NWA - Listed and SAR Bat Species Surveys and Tracking - NLEB;
Guidebook & Chapter: 12104
Legal Drivers:
Primary: Endangered Species Act
Secondary: Sikes Act
Tertiary: Fish & Wildlife Conservation Act, 16 USC 2901-2911
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Non-Annual Recurring, FY2019 and FY2022 Split Quarters 1st (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO)/ Naval Auxiliary Landing Field (NALFF); NASO Dam Neck Annex (DNA); and Naval Support Activity Hampton Roads Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* 1 year, 6 months… subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys).

Project Description: *(What does this project entail?)* Conduct basewide monitoring/roost/hibernacula tracking/identification surveys for the Northern long-eared bat. Conduct mist-netting, radio tracking, and acoustic monitoring efforts in accordance with current USFWS and State Guidance every 3 years from the baseline survey effort. Radio track 5-10 female bats (reproductively active, preferred) at each installation. Identify known roosting sites/habitat, and hibernacula on the installation. Establish the extant of use by this species on the installation (what habitats does the species utilize, where, when, and for what purpose). As the species is a short distance migrant species establish anticipated species arrival and departure dates for the installation (if applicable).

If tracking is scheduled and targeted species (NLEB) is not captured, the use of purchased radio tags on other SAR bat species is acceptable, as long as proper State/Federal permitting is obtained and coordination/approvals with/from both Navy CTR and ITR has completed/obtained.

Project Purpose Project Impact/Benefit to Military Mission: *(Why is this project needed?)* The Northern long-eared bat was listed in 2015 under the Endangered Species Act. Little is known about this species in Southeastern VA/Northeastern NC. The species was 1st document in SE VA/NE NC in 2013 on a Naval Installation located both in Chesapeake VA and Currituck Co. NC (NSA NWA) while conducting surveys for a State Listed Bat species. No prior bat survey work at Naval Installations in this area had previously documented this species. Additional bat work conduct in 2014 and 2015 identified the species on additional Naval properties further north along the east coast (NALFF and NWSYT). At 2 installations, NSA NWA and NALFF maternity colonies have been identified roosting on the installation and on adjacent landowner property.

Information on bat utilization of the installation will help in developing or enhancing existing INRMP goals and objectives that support this species, aiding the installation in avoiding potential future critical habitat designation on the installation.

There are several other bat species of concern that are currently not listed, but are anticipated to be proposed for listing under the ESA and are highly likely to become listed, in addition to State Listed Species. This project will also capture information on many of these species, which will help support future datacall taskers related to the listing of these other species.

Not funding this program would put the Navy at risk for being negligent to properly managing for ESA species of concern on their bases. Not funding increases the potential for violations of various Federal Laws to occur, including but not limited to the Endangered Species Act and the Sikes Act. Not properly managing for species of concern could: open the Navy and the Base to Lawsuits from the public; result in very costly mitigation and permitting requirements; and could stop or at least restrict military mission operations (resulting in loss of required military training and the associated costs with such a situation).

Funding this project would allow the Navy to better assess risks to military mission and allow the military to address the concerns accordingly and stop the need for an issuance of a military mission stopping violation. Also, funding a project will allow the base to manage on property, and develop off property partnerships to increase stability of species populations in an attempt to get species delisted or keep them from becoming listed (A GREAT Benefit to the Military Mission).

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)*

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Monthly Project Status Reports
4	Draft Final Report and Geodatabase
5	PreFinal Report and Geodatabase
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase.
7	Draft and Final GIS Data Layers/Geodatabase (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs, permits, etc.)
9	Maps
10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA or conduct contract proposal bidding process. Grantee will provide monthly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports and GIS data will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS geodatabase, photographs, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. (Grantee will also notify the Navy immediately if a species of concern is identified providing species name, GPS location, installation name, and photograph, if a camera is available and authorized for use.)

Cost Estimations:

Project was initially funded via EPRs 32442NR205, 60191NR205, and 4275ANR205 as the bat had not been officially listed when 1st confirmed to be present in SE VA. POM18 is the 1st POM cycle to occur in the 3 year survey timeline since baseline survey work was initiated.

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Estimate was derived from taking the FY2014 awarded contract final costs and requested Inhouse fees with the following applied annual inflation rates and rounded up to the nearest dollar: years prior-2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% .
    - FY14 Awarded Contract N62470-13-D-8016-WE07 NLEB Survey:
      - PMs = Emmett Carawan; Thad McDonald
        - Task 3 NSA NWA presence/absence survey $61,574.00
        - Option 2 NSA NWA presence/absence survey $44,886.45
        - Option 4 NASO presence/absence survey $44,886.45
        - Option 5 NALFF presence/absence survey $44,886.45
        - Option 6 NSA NWA baseline acoustic/netting $36,091.25
        - Option 8 NASO DNA baseline acoustic/netting $36,091.25

BASE	~2015 Baseline (Acoustic Monitoring/Netting)	~2015 Presence/Absence Roosting Locations (Netting/Tracking)	~2015 Inhouse Fees	Total:
NASO DNA	$44,886.45	$36,091.25	$5,000.00	$85,977.70
NSA NWA	$106,460.45	$36,091.25	$5,000.00	$147,551.70
NASO/NALFF	$89,772.90	$72,182.50	$5,000.00	$166,955.40

Project Requested Funding: (Non-Annual Recurring Funds Project)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$91,061.32	$0.00	$0.00	$96,635.00	$0.00
NSA NWA	$156,276.02	$0.00	$0.00	$165,841.36	$0.00
NASO/NALFF	$0.00	$180,363.55	$0.00	$0.00	$191,403.24

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 7 July 2015

Project Number: 32442NR234; 60191NR233; 427ANR233
Project Title: BAGEPA MA NASO DNA – Nesting Bald Eagle Surveys and Habitat Suitability Assessment; BAGEPA MA NSA NWA – Nesting Bald Eagle Surveys and Habitat Suitability Assessment; and BAGEPA MA NASO/NALFF – Nesting Bald Eagle Surveys and Habitat Suitability Assessment
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Bald and Golden Eagle Protection Act
Secondary: Migratory Bird Treaty Act
Tertiary: Sikes Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2018-FY2022, Split Quarters 2nd (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana - Dam Neck Annex (NASO DNA)

Project Duration: *(Estimated length of time and Start & End Dates)* 1 year, 5 months for each 5th year more detailed reporting cycle. Time estimates are subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys) and will be handled on a case by case basis.

Project Description, Purpose, and Utilization: *(What does this project entail?)* With the confirmation of an active eagle nest on NAS Oceana and nests that are relatively close to each of the 4 installations (within <5 miles), coupled with the fact that the state no longer surveys all suitable eagle nesting habitat, a CESU package to conduct Winter Eagle Nest Surveys and Fledgling Eagle Tracking associated with the nests located these Navy properties is recommended. This is particularly critical installations with an aviation mission (especially, for identifying problematic nests for potential removal).

NAS Oceana (NASO) has one confirmed eagle nest, as of fall 2014, along the Owl's Creek waterway, that may have gone unidentified in the previous year. Eagles have been observed on the NASO Airfield and flying over the NASO Golf Course. NASO maintains an USFWS eagle depredation permit, which allows us to harass eagles off of the airfield. NASO is located within several watersheds and is less than a mile from multiple water sources (Atlantic Ocean, Lynnhaven River Tributaries, Golf Course Ponds, etc.) within Virginia Beach, VA. No formal basewide eagle nest surveys have been completed since the VDGIF & CCB stopped surveying all suitable nesting habitat in VA.

NASO Dam Neck Annex (DNA) has confirmed eagle nests located less than 600ft away from its border, but has not confirmed an active nest on property. It is rumored that there may be a

nest or even a possible roost site on the southwest corner of the installation off of Lake Tecumseh. NASO DNA is also located within Virginia Beach, VA and is less than a mile from multiple water sources (Lake Tecumseh, Redwing Lake, Atlantic Oceana, Golf Course Ponds, etc.). No formal basewide eagle nest surveys have been completed since the VDGIF & CCB stopped surveying all suitable nesting habitat in VA.

NALF Fentress (NALFF) has confirmed eagle nests located within 1.25 kilometers of the installation border. Eagles have been documented on the airfield. NALFF is located between branches of the North Landing River and Pocaty Creek in Chesapeake, VA. No formal basewide eagle nest surveys have been completed since the VDGIF & CCB stopped surveying all suitable nesting habitat in VA.

NSAHR Northwest Annex (NWA) has confirmed eagle nests located within 3 kilometers of the installation border. Eagles have been documented loafing and flying over the property but not nesting on site. NSAHR NWA is located in close proximity to the Northwest River and has an open body of water on the property referred to as Lunker Lake . 2/3rds of NASHR NWA is located in Chesapeake, VA. The remaining 1/3rd of the installation is located in Currituck Co., NC. No formal basewide eagle nest surveys have been completed since the VDGIF & CCB stopped surveying all suitable nesting habitat in VA.

Task one of this agreement is to develop a GIS layer depicting suitable nesting habitat polygons for the 4 installations and within 2,640ft of each installation's boundary. The total acreages (~14,000acres) of owned Navy property (does not include the referenced buffer) considered under this agreement are: NASO =5846; NASO DNA =1900; NALFF =2556; and NSAHR NWA =3661. Partner will conduct a desktop analysis utilizing Navy supplied GIS data (boundary layers, vegetation classification data, water source/wetland data, etc.) and available other data (Public Domain/Google Images/Etc., State, Partner, USFWS, USGS, etc. data/imagery) to identify suitable habitat on the installation and within the 2,640ft installation boundary buffer. This suitable habitat layer will be utilized to establish the survey location/paths/routes (this layer should be developed prior to 01 Oct 2015) to be utilized in association with task two of this agreement.

Task two of the agreement is to complete annual winter Eagle Nest and Roost Surveys of all suitable eagle nesting habitat for all 4 installations and if possible suitable habitat within 2,640ft on the installation borders. We suspect the best and most time efficient way to accomplish this task is via aerial survey methodologies. Survey routes/locations should be tracked and delivered utilizing GIS/GPS technologies (point, line, and or polygon geometry). Nest and roost locations will be collected via GPS as point geometry.

Task three of the agreement is to observe identified nests to determine status (active, failed, abandoned, etc.) . This should be recorded as part of the GIS attributes of the nest locations identified in task 3. Access will be granted on Navy property to access nest locations for ground based survey efforts.

Task four of the agreement is for active successful nests to track eaglets associated with tasks 2 and 3's findings. Because food is abundant it is possible to have more than one eagle nest on each of these installations. At this time we are only budgeting for 6 eagle nests with 2 chicks per

nest. For a total of 12 tracking devices. (This budget can be altered depending on available funds.)

GIS Deliverables would need to be compliant with NAVFAC ML Geodatabase SDFIE Environmental Module Requirements. We expect this project's Geodatabase to populate the follow 3 EV Model Feature Types: "NaturalResourceSurvey;" "SpecialStatusSpeciesHabitat;" “LandManagementZone ;” and "SpecialStatusSpeciesObs." The "NaturalResourcesSurvey" layer will include polygon, line, or point data of the actual areas/locations surveyed within the installation and buffered distance of the installation's boundary. The "SpecialStatusSpeciesHabitat" layer will include polygons of the extent of the suitable eagle nesting habitat within the installation and buffered distance of the installation's boundary. The “LandMangementZone” layer will include the USFWS specified distance buffers from known nest specified distances (330', 660', 1000', and 2640'). The "SpecialStatusSpeciesObs" layer will include point locations of identified eagle nests, roosts and eagles. The established EV Model Layers possess the Navy required attribution, this does not mean that all attribution required for this project is prepopulated in the established Geodatabase layer. The established EV Model attribution must be populated; however, if data to be collected does not fit into the pre-established attributions additional attribution can be added into the geodatabase or joinable tables can be created to link to the appropriate GIS files.

All data will be collected and reported to the installation Natural Resources Manager (iNRM). All access requests will be coordinated through the iNRM.

This is a data collection effort and we currently only anticipate receiving the data within a Geodatabase, within either an Access Database or Excel Spreadsheet, and via digital copies of any datasheets. The submittal of the Access Database or Excel Spreadsheet is to ensure we have two different ways to obtain and view pertinent data (nest, roost, and eagle locations) . As we all know, sometime our GIS systems and our Microsoft office systems, are not always available when needed, so it is best to have both media available. The Access or Excel deliverable should include the GIS feature identifier, a point location Lat/Long or UTM, and any attribution/data collected. In addition a copy of any hardcopy and/or electronic datasheets and photographs should be provided to the iNRM. Hardcopies can be scanned and provided digitally. All Final deliverables should be submitted on either a DVD or CDR, as appropriate. Draft deliverables can be submitted via the AMRDEC SAFE system.

This data can be utilized to aide with eagle nest research; however, it's inclusion in publications, presentations, and other media should be coordinated with the associated iNRM to obtain appropriate Navy authorizations for release. Prior to nests being added to public viewable sites, such as the State Eagle NestLocator website, Navy authorization should be obtained. At this time we do not want the tracked eagle locations to be available for public viewing, unless we can provide a public accessible location for people to view the nest. We cannot encourage people to want to come onto certain areas of the installation to view these animals as many areas of the installation are closed to unauthorized individuals (safety/military mission issues). The data not authorized by the Navy to be posted on publicly viewable sites can be made available upon request for official business, but not for recreational/personal use.

This data will be utilized to update 3 Installation Natural Resources Management Plans, associated with identified survey properties. Data will also be utilized by the iNRM and

installation planners to advise appropriate parties regarding changes to the installation's landscape and military operations (e.g., project planning, master planning, NEPA, etc.).

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Eagle nest locations are needed to ensure that we are adequately protecting these species in accordance with the Bald and Golden Eagle Protection Act (BAGEPA) and the Migratory Bird Treaty Act. This species is a former Endangered Species Act listed species. Not knowing the locations of nesting eagles could result in unintended take, and Notice of Violation, and law-enforcement actions/penalties, which could put a stop, and/or delay military mission projects. Knowing in advance what potential concerns there are would allow the command to plan around avoiding potential impacts and to plan for permitting and mitigation requirements, which may be needed to meet military training requirements.

Installation Aviation, Firing Range, Boat-launch and other military training and construction activities can be considered take of an eagle if an eagle abandon's a nest due to these actions; however, if these actions were routinely occurring on the installation prior to the bird nesting within the recommended USFWS nest buffer distance for the type of activity a pre-existing conditions argument can be applied which has the potential to exempt the actions from further restrictions or violations.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)*

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., etc.)
9	Maps
10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. In general the data will be utilized to identify any trends in impact to bird species of concern given the various military missions, it will be used to identify potential habitat modification requirements to minimize bird strikes, it will be used to update Bird Depredation Permits where required, and it will be used to help in conducting planning level reviews of proposed projects and activities with consideration for impacts to wildlife and the mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - Cost estimation was derived from the FY2015 GCE for the development of a CESU with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%
    - Annual recurring eagle habitat assessments and nesting activity surveys have been reclassified under a this new EPR Number for Better Tracking purposes since the surveys are tied to a specific Federal Law (BAGEPA). Project was funded in 2015 in association with funding from EPRs 32442NR205, 60191NR205, and 4275ANR205. Project could also have been tied to EPRS 32442NR204, 60191NR204, and 4275ANR204.

- **Estimate #1:**

BASE	2015 CESU GCE	2015 CESU Inhouse Fee	~2015 CESU Total
NASO DNA	$22,940.00	$1,250.00	$24,190.00
NSA NWA	$10,194.00	$1,250.00	$11,444.00
NASO/NALFF	$32,523.00	$2,500.00	$35,023.00

Project Requested Funding: (Recurring Funds Project)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$25,620.29	$26,132.69	$26,655.35	$27,188.45	$27,732.22
NSA NWA	$12,120.65	$12,363.06	$12,610.33	$12,862.53	$13,119.78
NASO/NALFF	$37,093.81	$37,835.69	$38,592.40	$39,364.25	$40,151.53

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 7 July 2015

Project Numbers: 60191NR232; 32442NR232; 4275ANR232
Project Title: SIKES MA NASO/NALFF - Resource Protection Agreement; SIKES MA NASO DNA - Resource Protection Agreement; SIKES MA NSA NWA - Resource Protection Agreement
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Sikes Act
Secondary: Endangered Species Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual , Split Quarters 1st, 2nd , 3rd, & 4th (or all at the 1st quarter, as funds are to be MIPR'd to another agency for a full year's service)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual.

Project Description: *(What does this project entail?)* Create and maintain a cooperative agreement with the US Fish & Wildlife Service, the VA Department of Game & Inland Fisheries, and/or installation Security to supply Conservation Law-enforcement protection over the natural resources on Navy Property.

Project Purpose: *(Why is this project needed?)* Protection of Natural Resources via adequately staffed and trained Conservation Law-enforcement Officers (CLEOs) is required under the Sikes Act. The CLEO's would enforce a wide number of legal and policy requirements at these installations: CWA; CZMA; EO 11990 (Protection of Wetlands); ESA (e.g., enforcing/executing existing Biological Opinions for such species as the Federally Threatened Loggerhead Sea Turtle); MBTA (e.g., ensuring Migratory Bird depredation work is being carried out in accordance with permit requirements); SWCA; 32 CFR 190 (Natural Resources Management Program); DoDI 4715.03 (Environmental Conservation Program); OPNAVINST M-5090.1; Chesapeake Bay Preservation Act and Federal Agreement; DoD Instruction 4150.7 (Pest Management); EO 13751 (Invasive Species/ Exotic Organisms); and various other Federal and State laws (particularly related to hunting and fishing regulations, and state T&E listed species), regulations, policies, and conservation agreements (MMPA, NMFA, EFH, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

Neither NR staff nor military police currently have the staffing and training levels too sufficiently and legally process and investigate natural resources legal actions. NASO, NALFF, NASO DNA, and NSA NWA all require conservation law-enforcement officer (CLEO) support. Each of these facilities is located within a highly urbanized area and receives a high amount of authorized and unauthorized human access (bases are not 100% fenced in, majority of natural areas are found outside of "secured" compounds). Each of these bases support species of concern, habitats of concern, and hunting &

fishing programs. There have been known and suspected negative impacts to natural resources on each of these bases (i.e., vandalism, killing, filling wetlands, planting of non-native invasive species, harassment of Endangered Species and Migratory Birds, poaching, etc.).

Conservation Law-enforcement is a dangerous job (diseased animals, aggressive animals, hunters with loaded weapons, etc.) and should be done in such a manner that when an officer responds to an emergency situation or a situation where they think they may need to use force (i.e., weapons) they should have adequately trained back-up or someone to attend/investigate with them for safety purposes. Also, staffing should be at a level in order to avoid a situation where a single person is working or on call 24 hours 7 days a week. It is recommended that at a minimum the cooperative agreement or Navy staffing levels provide for 3 adequately trained individuals to provide conservation law-enforcement support to NASO/NALFF, NASO DNA, and NSA-NWA. This way there is the ability to safely work emergency situations and to allow for at least one CLEO to have official time-off on a rotational basis.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with laws, regs., and policies and reduces the potential for incurring Notices of Violations. NOVs could be issued for knowingly and unknowingly allowing the occurrence of negative impacts to resources. It has been identified that current staffing levels and training/cert. levels are not adequate for implementing conservation law-enforcement actions, across all four bases, regarding natural resources. In effect one may draw the conclusion the Navy is knowingly allowing negative impacts to occur to resources based on the lack of providing enough adequately trained conservation law-enforcement professionals.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* Projects has been requested for funding since 2012. Funding was received in 2015 to complete a programmatic assessment. POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

Conservation Law-enforcement Support: Federal, State, and Navy Regulation Enforcement, Patrols, Investigation, Ticketing, other Law-enforcement Legal Support, Nuisance Wildlife Response, Emergency Wildlife Response, Hunting Program Support, Fishing Program Support, etc.

Costs are based off of 2015 OPM Payscales for Law-enforcement:

- 2015 Awarded Assessment may identify a need for additional manpower support; since the assessment has not been completed a minimum number of officers required was estimated. The assessment will also identify training, certification, and equipment support in the event that a Cooperative Agreement Cannot be established that would provide training and equipment.
- Utilized Step 10 for each pay series
- Anticipate a 1st 40 work schedule
- Estimate Night-time Differential and Hazardous Duty Pay May Also Apply and are factory as an overhead % estimate.
- Estimated 8 Hours of Overtime/Week/Person as CLEO work is subject to on Call Services and OT.

Personnel	Qty	Mths	# wks	Hrs/ week	$/hr	$OT/ hr	45% Overhead	Total:	Comments
CLEO (GS 7)	2	12	52	40	$24.65	$36.98	$59,990.11	$193,301.47	
CLEO Team Lead (GS 11)	1	12	52	40	$36.48	$38.31	$41,316.91	$133,132.27	
CLEO Supervisor									To be supplied by CA partner.
Training									To be supplied by CA partner.
Equipment									To be supplied by CA partner.
Benefits									To be supplied by CA partner.

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	Final Report (Breakdown of types of investigations, locations, results, hours spent on each case, etc.)
6	GPS location of infraction concerns (In Navy Standard Format, i.e. WGS84)
7	Frequent correspondence with base Natural Resources Manager
8	Permit Acquisitions (as required)
9	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee(s) staff to develop and obtain approvals of SOW and CA. Navy staff will work with grantee Partners and the CLEOs to identify and report problems. CLEOs will also be available to support other NR related missions if time allows such as prescribed burning, nuisance wildlife and emergency wildlife calls. The submittal of draft a final report will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a document that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: track what types and frequencies of conservation legal infractions are occurring on the bases; update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimate was derived from minimum estimated need requirements and the 2015 OPM pay-scale for Law-enforcement with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%
  - Pending the outcome of the final Cooperative Agreement results, there may be an increase in the amount of funding required to come to a resolution regarding training, equipment, benefits, etc.

- It is recommended that an interagency cooperative agreement with USFWS, VA Department of Game and Inland Fisheries and/or NC Wildlife Commission, or installation Security be developed as these agencies have trained Conservation Law-enforcement Officers and have established programs specifically for conservation law enforcement. USFWS would be the primary choice as they are Federal Government and can cross state jurisdictional boundaries without conflict in regards to conservation law-enforcement actions.
- This estimate has been split between each of the Oceana NR AOR bases, which cover 3 INRMPs (NASO/NALFF, NASO DNA, and NSA NWA), because the CLEOs would service all 4 sites.

Project Requested Funding: (Recurring Funds Project within a given POM Cycle),

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$48,402.88	$49,370.94	$50,358.36	$51,365.52	$52,392.83
NSA NWA	$93,348.41	$95,215.38	$97,119.69	$99,062.08	$101,043.32
NASO/NALFF	$207,440.91	$211,589.73	$215,821.53	$220,137.96	$224,540.72

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 15 July 2015

Project Number: 60191NR231; 32442NR231; 4275ANR231
Project Title: MSFCA MA NASO – Nearshore Environment Assessment; MSFCA MA NASO DNA – Nearshore Environment Assessment; MSFCA MA NSA NWA – Nearshore Environment Assessment
Guidebook & Chapter: 12101
Legal Drivers:
Primary: MSFCM
Secondary: ESA
Tertiary: SIKES
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2018-FY2022, Split Quarters 2nd (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana – Dam Neck Annex (NASO DNA); and Naval Support Activity Hampton Roads – Northwest Annex (NSA NWA).

Project Duration: *(Estimated length of time and Start & End Dates)* ~1 year, 5 months for each 5 year assessment. Time estimates are subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys) and will be handled on a case by case basis. Frequency of assessments may be increased due to mission changes or major landscape changes (man-made or natural).

Project Description: *(What does this project entail?)* Conduct research and analyses to produce a report to be incorporated into the INRMP on the detailed analysis/assessment of near shore environment associated with shore installations for inclusion in the INRMP. Identify and map (providing GIS layers and metadata) boundary of near shore environment. Provide property ownership information on the near shore environment lands and agreements between the property owner and the Navy. Provide species and habitat data information within the near shore environment. Provide near shore environment topography and tidal fluctuation information. Identify military training that currently impacts the near shore environment and how the environment is impacted. Identify potential conflicts with the military mission and the near shore environment. Indentify potential habitat conservation initiatives the Navy can support associated with the near shore environment. Due to natural weather events the nearshore environment is dynamic and like dune systems can change drastically in a relatively short amount of time. In addition at these installations man-made actions also impact the nearshore environment such as military training, pile driving, dredging, beach replenishment operations, and general recreation (fishing, swimming, boating, etc.). Given the dynamic nature of this environment Nearshore Assessments should recur every 5 years, sooner if a major land alteration or climatic condition change occurs.

Project Purpose: *(Why is this project needed?)*
Project need was identified in 2010 via the INRMP metrics annual review, indicating that the INRMP does not sufficiently address nearshore environments. INRMP update list and project lists were updated to include this need.

Currently, these bases do not have sufficient biological information to determine if they are negatively impacting species and habitats within the nearshore environment. This lack of information puts the Navy at risk for violating several federal and state laws. In addition to federally mandated requirements, Navy and

State Policies and Plans dictate that we should have a working knowledge of our impacts to wildlife. This EPR exhibit works to get the Navy in compliance with these requirements.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Assessments of nearshore environments associated with bases are necessary to understand how mission requirements will affect species and habitats of concern and vice versa (how impact to species, habitats, and landscapes will impact the military mission). Various laws and regulations will be impacted by climate change (endangered species act, soil conservation act, clean water act, marine mammal protection act, essential fish habitat, etc.). The Sikes Act, National Environmental Policy Act, and Navy & DoD Policy (OPNAVINS M-5090.1, 4715.03, etc.) requires installations with INRMPs to have a working knowledge of climate change and near shore environments, which are to be included in the INRMPs. Knowing in advance what potential concerns there are would allow the command to plan around avoiding potential impacts and to plan for permitting and mitigation requirements, which may be needed to meet military training requirements.

Not having sufficient biological information related to Nearshore environments leaves the Navy vulnerable to lawsuits when this insufficient information is produced in NEPA documentation associated with military action projects. Obtaining sufficient information will help to avoid these situations or at least help the Navy to win or have such accusations overturned in a court of law.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* Project need was identified in 2010 via the INRMP metrics annual review, indicating that the INRMP does not sufficiently address nearshore environments. INRMP update list and project lists were updated to include this need. Exhibit was approved without funding for FYs 2014 & 2015. Partial funding was received for Nearshore Assessments in 2015 under a separate EPR (32442MH103) that covered NASO and NASO DNA. POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report and Geodatabase
5	PreFinal Report and Geodatabase
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs, etc.)
9	Maps
10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA/Contract. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. In general the data will be utilized to identify any trends in impact to bird species of concern given the various military missions, it will

be used to identify potential habitat modification requirements to minimize bird strikes, it will be used to update Bird Depredation Permits where required, and it will be used to help in conducting planning level reviews of proposed projects and activities with consideration for impacts to wildlife and the mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimation was derived utilizing the FY2015 Negotiated Nearshore Assessment Projects with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%. Due to how contract execution funding documentation was prepared EV22 Marine Resources SME recommended utilizing $65,000.00 as the FY15 GCE for the Oceana nearshore assessment cost (a.k.a,., Owls Creek).
  - If projects the following projects 60191NR231, 32442NR231, and 4274ANR231 are not funded at the same time the overall cost will likely be more expensive due to additional coordination, inhouse fees, and equipment mobilization requirements.

BASE	2015 Near Shore Contract Award	2015 Near Shore Inhouse Fees
NASO DNA	$404,904.84	3,277.71
NSA NWA	$0.00	0.00
NASO/NALFF	$65,000.00	0.00

Project Requested Funding: (Non-Annual Recurring Funds Project within a given POM Cycle)

- FY21 is for the Recurring Nearshore Environment Assessment following the Baseline Assessment (Recurring assessment due every 5 years after initial baseline).

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$0.00	$0.00	$0.00	$458,778.51	$0.00
NSA NWA	$0.00	$0.00	$0.00	$0.00	$0.00
NASO/NALFF	$0.00	$0.00	$0.00	$73,057.03	$0.00

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 7 July 2015

Project Numbers: 60191NR228
Project Title: SIKES MA NASO/NALFF **-** Natural Resources Staff Certification Requirements;

Guidebook & Chapter: 12110
Legal Drivers:
Primary: SIKES Act
Secondary: ESA
Tertiary: FIFRA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual.

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); and Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual.

Project Description: *(What does this project entail?)*
Certification and re-certification requirements for maintaining key training for properly implementing INRMP identified program areas. This EPR is specifically for training required to obtain professional certifications in support of implementing INRMP program areas. Additional training, conferences, or meetings that are not required in support of a certification are not listed in this EPR exhibit, but should be identified in the individual's professional development plan and should be funded through a different funding pool.

Project Purpose: *(Why is this project needed?)* Adequately train personnel and maintain certifications that will allow staff to conduct INRMP identified projects in accordance with Federal and State Laws and Policies.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Not funding this exhibit could delay or prevent staff from receiving the training/certification required to legally implement INRMP program areas. As such this could delay mission critical operations until adequately trained personnel are hired to complete the various requirements.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Training, Travel & Certification

Navy Utilization of Deliverables:
Navy staff will utilize their certifications to legally and safely implement INRMP identified projects.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimates were derived based on historic certification cost/tuition fee requirements with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%
  - Required training/certifications were derived based off of the type of work required to implement INRMP identified program areas and as dictated via the Sike's Act, OPNAVINST M-5090.1, NAVFAC Community Management Plan, INRMP, etc.
  - Since the Natural Resources Staff Servicing NASO/NALFF, NASO DNA, and NSA NWA are supervised by the NASO IEPD and the training requirements are the same for each base, only one EPR (60191NR228) will be utilized to track funding for NR training for these installations vice 3 from previous POM cycles. As such POM18 requirements for EPR 32442NR228 and EPR 4275ANR228 were not submitted.
  - Note: The current Conservation Law-enforcement Officer (CLEO) was grand-fathered into the program before the FLETC training requirement was established. The current CLEO now exceeds the recommended age to send to Basic FLETC training. FLETC training is included in the table below as an identified requirement, if a new CLEO were to come on staff; however, no new NR staff CLEO GOV positions are anticipated to be funded in POM 18. As such, the FLETC CLEO training is not included in the overall cost requested during the POM 18 cycle.

- **Estimate #1:**
  - **Historic and Typical Cost Estimates:**

Training and Certification Requirement (as of 2013):

Course:	# of Staff:	# of Staff Requiring/ Year:	Frequency:	Unit Tuition Cost:	Minimum Annual Tuition Cost:	Maximum Annual Tuition Cost:	CECOS/Safety Center Avail.:	Anticipated Vendor:
EPR Exhibit Training/Certification Requirements:								
Airport Biologist Certification/ Recertification	1	1	Bi-Annual	400	400	500	NA	USDA/USA BASH COMMITTEE
Professional Wildlife Biologist Certification	1	1	Annual	400	400	400	NA	NMFWA
Professional Wildlife Biologist Certification	1	1	Bi-Annual	600	600	600	NA	TWS
Nuisance Wildlife Control Certification	3	2	As Needed, Tri-Annual	50-1000	50	1000	NA	NCTC
Wetland Identification/ Refresher Training	3	1	As Needed	50-1000	50	1000	NA	NCTC
BASH Training/ Certification	3	2	Tri-Annual	400	400	500	NA	USDA/USA BASH COMMITTEE
Species Specific Certifications	3	1	As Needed	50-1000	50	1000	NA	NCTC

Course:	# of Staff:	# of Staff Requiring/ Year:	Frequency :	Unit Tuition Cost:	Minimum Annual Tuition Cost:	Maximum Annual Tuition Cost:	CECOS/Safety Center Avail.:	Anticipated Vendor:
Equipment Operation Certifications	3	2	As Needed	50-1000	50	1000	NA	NCTC
Migratory Bird Treaty Act Certification	3	1	As Needed	500	500	500	NA	NCTC
Prescribed Burning Certifications	3	1	As Needed	100	100	100	NA	VDOF
Prescribed Burning Cert. - Refresher	3	3	Annual	100	300	100	NA	VDOF
Federal Conservation Law-Enforcement Certification (Basic) - LMPT	1	1	Once				NA	FLETC
Federal Conservation Law-Enforcement Certification (Advanced) - BTTTP, COPTP, ASTTP, AFTCSI, AFTCSII, AILEITP AILEITP M, Defensive Tactics	1	1	Once, per course				NA	FLETC
Federal Conservation Law-Enforcement Certification (Refresher)	1	1	Annual - As Needed				NA	NCTC/Other
TOTAL with FLETC:					**25,800**	**36,500**		
TOTAL minus FLETC:					**$17,000**	**$9,400.00**		

Additional Training, Certifications, Meetings:	
Pesticide/Herbicide Applicator Initial Cert.	Pesticide/Herbicide Applicator Re-Cert.
Weapons Qualifications Certifications	Weapons Qualifications Refreshers
Sikes Act Certification	1st Responder/CPR Training/Certification
VA & NC Wildlife Society Meetings	PIF State & Regional Meetings
Additional Training, Certifications, Meetings:	
Sustaining Military Readiness Conference	Pollution Prevention Program Operations & Management

	(AFIT ENV 022) or CECOS web conference version
DoD Partners in Flight Representative	Buying Green: A Multifunctional Approach to Pollution Prevention (DCPSO00R750)
Deer Study Group Meetings	Environmental Management Systems 101
GIS Refresher Training	Water Quality Management (AFIT ENV 541)
Equipment Operation Certification - Tractor	Air Quality Management (AFIT ENV 531)
Equipment Operation Certification – Chain-saw	Natural Resources Compliance (A-4A-0087)
Equipment Operation Certification - ATV	Ecological Risk Assessment (A-4A-0081)
Invasive Species Training	Historic Preservation Law and Section 106 Compliance (A-4A-0073)
Advanced Environmental Management (A-4A-0063)	Human Health Risk Assessment (A-4A-0078)
Basic Environmental Law (A-4A-0058)	Environmental Quality Sampling (A-4A-0026)
Advanced Environmental Law (A-4A-0068)	DOD ICRMP course (DENIX)
Environmental Negotiation Workshop (A-4A-0067)	Incident Action Plan (IAP) A-493-2400
Health and Environmental Risk Communication Workshop (A-4A-0072)	Munitions Response Site Management (A-4A-0093)
NEPA Application (A-4A-0077)	Environmental Management Systems 101
Introduction to Cultural Resources Management Laws and Regulations (A-4A-0070)	Incident Command System 300 (ICS 300) (A-493-2300)
Navy Environmental Restoration Program (A-4A-0069)	Incident Command System 200 (ICS 200) (A-493-2200)
Environmental Geographic Information Systems (GIS)/Geostatistics (A-4A-0084)	Hazardous Substance Incident Response Management (A-493-0077) or Hazardous
Natural and Cultural Resources Management (Web U)	Introduction to Hazardous Waste Generation and Handling (A-4A-0080)
Native American Traditions and Cultures: Implementing DOD Native American Policy (A- 4A-0085)	Uniform Federal Policy for Quality Assurance Plans (A-4A-0095) for Environmental Restoration Program personnel
DOD Migratory Bird Act Training (DENIX)	Environmental Protection (within 1 year of initial assignment) (A-4A-0036)

Project Requested Funding: (Recurring Funds Project within a given POM Cycle)

FY2018	FY2019	FY2020	FY2021	FY2022
$9,955.80	$10,154.91	$10,358.01	$10,565.17	$10,776.47

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 7 July 2015

Project Numbers: 60191NR226; 32442NR226; 4275ANR226
Project Title: CHS MA NASO/NALFF - INRMP Updates and Planning; CHS MA NASO DNA - INRMP Updates and Planning; CHS MA NSA NWA - INRMP Updates and Planning
Guidebook & Chapter: 12103
Legal Drivers:
Primary: ESA
Secondary: Sikes Act
Tertiary: CWA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 2nd (85%) and 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual.

Project Description: *(What does this project entail?)* Acquire equipment and support necessary to keep INRMPs updated. Each INRMP requires annual updating to reflect project needs, survey/inventory results, species status changes, metrics updates, site boundary mapping, map updates, statistical modeling/analysis updates, etc. If staffing levels are insufficient to allow for incorporation of annual updates (pen and ink changes) to be added to the physical document, if significant mission changes occur, if significant property alterations occur, if it is determined that existing INRMP NEPA is insufficient, etc. additional support may be needed every 4 years to ensure INRMPs are compliant with Federal, State, and Navy Policies, prior to their 5 year Sike's Act required review for Operation & Effect Concurrence. If the significance level is high enough to warrant an INRMP Revision vice an Update, additional funding will be required to conduct appropriate survey/inventory baseline data needs/analyses, consultations, and NEPA updates. At this time, no Revisions are anticipated for the POM 18 planning effort.

NASO/NALFF INRMP: Compliant INRMP dated 9 June 2015.

NASO DNA INRMP: Compliant INRMP dated 9 June 2015.

NSA NWA INRMP: Compliant INRMP dated 18 June 2015.

Project Purpose: *(Why is this project needed?)* Existing equipment does not allow the functionality to properly update and produce planning level analyses for the INRMP. As such, equipment is needed that does not connect to the network; therefore not requiring some of the restrictions that interrupt and prevent completion of detailed analyses and mapping efforts. Additionally, the equipment that is issued does not possess the speed and storage capabilities necessary for data processing and storage.

Support to maintain and utilize the equipment and keep INRMP data updated in accordance with various Navy and INRMP identified requirements (e.g., Geographic Information System collection and metadata requirements, map updates, data updates, analyses, modeling, etc.).

Update physical and digital versions of INRMPs to ensure all agreed upon metrics items and annual update needs have been appropriately addressed/placed into the INRMP in order to obtain 5 year Operation and Effect Concurrences to maintain a legally compliant document.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project will aide in making sure the bases are keeping in compliance with various Federal and State laws, regulations, policies, and conservation agreements (ESA, MBTA, MMPA, NMFA, Invasive and Pest Control, Sikes Act, INRMP, OPNAVINST M-5090.1, ADA, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

INRMPs have a number of updates that are listed and approved by the annual INRMP metrics review teams (Navy, USFWS, and State Wildlife Agency representatives) as needed to be made to the INRMP plan, but current staffing levels and equipment are insufficient to accomplish the required updates. Many updates require research, analysis, and data modeling to accomplish the completed desired results for the official INRMP document.

Funding this project ensure the installation has accurate planning level data to make educated decisions related to military training and readiness activities. A fully compliant and implemented INRMP helps to ensure that Natural Resources are managed appropriately ensuring both conservation objectives and realistic training opportunities exist for our active duty and civilian workforce. A fully compliant and implemented INRMP also helps to ensure that natural resources and associated activities (nature trails, hunting, fishing, etc.) are maintained that support the Morale and Welfare of our active duty and civilian workforces, in addition to and as authorized retired, veteran, disabled, contractors and general public individuals.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)*

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Purchase Computer
2	Purchase ESRI and Trimble Software Maintenance/Update Packages
3	Purchase SPSS
4	Acquire FRAGSTATS
5	Purchase External Hard-drive
6	Purchase Surge protectors (2)
7	Maintenance (as needed)
8	Itemized Purchase Receipts
9	Analysis, GIS support, data management, GPS work, and document update support
10	Annually Updated INRMP document (Pen & Ink Changes, minimum)
11	Every 4 Years, if needed, Consolidated Pen & Ink Changes or Major Update Requirement to Digital and Hardcopy INRMP and/or Initiate INRMP NEPA Update.

**Pathfinder and Active Sync Acquisition Requirements have been completed.*

Navy Utilization of Deliverables:

Navy staff will utilize this equipment to more efficiently and expeditiously perform updates and analyses associated with maintaining current INRMPs.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimate was derived from FY2012 and FY2015 funded projects associated with this EPR with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%.
  - Note: As INRMP Compliance was obtained later than originally planned during the POM16 cycle, the 2017 POM'd funds should be utilized to reassess/obtain new NEPA documentation or provide an overhaul to the Migratory Bird and Endangered Species sections of the INRMPs.

Base	FY2012 4-5 year Consolidated Plan Updates (Includes an Inhouse Fee of $1,545.45 ea)	FY2015 GIS and GPS Support for Annual Plan Updates (Inhouse Support)
NASO DNA	$24,687.89	$8,333.00
NSA NWA	$24,687.89	$8,333.00
NASO/NALFF	$24,687.89*	$8,333.00

*This Estimate was adjusted to match estimates for other INRMPs. The cost was artificially lower in 2012 due to age of INRMP. There were actually more updates needed to the document than were made during the contracted update.

Project Requested Funding: (Recurring funds project with Non-Annual Recurring component within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$8,825.71	$37,056.24	$9,182.63	$9,366.28	$9,553.61
NSA NWA	$8,825.71	$37,056.24	$9,182.63	$9,366.28	$9,553.61
NASO/NALFF	$8,825.71	$37,056.24	$9,182.63	$9,366.28	$9,553.61

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 7 July 2015

Project Numbers: 60191NR224; 32442NR224; 4275ANR224
Project Title: SIKES MA NASO/NALFF - Equipment Maintenance & Repair; SIKES MA NASO DNA - Equipment Maintenance & Repair; SIKES MA NSA NWA - Equipment Maintenance & Repair
Guidebook & Chapter: 12999
Legal Drivers:
Primary: EO_Invasive Species
Secondary: Sikes Ac t
Tertiary: SWCA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 1st, 2nd, 3rd & 4th

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Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); and Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual, as needed.

Project Description: *(What does this project entail?)*
Maintain and repair equipment to keep them in working order to complete projects required under the Integrated Natural Resources Management Plan (INRMP). INRMP projects support Species and Habitats of Concern management, invasive species management, outdoor recreation, etc.

Project Purpose: *(Why is this project needed?)* Some equipment requires annual maintenance checks and repairs as needed. Other equipment may break while in use and will need repairs. This equipment is needed to support INRMP identified projects and maintain compliance with Federal, State, and Navy laws, regulations, and policies. Without working equipment the Navy cannot accomplish their INRMP and Permit requirements, and will be labeled non-compliant and possibly be issued Notices of Violation.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)*
Equipment repairs and maintenance are needed to maintain compliance with the: Sikes Act; Endangered Species Act; EO_Invasive Species; Migratory Bird Treaty Act; OPNAVINT M-5090.1; Clean Water Act; Soil & Water Conservation Act; American with Disabilities Act; etc.

The equipment needing to be properly maintained and repaired is utilized for various projects that support requirements under federal and state law and Navy policy. This equipment performs functions in support of Endangered Species work (issued biological opinion), Migratory Bird work, invasive species work, nuisance wildlife work, erosion control work, habitat enhancement work, the Sikes Act, outdoor recreation, environmental compliance inspection access, etc.

Maintaining this equipment enables the Navy to continue supporting these efforts and help to keep the bases in compliance with these laws and regulations; as such, reducing the potential for NOVs to be issued. This helps to save time and money enabling the military to continue training without interruption.

Proper maintenance and repair of the equipment extends the life of the equipment and delays the need for more costly repairs or even new equipment purchasing.

Without equipment the Natural Resources managed outdoor recreation program would likely have to shut down due to access and safety issues, thus reducing military morale and welfare.

Without this equipment the Military will have to pay additional funding to maintain areas (at a much greater cost) they utilize for training purposes because Natural Resources will not be able to maintain their dual purpose land management objectives.

Without this equipment the facilities will be endangered of wildfire intrusion because the Natural Resources program will not be able to maintain their firebreaks.

Without this equipment the facilities will be more likely to flood because invasive plant species management, which block the ditches and create security breaches, will have to be stopped until funding can be obtained.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* If equipment does not get repaired, projects do not get completed, and the Navy becomes non-compliant with established requirements. POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Equipment Annual Maintenance Checks
2	Equipment Repair
3	Work estimates for repair and maintenance activities
4	Itemized Work Receipts

Navy Utilization of Deliverables:

Navy staff will continue to utilize equipment to maintain INRMP identified requirements, and new regulatory permit requirements.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimates were derived via an internet search and vendor supplied quotes of items and shipping costs, and known labor costs from prior Navy support equipment maintenance and repair and FY15 PWD Inhouse Fees. Estimate 1 is a worst case scenario, were all equipment requires repair and maintenance.
  - This estimate has been split between each of the Oceana NR AOR bases, which cover 3 INRMPs (NASO/NALFF, NASO DNA, and NSA NWA) because the equipment services all 4 sites.
  - The following inflation rates were applied and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%

Estimate #1:

- **Internet Costs & Labor Research & Vendor Quotes & Previous Cost History:**

2015 Equipment Maintenance & Repairs Needs:

Items:	Year	Total Cost:
Tractor (4)	Annual	12,000.00
ATV (2)	Annual	2,000.00
Gator (1)	As Needed	1,000.00
Chainsaw (3)	As Needed	1,500.00
Weapons (6)	As Needed	3,000.00
Vehicle Tow Hitches (2)	As Needed	2,000.00
Vehicle Wench (2)	As Needed	6,000.00
Vehicle Lift-Gate (2)	As Needed	2,000.00
Vehicle Accessory Lights (3)	As Needed	500.00
Lawn Mower (1)	As Needed	500.00
Hedge Trimmers (2)	As Needed	500.00
Weed whackers (3)	As Needed	500.00
Augers (5)	As Needed	1,500.00
Sprayer (4)	As Needed	3,000.00
Tow Trailer (2)	As Needed	2,000.00
Fire Trailer (1)	As Needed	1,000.00
Walk-in Cooler (1)	As Needed	3,000.00
Hand Held Radios (6)	As Needed	2,400.00
Digital Cameras (5)	As Needed	1,000.00
Truck Radios (2)	As Needed	2,000.00
Trimble GPS (3)	As Needed	3,000.00
Garmin GPS (5)	As Needed	1,000.00
Annual Requirement	Annual	14,000.00
Non-Annual Potential Emergency Repair Funds	As Needed	37,000.00
Annual Requested Emergency Repair Funds	Annual	11,000.00
Total Annual Request		**24,000.00**

Project Requested Funding: (Recurring Funds Project within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$3,558.67	$3,629.84	$3,702.44	$3,776.49	$3,852.02
NSA NWA	$6,863.14	$7,000.41	$7,140.42	$7,283.22	$7,428.89
NASO/NALFF	$15,251.43	$15,556.46	$15,867.59	$16,184.94	$16,508.64

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 7 July 2015

Project Numbers: 60191NR223; 32442NR223; 4275ANR223
Project Title: SIKES MA NASO/NALFF - Equipment Storage Structures; SIKES MA NASO DNA - Equipment Storage Structures; SIKES MA NSA NWA - Equipment Storage Structures
Guidebook & Chapter: 12999
Legal Drivers:
Primary: Sikes Act
Secondary: CWA
Tertiary: SWCA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2014-19, Split Quarters 2nd (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads – Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual as needed.

Project Description: *(What does this project entail?)*
- Demolish metal temporary storage structure that is rusting and collapsing at the Natural Resources Center on NASO. Replace storage structure. (2019)
- Construct new equipment storage shed capable of housing tractors and associated equipment parts at NASO. (2020)
- Repair storm damaged tractor storage shed at NASO. (2018)
- Repair storm damaged tractor storage shed at NSA NWA. (2018)
- Maintain equipment storage structures. (annually)

Project Purpose: *(Why is this project needed?)* Existing storage structures are in disrepair and are not being utilized for their intended purposes. One structure is a safety hazard and needs to be demolished (needs to be replaced with a secure locking concrete storage shelter, vandals have been known to steal items from the Natural Resources Center). One structure is leaking during storm events and damaging equipment. One structure lost its doors during a storm event and now items can not be securely stored (due to location of this structure with out doors nothing can be stored in this structure). Even with the repair and replacement of these structures there is still not enough storage to properly store equipment from elemental damage. As such a new structure must be constructed to protect hundreds of thousands of dollars of equipment and extend the life cycle of this equipment.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* The equipment needing to be properly stored is utilized for various projects that support requirements under federal and state law and Navy policy. This equipment performs functions in support of Endangered Species work, Migratory Bird work, invasive species work, nuisance wildlife work, erosion control work, habitat enhancement work, the Sikes Act, etc.

Maintaining this equipment enables the Navy to continue supporting these efforts and help to keep the bases in compliance with these laws and regulations; as such, reducing the potential for NOVs to be issued. This helps to save time and money enabling the military to continue training without interruption.

Protecting the equipment extends the life of the equipment and delays the need for costly repairs or even new equipment purchasing.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* Project scheduled in 2012 and 2013, but unfunded. POM 14 only annual maintenance funding received, no construction $ received. POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Storage Structure Demolition
2	Storage Structure Repairs
3	Storage Structure Purchasing
4	Storage Structure Construction
5	Quarterly Reports of Project Status
6	Copies of Operation Manuals
7	Placement of Qualifying Structures on the Base Facility Inventory List
8	Itemized Receipts for all work completed and items purchased

Navy Utilization of Deliverables:

Navy staff will utilize these structures to store equipment out of the elements to extend the life expectancy of vital programmatic equipment. Placement of qualifying equipment on the base facility inventory list will allow those structures to receive maintenance from the Public Works maintenance funding, instead of through the ENV program. Please note that many of these structures will not qualify for designation on the facilities list and will continue to require EV funds for maintenance as needed.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - Cost estimates were derived via an internet search and vendor supplied quotes of items and shipping costs, and known labor costs for Navy support construction and demolition work. Structure repair, maintenance, and construction needs were established based off of equipment and storage structure inventories.
    - This estimate has been split between each of the Oceana NR AOR bases, which cover 3 INRMPs (NASO/NALFF, NASO DNA, and NSA NWA) because the equipment services all 4 sites.
    - The following inflation rates were applied and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%

- **Estimate #1:**
  - **Internet Costs & Labor Research & Vendor Quotes:**

Storage Structure Needs:

Items:	Year	2015 Unit Cost:	2015 Labor Rate:	2015 Total Cost:
Pre-fabricated Storage Shed (Concrete structure), NASO	2019	$16,000.00	20%	$19,200.00
Facilitiy Demo (metal shed), NASO	2019	$4,000.00	20%	$4,800.00
Fabric Tractor Shed (with foundation), NASO	2020	$45,000.00	20%	$54,000.00
Tractor Shed Door Installation	2018	$30,000.00	20%	$36,000.00
Structure Maintenance, NASO-DNA-NWA	Annual	$4,000.00	20%	$4,800.00

Project Requested Funding: (Recurring Funds Projects with Non-Recurring Components within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$711.73	$725.97	$740.49	$755.30	$770.40
NSA NWA	$1,372.63	$1,400.08	$1,428.08	$1,456.64	$1,485.78
NASO/NALFF	$38,128.58	$25,927.43	$59,503.46	$3,236.99	$3,301.73

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 7 July 2014

Project Numbers: 60191NR222; 32442NR222; 4275ANR222
Project Title: MSFCA MA NASO/NALFF - Outdoor Recreation Program Requirements; MSFCA MA NASO DNA - Outdoor Recreation Program Requirements; MSFCA MA NSA NWA - Outdoor Recreation Program Requirements
Guidebook & Chapter: 12109
Legal Drivers:
Primary: Sikes Act
Secondary: MSFCA (originally planned to be Primary; however EPRweb does not provide that option)
Tertiary: M-5090.1
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 1st, 2nd, 3rd, & 4th

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual, as needed

Project Description: *(What does this project entail?)* Maintain hunting, fishing, and nature: trails; boardwalks; fishing stations picnic shelters; ranges; elevated shooting stands/platforms; check-station; walk-in cooler; freezer; and brochures (i.e. mass production of rules & regulations pamphlets, maps, archery training materials, permits, etc.).

Project Purpose: *(Why is this project needed?)* Maintenance of these items is required: to allow people to safely recreate on these bases; to allow people with physical disabilities to recreate; to ensure people have written documentation or rules/regs./procedures; to promote education opportunities; and to allow proper processing and checking of wildlife taken during recreational activities. Implementation of this project is conducted under the guides of the Sike's Act and in accordance with Navy, USFWS and State mandated policies regarding wildlife population management. The outdoor recreation program also supports objectives linked to the Endangered Species Act, Migratory Bird Treaty Act, Americans with Disabilities Act, NAVFAC OPNAVINST M-5090.1, and numerous other laws and policies linked to invasive species, water quality, and nuisance wildlife control.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project maintains upkeep of the arteries of the Natural Resources (NR) Outdoor Recreation program (ORP). The NR ORP supports a number of wildlife population management objectives, including but not limited to: deer herd population reduction; nuisance wildlife removal; invasive species removal; and bird aircraft strike hazard (BASH) reduction.

Comment [MFW1]:
Section 504 of /Rehabilitation Act of 1973 and Implementing Regulations
http://www.dol.gov/oasam/regs/statutes/sec504.htm

Americans with Disabilities Act of 1990 (ADA) and Implementing Regulations
http://www.adagreatlakes.org/ADA/

U.S. Access Board, Accessible Boating Facilities Accessible Fishing Piers & Platforms
http://www.access-board.gov/outdoor/outdoor-rec-rpt.htm

Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines, United States Access Board
http://www.access-board.gov/ada-aba/final.htm

Americans with Disabilities Act Accessibility Guidelines of 2002 (ADAAG)
http://www.access-board.gov/adaag/html/adaag.htm

ADA Accessibility Guidelines for Play Areas 2001, Outdoor Developed Areas, 1999 Final Report; Recommendations for Accessibility Guidelines
http://www.access-board.gov/outdoor/outdoor-rec-rpt.htm

Accessible Temporary Events A Planning Guide, from NC State University, The Center of Universal Design

USDA Forest Service Draft Guidelines 2004

Outdoor *Recreation Accessibility Guidelines,* Outdoor Recreation

Accessibility Guidelines Draft 2004
USDA Forest Service Trail Accessibility Guidelines,
http://www.fs.fed.us/recreation/programs/accessibility/

This program supports the military mission in 3 primary ways: 1. increasing Morale and Welfare by allowing outdoor recreation; 2. educating military regarding NR concerns and how they contribute; and 3. ensuring safety to allow military training to continue (BASH reduction).

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	STATUS:	~2015 COST:
Printer (For Recreation Program)	Non-Recurring	$2,000.00
Chain Saw and Weed-whacker Parts	Recurring	$400.00
Lumber	Recurring	$1,000.00
Nuts & Bolts	Recurring	$250.00
water Hose	Non-Recurring	$50.00
Weighing station supplies	Non-Recurring	$500.00
POWER STOP ARCHERY TARGET	Recurring	$1,600.00
Spray Paint	Recurring	$200.00
Brochures	Non-Recurring	$1,500.00
Misc.	Recurring	$1,300.00
TOTAL RECURRING:	**Recurring**	**$4,750.00**
TOTAL NON-RECURRING:	**Non-Recurring**	**$4,050.00**

Navy Utilization of Deliverables:

Navy staff will utilize purchased items to maintain ORP as indicated above.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimate was derived from known need requirements, 2015 executed purchase requests, and a 2015 internet search of cost estimates from online vendors.
  - This estimate has been split between each of the Oceana NR AOR bases, which cover 3 INRMPs (NASO/NALFF, NASO DNA, and NSA NWA because the Natural Resources staff service all 4 sites.
  - The following inflation rates were applied and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%
  -

Project Requested Funding: (Recurring Funds required within the POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$704.32	$718.41	$732.77	$747.43	$762.38
NSA NWA	$1,358.33	$1,385.50	$1,413.21	$1,441.47	$1,470.30
NASO/NALFF	$5,018.51	$3,078.88	$3,140.46	$3,203.27	$3,267.34

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 6 July 2015

Project Numbers: 60191NR221; 32442NR221; 4275ANR221
Project Title: EFH MA NASO/NALFF - Fisheries, Ditches & Streams; EFH MA NASO DNA - Fisheries, Ditches & Streams; EFH MA NSA NWA - Fisheries, Ditches & Streams
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Magnuson-Stevens Fishery Conservation and Management Act
Secondary: Clean Water Act
Tertiary: EFH
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual Split Quarters 2nd (85%) and 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); NASO Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* 15 months for baseline inventories/assessments/management plan (every 5 years or as deemed necessary due to major land or mission changes); annual implementation and monitoring of implemented management plan requirements.

Project Description: *(What does this project entail?)* Conduct an inventory and assessment of ditch, stream, pond, and lake functions (this includes wildlife that live in and contribute to the functionality of the water resource, i.e. fish population assessments) and hydrology. Develop a Habitat enhancement plan for these water resources. Purchase equipment, supplies, fish, plants, etc. to assist with this project.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Project allows the base to maintain compliance with: the Sustainable Fisheries Act Amendment to the Magnuson-Stevens Fishery Conservation and Management Act in 1996; the Chesapeake Bay Preservation Act; the Clean Water Act; Coastal Zone Management Act; Essential Fish Habitat protection; OPNAVINST M-5090.1; base INRMPs; Sikes Act; and numerous other plans Southern Watershed Area Management Plan (SWAMP); Lynnhaven River Watershed Restoration Plan (sub of Chesapeake); Back Bay Watershed Restoration Plan (sub of southern).

The waterways of NASO, NALFF, NASO DNA, and NSA NWA connect to several watersheds which all have the potential to influence Essential Fish Habitat (EFH) within the Atlantic Ocean, and/or Chesapeake Bay.

The fish stocking is intended to produce breeding populations of native fish to increase water resources and functionality (as appropriate). Since several of the water resources where fish are anticipated to need to be stocked are areas where recreational fishing is allowed this project also

benefits the military community by allowing additional outdoor recreation opportunities, thus potentially increasing Morale and Welfare.

In addition the data is utilized to make more informed NEPA property management decisions in associated with DoD/military mission changes.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., etc.)
9	Maps
10	Ground-truthing
11	Purchase, stocking, planting, installation, etc. of fish, plants, equipment etc.
12	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Estimates have been derived from the contracted FY2012-2014 funded projects with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%

	Inhouse	Contracted
Golf Course	$10,000.00	$0.00
NW-Stell	$5,000.00	$39,942.54
OC & DN TT	$5,000.00	$171,804.83
FN	$5,000.00	$70,276.83

- Partial Funding may be available via Sikes Act, Agricultural, or Forestry Funds. It is unlikely Ag or Forestry Funds will be available. Sikes Act funds will be minimal at best.

Base	FY12-14 Baseline Inventory Costs	~FY2015 Costs (monitoring, stocking, etc.)	~FY2015 Costs (monitoring, stocking, etc.)
NASO/NALFF	$217,880.45	$4,952.00	$4,952.00
NASO DNA	$44,201.21	$3,597.00	$3,597.00
NSA NWA	$44,942.54	$8,439.00	$8,439.00

Project Requested Funding: (Recurring Funds Project within a given POM Cycle)…highlighted funds include assessment and annual recurring fee. Note for NASO and NALFF their assessment fall on different years from one another.

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$3,809.68	$49,388.33	$3,963.59	$4,042.86	$4,123.72
NSA NWA	$50,068.96	$5,349.69	$5,456.69	$5,565.82	$5,677.14
NASO/NALFF	$8,937.97	$159,338.51	$84,358.87	$9,485.05	$9,674.75

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 5 July 2015

Project Numbers: 60191NR220; 32442NR220; 4275ANR220
Project Title: 4 SAR MA NASO/NALFF – Nuisance Wildlife Inventory, Assess & Remove; 4 SAR MA NASO DNA – Nuisance Wildlife Inventory, Assess & Remove; 4 SAR MA NSA NWA – Nuisance Wildlife Inventory, Assess & Remove
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Sikes Act
Secondary: Endangered Species Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual (as needed), Split Quarters 2nd , 3rd, & 4th

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Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual (as needed) for control and monitoring. 15 Months for baseline inventory and assessment (to be repeated every 5 years).

Project Description: *(What does this project entail?)* Develop a nuisance wildlife assessment and management plan (revised every 5 years); remove nuisance wildlife, and conduct pre, during and post nuisance wildlife removal effort monitoring (annually).

Project Purpose: *(Why is this project needed?)* NASO, NALFF, NASO DNA, and NSA NWA all have nuisance wildlife issues that are killing species of concern, damaging habitat of species of concern, and damaging ditch and stream banks (promoting erosion and sediment control problems).

This project is needed to maintain compliance with a variety of Federal, State, and Navy laws, regs., and policies.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with laws, regs., and policies reduces the potential for incurring Notices of Violations. NOVs could be issued for a number of reasons to include, but not limited to: knowingly allowing nuisance wildlife to negatively impact species of concern; and failing water quality testing, due to lack of proper erosion and sediment control.

Allowing nuisance wildlife to damage ditches and streams also poses health and safety threats to the base in that the damage by nuisance wildlife can collapse and clog vital storm water run-off structures. Damage of these water structures could cause flood and damage to the base, waste water treatment facilities, training facilities, homes, etc. Such devastation could make the base or portions of the base unusable for military training and displace people who live on or adjacent to the base. In addition pooling water creates ideal breeding habitats for a variety of mosquito species (some of which are classified as invasive species), which increase the threat of wildlife borne disease which can spread to humans and other wildlife.

In addition controlling wildlife species in support of species of concern, water quality, human health & safety, and training land functionality there are also some residual beneficial side effect. Such benefits may include: increasing agricultural crop yields; reduction of emergency wildlife calls; and reduction of potential BASH concerns.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., etc.)
9	Maps
10	Nuisance Wildlife Removal
11	Permit Acquisitions (if required, typically Navy acquires)
12	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimate was derived from: discussions with USDA personnel in the VA regional field office; similar work conducted on installations in VA and the known nuisance wildlife concerns and acreages of the bases (NASO, NALFF, NASO DNA, & NSA NWA); and final cost estimates obtained from the FY2012 nuisance wildlife inventory.
  - Due to the nature of this project it is likely that the cost will fluctuate up or down due to removal success, new species, changes in species population levels, etc.
  - It is recommended that an interagency cooperative agreement with USDA Wildlife Services (WS) for nuisance wildlife control is developed. USDA WS is specialized in this area of work. As a sister agency overhead cost are lower than many outside contractors. Previous MIPR agreements have been made with USDA for similar services. USDA currently works on other installations across DoD and has conducted some previous work on Hampton Roads, VA bases.
  - Funds requested are for WS support only. Navy support is in-house. WS will be responsible for: the development of existing conditions assessment, complete listing of onsite nuisance wildlife, and

management plans; some monitoring; and take and removal of designated nuisance wildlife species. Navy personnel will: acquire and maintain appropriate depredation permits; will assist where needed to conduct wildlife surveys for monitoring efforts; and will coordinate USDA access for project completion.

- The following inflation rates were applied and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%.

Estimate #1:

BASE	FY2012 Actual Cost Inventory	FY2012 Inhouse Fee (Inventory)	FY12 Unfunded Est. Control	FY2012 Unfunded Inhouse Fee (Control)
NASO DNA	$24,696.74	$1,545.45	$49,393.48	$1,545.45
NSA NWA	$23,179.36	$1,545.45	$46,358.72	$1,545.45
NASO/NALFF	$37,816.05	$1,545.45	$75,632.10	$1,545.45

Project Requested Funding: (Recurring Funds Project with Non-Annual Recurring Component within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$56,749.34	$29,820.25	$30,416.65	$31,024.98	$31,645.48
NSA NWA	$53,368.41	$28,095.98	$28,657.89	$29,231.05	$29,815.67
NASO/NALFF	$85,980.90	$44,728.34	$45,622.91	$46,535.37	$47,466.07

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 5 July 2015

Project Numbers: 60191NR219; 32442NR219; 4275ANR219
Project Title: SIKES MA NASO/NALFF - Wildlife Emergency Response; SIKES MA NASO DNA - Wildlife Emergency Response; SIKES MA NSA NWA - Wildlife Emergency Response
Guidebook & Chapter: 12999
Legal Drivers:
Primary: SIKES Act
Secondary: Endangered Species Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 1st, 2nd , 3rd, & 4th

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Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual (on call: 24 hours, 7 days a week).

Project Description: *(What does this project entail?)*
Purchase of wildlife control equipment and supplies to support emergency wildlife calls supported by the Base and Region Natural Resources Program Staff. Refresher training/cert. for NR staff in support of Emergency Wildlife control calls is covered under a separate training EPR.

Project Purpose: *(Why is this project needed?)* NASO, NALFF, NASO DNA, and NSA NWA are all located with in the Hampton Roads Region of VA. Hampton Roads is a mix of urban, rural, and natural areas. This land fragmentation, coupled with urban sprawl, puts wildlife and humans in direct competition for the same limited resources and results in human-wildlife conflicts. In an attempt to minimize impacts to humans and wildlife the base Natural Resources staff, in coordination with USFWS and State & Local Wildlife Agencies, respond to emergency wildlife calls.

People who respond to these calls need to be supplied with appropriate equipment to safely and efficiently address these concerns.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project promotes safety of NR personnel, military, civilians, and wildlife. This project minimizes impacts to military training in two primary manners by: 1. expeditiously and safely addressing wildlife concerns; and 2. protecting species of concern, preventing potential Notices of Violation and mitigation costs/requirements. There is a number of Federal and State listed species of concern that either live or seasonally visit bases in the Hampton Roads Area. As such this project allows the Navy to maintain compliance with various Federal and State laws, regulations, policies, and conservation agreements (ESA, MBTA, MMPA, NMFA, Invasive and Pest Control, Sikes Act, INRMP, OPNAVINST M-5090.1, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

Any call that can not be safely and efficiently handled by base NR staff will be turned over to State Wildlife Agency officials to address.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

Equipment list with 2009 cost estimates.

Item	Qty.	Unit	Cost/ unit	Subtotal	Shipping	Total Cost	Status
Tow Straps	8	ea	17.00	136.00	34.00	170.00	Non-recurring
Weapon (12 Gauge Pump Remington 870)…Process through Navy Safety Center	1	ea	400.00	400.00	100.00	500.00	Non-recurring
Weapon (.270 Rifle Remington)….Process through Navy Safety Center	1	ea	500.00	500.00	125.00	625.00	Non-recurring
Weapon (.22 Rifle Remington)…Process through Navy Safety Center	1	ea	550.00	550.00	137.50	687.50	Non-recurring
Weapon Scope (12 Gauge)	1	ea	60.00	60.00	30.00	90.00	Non-recurring
Weapon Scope (Air Rifle)	1	ea	60.00	60.00	30.00	90.00	Non-recurring
Weapon Scope (.270 Rifle)	1	ea	60.00	60.00	30.00	90.00	Non-recurring
TOTAL Non-Recurring:	**14**	**ea**	$1,647.00	$1,766.00	$486.50	$2,252.50	**Non-recurring**
Nitrile Gloves (sm), 50/box	2	box	9.00	18.00	4.50	22.50	Recurring
Nitrile Gloves (med), 50/box	2	box	9.00	18.00	4.50	22.50	Recurring
Nitrile Gloves (Lrg), 50/box	2	box	9.00	18.00	4.50	22.50	Recurring
Mosquito Caps	6	ea	20.00	120.00	30.00	150.00	Recurring
Bleach (4/case)	1	case	20.00	20.00	5.00	25.00	Recurring
Hand Sanitizer (4oz)	16	ea	2.75	44.00	11.00	55.00	Recurring
Duct Tape	10	ea	10.00	100.00	25.00	125.00	Recurring
Deep Woods Off	24	ea	8.75	210.00	52.50	262.50	Recurring
Safety Glasses (12)	1	case	2.80	2.80	0.70	3.50	Recurring
Ammunition (12 GAUGE SHELL CRACKERS)	20	box	34.83	696.60	174.15	870.75	Recurring
Ammunition (12 GAUGE BIRDFRITE SCARE CARTRIDGES)	10	box	75.00	750.00	187.50	937.50	Recurring
Ammunition (12 Gauge Nitro-Steel High Velocity Magnum Load Shotshell, 3" Shell, #1 Zinc-Plated Shot, 1-1/4 oz.)	30	box	21.42	642.60	160.65	803.25	Recurring
Ammunition (12 Gauge Remington Sportsman Hi-Speed Steel, 2-3/4", #6 Steel Shot, 1 oz.)	30	box	10.05	301.50	75.38	376.88	Recurring
Ammunition (.22 bebees pellets)	1	ea	10.00	10.00	2.50	12.50	Recurring
Weapon Cleaning Kit	1	ea	100.00	100.00	25.00	125.00	Recurring

Item	Qty.	Unit	Cost/ unit	Subtotal	Shipping	Total Cost	Status
TOTAL Recurring:	**156**	*	$342.60	$3,051.50	$762.88	$3,814.38	**Recurring**
TOTAL:	**170**	*	$1,989.60	$4,817.50	$1,249.38	$6,066.88	**Non & Recurring**

Navy Utilization of Deliverables:

Navy staff will utilize this equipment to safely and expeditiously resolve the majority of the emergency wildlife calls/concerns to which their assistance is requested.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)* See Proposed deliverables section for a detailed purchase list.
  - 2009 Cost estimates were derived via an internet search and vendor supplied quotes of items and shipping costs.
  - Equipment need was based off of a 2008 and 2012 internal equipment inventory and assessment of types of response calls to which staff typically respond.
  - Equipment list status and cost estimates per item are provided under proposed deliverables.
  - This estimate has been split between each of the Oceana NR AOR bases, which cover 3 INRMPs (NASO/NALFF, NASO DNA, and NSA NWA) because the equipment services all 4 sites.
  - The following inflation rates were applied and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%

Project Requested Funding: (Recurring Funds Project within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$1,391.72	$1,419.56	$1,447.95	$1,476.91	$1,506.44
NSA NWA	$1,391.72	$1,419.56	$1,447.95	$1,476.91	$1,506.44
NASO/NALFF	$2,783.43	$2,839.10	$2,895.88	$2,953.80	$3,012.88

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 6 July 2015

Project Numbers: 60191NR218; 32442NR218; 4275ANR218
Project Title: EO 13751 MA NASO/NALFF - Invasive Species; EO 13751 MA NASO DNA - Invasive Species; EO 13751 MA NSA NWA - Invasive Species
Guidebook & Chapter: 12106
Legal Drivers:
Primary: EO 13751 Invasive Species
Secondary: National Invasive Species Act or Plant Protect Act (sup. Fed Nox. Weed Act)
Tertiary: Soil and Water Conservation Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 2nd (85%), & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual monitoring with a more detailed baseline assessment every 5 years (Jan-Dec). Annual control application of herbicide (Sept-Nov, unless otherwise stipulated).

Project Description: *(What does this project entail?)* Develop an invasive species assessment and management plan (to be updated every 5 years); remove/control invasive species (as plan recommends upon approval), and conduct pre, during and post invasive species control monitoring (annually).

Assessment plans at a minimum will include: surveying for invasive species (flora and fauna); providing a prioritized list of invasive species on base for removal; developing population estimates; mapping extent of species on base; providing management techniques and plan for the control/removal of the invasive species from the base; production of GIS layers associated with species distribution and management.

Annual Monitoring will be an assessment of implemented control techniques. This may include water quality testing; vegetation sampling or surveying; mapping of control area application boundaries prior to treatment; mapping of control area after treatment; etc.

Implemented control/removal techniques may involve pesticides, prescribed burning, mechanical removal, biological controls (for uncontrolled biologics, only native species are authorized) or other habitat alterations (e.g., managing for vegetation height to shade out the non-native).

A Non-native Flora Inventory was Awarded in 2012 that Identified 38 targeted species. Of those species 5 are currently being controlled utilizing a combination of herbicide and manual treatment: kudzu, phragmites, alligator weed, golden bamboo and parrotfeather milfoil.

A Non-native Fauna Inventory has not been awarded for these installations; however several non-native faunal species have been identified on the installations that pose a potential threat to native species.

Project Purpose: *(Why is this project needed?)*
To obtain compliance with and contribute to the goals of the: National Invasive Species Act, EO 13751 Invasive Species, Soil and Water Conservation Act, Clean Water Act, OPNAVINST M-5090.1, Integrated Natural Resources Management Plan, Integrated Pest Management Plan, Endangered Species Act, Migratory Bird Treaty Act, Essential Fish Habitat, etc.

Neither NR Staffing Levels nor training/certifications are adequate to handle the severity of the invasive species problem on these 4 bases. NASO, NALFF, NASO DNA, and NSA NWA all have known invasive species issues that are or could potentially kill species of concern, damage habitats of concern, damage ditch and stream banks (promoting erosion and sediment control problems), and threaten base and military mission security. This project is needed to maintain compliance with a variety of Federal, State, and Navy laws, regulations, and policies.

Between the 4 bases: 38 invasive plant species have been identified to occur on base (prior to 2013 only 23 invasive plant species had been confirmed); and 7 known vertebrate/invertebrate invasive species are known to occur with an additional 2 suspected to occur (no formal inventory for invasive fauna has been completed). There is undoubtedly additional species that should be added to the list of invasive species.

The 2006 EA associated with this EPR for the control of phragmites and kudzu indicates that in addition to the aerial herbicide application that manual ground herbicide treatments will be used for treatment of stands that are not accessible by aircraft and prescribed burning will be used as a follow-up treatment for the control of this species. Unfortunately, adequately trained staffing levels and weather conditions have made it almost impossible to both conduct the manual spraying or conduct prescribed burns (prescribed fire is covered under a different EPR) on the frequency needed to control these species.

Due to security requirements along fence and building perimeters there is an annual mowing contract which cuts the vegetation away from the fence line out to 30ft. This mowing stops some invasive species. Unfortunately, this mowing is also spreading and increasing the threat of other invasive species such as Phragmites. Phragmites grows quickly and forms dense tall stands which: block the view of the security perimeter; chokes out the native plant and animal species; and clogs ditches vital to keep the base from flooding during storm events.

NR staff is observing similar levels of destruction occurring due to other species such as Kudzu, Wisteria, Tree-of-Heaven, Bamboo, and Sericea lespedeza.

Several of these species have invaded wetland mitigation sites and are threatening the integrity and the success of the wetland. If adequate control can not be maintained the site may fail to be approved by the permit/mitigation regulating agencies and may require renegotiations and additional mitigation to be conducted elsewhere.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with laws, regs., and policies reduces the potential for incurring Notices of Violations. NOVs could be issued for a number of reasons to include, but not limited to: knowingly allowing invasive species to negatively impact species of concern; and failing water quality testing, due to lack of proper erosion and sediment control. Internal to the navy additional NOVs can be issued for fire and security hazards.

Proper management of invasive species provides multiple benefits to species, the ecosystem and the military. This project: supports the reduction of Bird-Animal Aircraft Strike Hazards (BASH) concerns by altering vegetation structure to reduce site desirability for species that would or have posed BASH threats; reduces height obstructions associated with various military equipment requirements (i.e., Antenna arrays, Flight Ops, etc.); reduces the risk of facilities being overrun by uncontrollable “wildfires” or flooding; and reduces disease outbreaks.

Allowing invasive species to damage ditches and streams also poses health and safety threats to the base in that the damage by these species can clog vital storm water run-off structures. Damage of these water structures

could cause flood and damage to the base, waste water treatment facilities, training facilities, homes, etc. Such devastation could make the base or portions of the base unusable for military training and displace people who live on or adjacent to the base. In addition pooling water creates ideal breeding habitats for a variety of mosquito species (some of which are classified as invasive species), which increase the threat of wildlife borne disease which can spread to humans and other wildlife.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Partially approved, only approved survey/inventory funds, did not approve control/management funds. Invasive fauna surveys have not been funded.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA), Contract, Project Order, Work Order & Support Documentation
3	Quarterly/Monthly Project Status Reports
4	Draft Flora Inventory Final Report and Geodatabase
5	PreFinal Flora Inventory Report and Geodatabase
6	Final Flora Inventory Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
7	Draft Fauna Inventory Final Report and Geodatabase
8	PreFinal Fauna Inventory Report and Geodatabase
9	Final Fauna Inventory Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
10	Draft Control/Monitoring Final Report and Geodatabase
11	PreFinal Control/Monitoring Report and Geodatabase
12	Final Control/Monitoring Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
13	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
14	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs etc.)
15	Maps
16	Invasive Species Removal/Control
17	Permit Acquisitions (as required)
18	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA/Contract. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - Cost estimate was derived from FY2012 contracted invasive species inventory project costs and FY2008-2015 invasive species control project costs with the following applied annual inflation rates

and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%.

- Due to the nature of this project it is likely that the cost will fluctuate up or down due to removal success, new species, changes in species population levels, etc.
- There is the potential to develop a cooperative agreement with USFWS regarding this project, because there are 2 US National Wildlife Refuges adjacent or within the same regional management unit as these 4 Navy bases, which are also working similar invasive species concerns. It is typically cheaper to group projects into a single larger project than to conduct smaller individual projects. USFWS has written the majority of the invasive species best management practices. USFWS is also one of the signatories on our INRMPs.

- **Estimate #1:**
  - **Contract Vendor and Previous History Estimates:**

Base	FY2012 Cost for Plan, Inventory & Map (Flora)	FY12 Inhouse Fee Inventory (Flora)	FY2014-2015 Cost Monitor & Control (Flora)	FY14-15 Inhouse Fee Control (Flora)	~FY15 Cost for Plan, Inventory & Map (Fauna)	~FY15 Inhouse Fee Plan (Fauna)	~FY15 Cost Monitor & Control (Fauna)	~FY15 Inhouse Fee Control (Fauna)
NASO/NALFF	$113,990.21	$3,000.00	$17,706.76	2500	$119,903.10	$3,155.62	$17,706.76	2500
NASO DNA	$26,597.72	$3,000.00	$34,148.75	1250	$27,977.39	$3,155.62	$34,148.75	1250
NSA NWA	$51,295.59	$3,000.00	$75,886.12	1250	$53,956.39	$3,155.62	$75,886.12	1250

Project Requested Funding: (Recurring Funds Project with Non-Annual Recurring Component within a given POM Cycle)…*highlighted are the years with both control and inventory requirements.*

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$53,438.93	$54,507.70	$21,291.90	$21,717.74	$22,152.09
NSA NWA	$98,664.19	$100,637.47	$39,717.59	$40,511.95	$41,322.19
NASO/NALFF	$214,859.40	$219,156.58	$87,939.36	$89,698.15	$91,492.11

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 5 July 2015

Project Numbers: 60191NR219; 32442NR219; 4275ANR219
Project Title: SIKES MA NASO/NALFF - Wildlife Emergency Response; SIKES MA NASO DNA - Wildlife Emergency Response; SIKES MA NSA NWA - Wildlife Emergency Response
Guidebook & Chapter: 12999
Legal Drivers:
Primary: SIKES Act
Secondary: Endangered Species Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 1st, 2nd , 3rd, & 4th

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Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual (on call: 24 hours, 7 days a week).

Project Description: *(What does this project entail?)*
Purchase of wildlife control equipment and supplies to support emergency wildlife calls supported by the Base and Region Natural Resources Program Staff. Refresher training/cert. for NR staff in support of Emergency Wildlife control calls is covered under a separate training EPR.

Project Purpose: *(Why is this project needed?)* NASO, NALFF, NASO DNA, and NSA NWA are all located with in the Hampton Roads Region of VA. Hampton Roads is a mix of urban, rural, and natural areas. This land fragmentation, coupled with urban sprawl, puts wildlife and humans in direct competition for the same limited resources and results in human-wildlife conflicts. In an attempt to minimize impacts to humans and wildlife the base Natural Resources staff, in coordination with USFWS and State & Local Wildlife Agencies, respond to emergency wildlife calls.

People who respond to these calls need to be supplied with appropriate equipment to safely and efficiently address these concerns.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project promotes safety of NR personnel, military, civilians, and wildlife. This project minimizes impacts to military training in two primary manners by: 1. expeditiously and safely addressing wildlife concerns; and 2. protecting species of concern, preventing potential Notices of Violation and mitigation costs/requirements. There is a number of Federal and State listed species of concern that either live or seasonally visit bases in the Hampton Roads Area. As such this project allows the Navy to maintain compliance with various Federal and State laws, regulations, policies, and conservation agreements (ESA, MBTA, MMPA, NMFA, Invasive and Pest Control, Sikes Act, INRMP, OPNAVINST M-5090.1, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

Any call that can not be safely and efficiently handled by base NR staff will be turned over to State Wildlife Agency officials to address.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

Equipment list with 2009 cost estimates.

Item	Qty.	Unit	Cost/ unit	Subtotal	Shipping	Total Cost	Status
Tow Straps	8	ea	17.00	136.00	34.00	170.00	Non-recurring
Weapon (12 Gauge Pump Remington 870)…Process through Navy Safety Center	1	ea	400.00	400.00	100.00	500.00	Non-recurring
Weapon (.270 Rifle Remington)….Process through Navy Safety Center	1	ea	500.00	500.00	125.00	625.00	Non-recurring
Weapon (.22 Rifle Remington)…Process through Navy Safety Center	1	ea	550.00	550.00	137.50	687.50	Non-recurring
Weapon Scope (12 Gauge)	1	ea	60.00	60.00	30.00	90.00	Non-recurring
Weapon Scope (Air Rifle)	1	ea	60.00	60.00	30.00	90.00	Non-recurring
Weapon Scope (.270 Rifle)	1	ea	60.00	60.00	30.00	90.00	Non-recurring
TOTAL Non-Recurring:	**14**	**ea**	$1,647.00	$1,766.00	$486.50	$2,252.50	**Non-recurring**
Nitrile Gloves (sm), 50/box	2	box	9.00	18.00	4.50	22.50	Recurring
Nitrile Gloves (med), 50/box	2	box	9.00	18.00	4.50	22.50	Recurring
Nitrile Gloves (Lrg), 50/box	2	box	9.00	18.00	4.50	22.50	Recurring
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Item	Qty.	Unit	Cost/ unit	Subtotal	Shipping	Total Cost	Status
TOTAL Recurring:	**156**	*	$342.60	$3,051.50	$762.88	$3,814.38	**Recurring**
TOTAL:	**170**	*	$1,989.60	$4,817.50	$1,249.38	$6,066.88	**Non & Recurring**

Navy Utilization of Deliverables:

Navy staff will utilize this equipment to safely and expeditiously resolve the majority of the emergency wildlife calls/concerns to which their assistance is requested.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)* See Proposed deliverables section for a detailed purchase list.
  - 2009 Cost estimates were derived via an internet search and vendor supplied quotes of items and shipping costs.
  - Equipment need was based off of a 2008 and 2012 internal equipment inventory and assessment of types of response calls to which staff typically respond.
  - Equipment list status and cost estimates per item are provided under proposed deliverables.
  - This estimate has been split between each of the Oceana NR AOR bases, which cover 3 INRMPs (NASO/NALFF, NASO DNA, and NSA NWA) because the equipment services all 4 sites.
  - The following inflation rates were applied and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%

Project Requested Funding: (Recurring Funds Project within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$1,391.72	$1,419.56	$1,447.95	$1,476.91	$1,506.44
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Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 6 July 2015

Project Numbers: 60191NR218; 32442NR218; 4275ANR218
Project Title: EO 13751 MA NASO/NALFF - Invasive Species; EO 13751 MA NASO DNA - Invasive Species; EO 13751 MA NSA NWA - Invasive Species
Guidebook & Chapter: 12106
Legal Drivers:
Primary: EO 13751 Invasive Species
Secondary: National Invasive Species Act or Plant Protect Act (sup. Fed Nox. Weed Act)
Tertiary: Soil and Water Conservation Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 2nd (85%), & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual monitoring with a more detailed baseline assessment every 5 years (Jan-Dec). Annual control application of herbicide (Sept-Nov, unless otherwise stipulated).

Project Description: *(What does this project entail?)* Develop an invasive species assessment and management plan (to be updated every 5 years); remove/control invasive species (as plan recommends upon approval), and conduct pre, during and post invasive species control monitoring (annually).

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Project Purpose: *(Why is this project needed?)*
To obtain compliance with and contribute to the goals of the: National Invasive Species Act, EO 13751 Invasive Species, Soil and Water Conservation Act, Clean Water Act, OPNAVINST M-5090.1, Integrated Natural Resources Management Plan, Integrated Pest Management Plan, Endangered Species Act, Migratory Bird Treaty Act, Essential Fish Habitat, etc.

Neither NR Staffing Levels nor training/certifications are adequate to handle the severity of the invasive species problem on these 4 bases. NASO, NALFF, NASO DNA, and NSA NWA all have known invasive species issues that are or could potentially kill species of concern, damage habitats of concern, damage ditch and stream banks (promoting erosion and sediment control problems), and threaten base and military mission security. This project is needed to maintain compliance with a variety of Federal, State, and Navy laws, regulations, and policies.

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NR staff is observing similar levels of destruction occurring due to other species such as Kudzu, Wisteria, Tree-of-Heaven, Bamboo, and Sericea lespedeza.

Several of these species have invaded wetland mitigation sites and are threatening the integrity and the success of the wetland. If adequate control can not be maintained the site may fail to be approved by the permit/mitigation regulating agencies and may require renegotiations and additional mitigation to be conducted elsewhere.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with laws, regs., and policies reduces the potential for incurring Notices of Violations. NOVs could be issued for a number of reasons to include, but not limited to: knowingly allowing invasive species to negatively impact species of concern; and failing water quality testing, due to lack of proper erosion and sediment control. Internal to the navy additional NOVs can be issued for fire and security hazards.

Proper management of invasive species provides multiple benefits to species, the ecosystem and the military. This project: supports the reduction of Bird-Animal Aircraft Strike Hazards (BASH) concerns by altering vegetation structure to reduce site desirability for species that would or have posed BASH threats; reduces height obstructions associated with various military equipment requirements (i.e., Antenna arrays, Flight Ops, etc.); reduces the risk of facilities being overrun by uncontrollable “wildfires” or flooding; and reduces disease outbreaks.

Allowing invasive species to damage ditches and streams also poses health and safety threats to the base in that the damage by these species can clog vital storm water run-off structures. Damage of these water structures

could cause flood and damage to the base, waste water treatment facilities, training facilities, homes, etc. Such devastation could make the base or portions of the base unusable for military training and displace people who live on or adjacent to the base. In addition pooling water creates ideal breeding habitats for a variety of mosquito species (some of which are classified as invasive species), which increase the threat of wildlife borne disease which can spread to humans and other wildlife.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Partially approved, only approved survey/inventory funds, did not approve control/management funds. Invasive fauna surveys have not been funded.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA), Contract, Project Order, Work Order & Support Documentation
3	Quarterly/Monthly Project Status Reports
4	Draft Flora Inventory Final Report and Geodatabase
5	PreFinal Flora Inventory Report and Geodatabase
6	Final Flora Inventory Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
7	Draft Fauna Inventory Final Report and Geodatabase
8	PreFinal Fauna Inventory Report and Geodatabase
9	Final Fauna Inventory Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
10	Draft Control/Monitoring Final Report and Geodatabase
11	PreFinal Control/Monitoring Report and Geodatabase
12	Final Control/Monitoring Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices) and Geodatabase
13	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
14	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs etc.)
15	Maps
16	Invasive Species Removal/Control
17	Permit Acquisitions (as required)
18	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA/Contract. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - Cost estimate was derived from FY2012 contracted invasive species inventory project costs and FY2008-2015 invasive species control project costs with the following applied annual inflation rates

and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%.

- Due to the nature of this project it is likely that the cost will fluctuate up or down due to removal success, new species, changes in species population levels, etc.
- There is the potential to develop a cooperative agreement with USFWS regarding this project, because there are 2 US National Wildlife Refuges adjacent or within the same regional management unit as these 4 Navy bases, which are also working similar invasive species concerns. It is typically cheaper to group projects into a single larger project than to conduct smaller individual projects. USFWS has written the majority of the invasive species best management practices. USFWS is also one of the signatories on our INRMPs.

- **Estimate #1:**
  - **Contract Vendor and Previous History Estimates:**

Base	FY2012 Cost for Plan, Inventory & Map (Flora)	FY12 Inhouse Fee Inventory (Flora)	FY2014-2015 Cost Monitor & Control (Flora)	FY14-15 Inhouse Fee Control (Flora)	~FY15 Cost for Plan, Inventory & Map (Fauna)	~FY15 Inhouse Fee Plan (Fauna)	~FY15 Cost Monitor & Control (Fauna)	~FY15 Inhouse Fee Control (Fauna)
NASO/NALFF	$113,990.21	$3,000.00	$17,706.76	2500	$119,903.10	$3,155.62	$17,706.76	2500
NASO DNA	$26,597.72	$3,000.00	$34,148.75	1250	$27,977.39	$3,155.62	$34,148.75	1250
NSA NWA	$51,295.59	$3,000.00	$75,886.12	1250	$53,956.39	$3,155.62	$75,886.12	1250

Project Requested Funding: (Recurring Funds Project with Non-Annual Recurring Component within a given POM Cycle)…*highlighted are the years with both control and inventory requirements.*

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$53,438.93	$54,507.70	$21,291.90	$21,717.74	$22,152.09
NSA NWA	$98,664.19	$100,637.47	$39,717.59	$40,511.95	$41,322.19
NASO/NALFF	$214,859.40	$219,156.58	$87,939.36	$89,698.15	$91,492.11

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 6 July 2015

Project Numbers: 60191NR216; 32442NR216; 4275ANR216
Project Title: EO 13751 MA NASO/NALFF - Habitat Management - Prescribed Fire; EO 13751 MA NASO DNA - Habitat Management - Prescribed Fire; EO 13751 MA NSA NWA - Habitat Management - Prescribed Fire

Guidebook & Chapter: 12101
Legal Drivers:
Primary: EO 13751 Invasive Species
Secondary: Migratory Bird Treaty Act
Tertiary: Endangered Species Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 1st (85%), & 2nd (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual.

Project Description: *(What does this project entail?)* Develop an updated Prescribed Burning, Wildfire and Smoke Management Plan for each installation. The following should be utilize to develop the plans: existing INRMP data, site visits, and coordination with appropriate Navy, USFWS, and State Agency Prescribed-burn/Wildfire, Natural Resources, and Safety experts.

Create and implement a cooperative agreement with appropriate agencies to supply Prescribed Burning and Wildfire Control for NASO, NALFF, NASO DNA, and NSA NWA. If a cooperative agreement cannot be developed to implement the plans, then a contract should be pursued. Current Navy staffing and training levels do not allow for inhouse support of prescribed burning and wildfire control.

Project Purpose: *(Why is this project needed?)*
Prescribed burning is utilized for habitat management/restoration and invasive species control. This management and control technique is designed to address species of concern needs and requirements.

Existing prescribed burning, wildfire and smoke management plans need to be re-assessed for current validity and updated accordingly to meet current INRMP habitat and species management goals and objectives. Plans need to include appropriate pre-application evaluations, control prescriptions and techniques, goals & objectives, firebreak installation requirements and locations, burn area boundaries, post application monitoring, etc.

Current Navy staffing and training levels in the NAVFAC MIDLANT Hampton Roads area are inadequate to SAFELY accomplish desired prescribed burning and wildfire control. The last NASO,

NALFF, NASO DNA, and NSA NWA Prescribed Burning and Smoke Management Plans were prepared in 2010. In recent years 0% of the desired and planned burn areas have been treated due to weather conditions, inadequate staffing levels, and needed baseline habitat and species data-collection.

Project would adequately staff the Prescribed Fire program to implement the updated Prescribed Burning, Wildfire and Smoke Management Plans. Implementation would include site preparation, pre and post monitoring and reporting requirements, in addition to the physical prescribed burning and/or wildfire control actions.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with Federal and State laws, regs., and policies and reduces the potential for incurring Notices of Violations (NOV). Improper management of known threats to species of concern, such as habitat degradation, can lead to potential NOV situations.

The prescribed burning program provides multiple benefits to species, the ecosystem and the military. In addition to the aforementioned species of concern benefits, prescribed burning: is considered to be more ecologically friendly particularly for nutrient recycling and plant regeneration; supports the reduction of Bird-Animal Aircraft Strike Hazards (BASH) concerns by altering vegetation structure to reduce site desirability for species that would or have posed BASH threats; reduces height obstructions associated with various military equipment requirements (i.e., Antenna arrays, Flight Ops, etc.); and reduces the risk of facilities being overrun by uncontrollable "wildfires."

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* A contract to develop these plans is expected to be awarded in FY2015. 2 Different Cooperative Agreements with State and USFWS experts were pursued from 2013 to 2015, but were unable to be executed. POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA), Contract, Project Order, Work Order, & Support Documentation
3	Quarterly/Monthly Project Status Reports
4	Draft Prescribed Burning, Wildfire, and Smoke Management Plan and Geodatabase
5	PreFinal Draft Prescribed Burning, Wildfire, and Smoke Management Plan and Geodatabase
6	Final Draft Prescribed Burning, Wildfire, and Smoke Management Plan and Geodatabase
7	Draft Final Implementation Reports and Geodatabases
8	Final Implementation Reports (Breakdown of burning accomplished, summary of monitoring results, etc.) and Geodatabases
9	GPS Mapping of burn units and areas burned (In Navy Standard Format, i.e. WGS84)
10	Frequent correspondence with base Natural Resources Manager
11	Pre-burn site preparation and unit assessments
12	Conduct Prescribed Burns & Respond to Wildfire Concerns
13	Conduct after burn site evaluations and monitoring.
14	Permit Acquisitions (as required)
15	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee(s) staff to develop and obtain approvals of SOW and CA or Contract. Navy staff will work with grantee Partners and the prescribed burners to identify and report problems. The submittal of draft reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a document that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: track frequencies of burns; track habitat conditions pre and post burns; update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimate was derived from NAVFAC LANT FY2015 GCE, known need requirements, historic equipment purchases costs, and the 2015 OPM pay-scale for personnel.
  - Pending the outcome of the final Cooperative Agreement/Contract results, there may be an increase in the amount of funding required to come to a resolution regarding training, equipment, benefits, etc.
  - It is recommended that a cooperative agreement with USFWS, VA Department of Forestry, NC Forestry Commission and/or contractors supplying such services, which have obtained adequate National and State training, be developed as these agencies have established prescribed burning teams and are considered experts in the field of Prescribed Burning and Wildfire Control. Navy personnel that have obtained appropriate training and equipment will be available to support burning efforts. The base natural resources specialist has the lead with regards to prescribed burning objectives and the overall program on Navy lands.
  - This estimate has been split between each of the Oceana NR AOR bases, which cover 3 INRMPs (NASO/NALFF, NASO DNA, and NSA NWA), because the Prescribed Burning Fire Fighters would service all 4 sites.
  - The following inflation rates were applied and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%

Personnel:	Qty:	Mths:	# wks:	Hrs/ week:	$/hr:	$OT/ hr:	Total:	Comments
Prescribed Burning, Wildfire, and Smoke Management Plan	4	15	--	--	--	NA	$121,925.04	Programmatic Re-evaluation Every 5 years, based off of NAVFAC LANT FY15 GCE. Utilized 60% NASO/NALFF, 14% NASO DNA, 27% NSA NWA Allocations.
Incident Commander (GS 11)	1	6	24	24.00	36.48	38.31	$21,012.48	Adjusted for Hazard pay estimates. OT is the responsibility of the Partnering Agency.
Burn Boss (GS 9)	2	6	24	24.00	30.15	38.31	$34,732.80	Adjusted for Hazard pay estimates. OT is the responsibility of the Partnering Agency.
Burn Technician (GS 7)	7	6	24	24.00	24.65	36.98	$99,388.80	Adjusted for Hazard pay estimates. OT is the responsibility of the Partnering Agency.

Benefits								To be supplied by CA partner.
Training								To be supplied by CA partner. Training for Navy staff is included in a separate EPR for training.
Non-Navy Staff Equipment								To be supplied by CA partner.
Inhouse Fees							3,000.00	Contract Management
Navy Staff Equipment							2,103.74	See base INRMP for detailed equipment list.

Project Requested Funding: (Recurring Funds Project with Non-Annual Recurring component within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$23,759.71	$24,234.91	$24,719.61	$44,399.34	$25,718.28
NSA NWA	$45,822.30	$46,738.75	$47,673.52	$85,627.30	$49,599.53
NASO/NALFF	$101,827.34	$103,863.89	$105,941.16	$190,282.89	$110,221.19

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 6 July 2015

Project Numbers: 60191NR213; 4275ANR213
Project Title: CWA MA NASO/NALFF – Agricultural Management; CWA MA NSA NWA – Agricultural Management
Guidebook & Chapter: 12107
Legal Drivers:
Primary: Clean Water Act
Secondary: Soil & Water Conservation Act
Tertiary: Farmland Protection Act (FAIRA)
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2018-2022, Split Quarters 2nd (85%) and 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Every 5 years, for total baseline agricultural field and run-off assessments/monitoring or as deemed necessary due to major land or mission changes. Annually, for agricultural field run-off monitoring.

Project Description: *(What does this project entail?)* Develop Soil and Water Conservation Management Plans for each Agricultural Lease Parcel, Prepare and Implement Agricultural Lease Agreements and Associated Modifications, Conduct Annual Lease Inspections to Ensure Soil and Water Conservation Management Plans are being properly implemented, Take Appropriate Actions with Real-estate Agent to Enforce Violations of Lease/Plan requirements, Process and Report Pesticide Utilization Documentation.

Conduct assessment of ditches, soil quality, water quality, erosion & sedimentation, etc. and determine if these fields meet the requirements to be classified as Prime &/or Unique (submittal of documentation to USDA-NRCS for concurrence is recommended).

Develop a primary agricultural ditch/run-off management protocol including needed ditch clearing, ditch planting, ditch buffering requirements, and/or sediment control structure construction. Assessments (monitoring of run-off) should be conducted prior to ditch alterations (plan would establish ditch alteration requirements), during ditch alteration events (would monitor water quality and success of erosion control structures), and post ditch alteration events (would monitor water quality and sedimentation rates post ditch work and would establish a success rate of implementing the project). This protocol should be incorporated into the next Soil and Water Conservation Management Plan to be enforced as part of the Real-estate lease agreement. Develop a Government Cost Estimate of to fully implement either establishing properly vegetated ditches and buffers, or install erosion and sediment control structures, or a combination of both as appropriate.

Individual developing/completing the run-off management protocols and assessments should utilize a combination of existing Navy Data and Field work to develop these guidance documents. The current INRMP Appendices provide copies of completed surveys (e.g., erosion control plan, nuisance wildlife, vegetation community, etc.). GIS data associated with the completed INRMP surveys can be acquired thru coordination with the installation natural resources manager and the NAVFAC ML environmental business line GIS coordinator.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)*
Farmland Protection Act, Sikes Act, CWA, CZMA, EO 11990 (Protection of Wetlands), 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST M-5090.1, Chesapeake Bay Preservation Act and Federal Agreement, regional effort - Southern & Dismal Swamp watershed protection plans (SWAMP).

The Agricultural (Ag) lease program is one of very few profit generating program areas which brings in funding specifically for environmental program usage. The Ag lease program also saves the military hundreds of thousands of dollars annually in land maintenance costs (i.e., reducing mowing contract requirements). In the long run it is more cost efficient to the Navy to make sure that the ag leases are functioning properly and regulatory requirements are being met. Portions of the NASO AG program falls within the Chesapeake Bay Watershed and has the potential to negatively impact the restoration of the bay if proper land management is not implemented. The remaining portion of NASO and all of NALFF's and NSA NWA's ag fields fall within the Southern Watershed Protection Plan Area and these fields have the potential to negatively impact these watersheds as well.

Annually the big problem with the ag program is that they are not properly maintaining vegetated ditches and vegetated conservation buffers from the top of the bank out towards the crops (currently a 3 foot buffer) as dictated in the Soil and Water Conservation portion of the lease agreements. The only enforcement action we have is to deny contract renewal because there is nothing specified as an actual penalty in the lease agreement. Also due to current economic constraints, and decline in farming interest it is estimated that we may lose the ag lease program all together. Because of the decreasing interest in farmers bidding on properties in this region it makes it hard to deny the few farmers that bid the right to farm the land.

In an effort to prevent farmers from breaking the ditch buffer regulation the base NR specialist has recommended that ditches be brought up to "code" (clean the ditches, properly vegetate the ditches, and ditch buffers or install multiple run-off and sediment control structures to minimize buffer requirements and maximize farmable land). If these rec recommendations are accomplished then the farmers would have no excuses for not properly implementing the requirements of the Soil and Water conservation agreement. This project requests the assessment of the field to develop a plan of action to implement one or more of these recommendations as appropriate.

In order to assess the success of implementing such an action pre (which would include ditch buffering/restoration plan of action), during (assessments during ditch upgrade), and post ditch and buffering upgrade and run-off control structure assessments should be conducted.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* Soil and Conservation Plan Development, Real-estate Contract Coordination/Oversight, Pesticide Application Reporting, and Agricultural Site Inspections have been being funded via ag-outlease funds. No assessments or monitoring have been funded to date.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA), Contract, Lease, Project Work Order, Purchase Request & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., photgraphs, etc.)
9	Maps
10	Ground-truthing
11	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA/Contract/Etc. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. Results of assessments will be utilized to develop future POM submission requirements related to agricultural leased properties.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - The below cost estimates have been derived from past NAVFAC ML Ag-Outlease program management oversight funding, agricultural projects completed at smaller scales and from past larger sediment and runoff control structure construction and monitoring for other purposes such as fuel and oil runoff concerns with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%.

Item:	~2015 Cost Est. NASO & NALFF	~2015 Cost Est. NSA NWA	Comments:
General Agricultural Program Management	$16,666.66	$8,333.33	Develop Soil and Water Conservation Management Plans for each Agricultural Lease Parcel, Prepare and Implement Agricultural Lease Agreements and Associated Modifications, Conduct Annual Lease Inspections to Ensure Soil and Water Conservation Management Plans are being properly implemented, Take Appropriate Actions with Real-estate Agent to Enforce Violations of Lease/Plan requirements, Process and Report Pesticide Utilization Documentation. It is expected that Litigation and associated fees pertaining to Agricultural Leases would be being funded by the activity that has resulted in the litigation action.
Agricultural Field Quality and Run-off	$90,480.00	$44,520.00	NASO/NALFF = 1,508 acres; NSA NWA = 742 acres. Determine soil quality and obtain confirmation of if the

Assessment ($60.00/acre)			agricultural fields would meet the requirements to be classified as Prime & Unique. Provide data and analysis of data to quantify erosion rates, sedimentation rates, and chemical run-off rates. Provide recommendations to minimize the erosion, sedimentation, and chemical run-off rates. One recommendation should include identify proper placement and number of run-off and sediment control structures to install to enhance water quality entering into the local watersheds. Agricultural program manager has not been successful in getting the farmers to maintain the 3 foot vegetative buffers around all ditches identified in the lease agreements. Ag mngr does not think we have the demand and presence of farmers in the area to enforce this requirement (no one to take over a lease that gets terminated). Mission impacts would be substantial without the agricultural fields being maintained due to height obstruction issues and a lack of funding to maintain these large tracts of land at desired heights. Assessments should be completed every 5 years.
Installation of Test Run-off Control Structures	$200,000.00	$100,000.00	1 control structure constructed at the most impaired agriculture associated main ditch at NASO, NALFF, and NSA NWA. 3 Total test initial structures. Additional structures to be added at later dates pending monitoring results from test structure installations. Should not retain water for more than 48 hours unless covered, due to BASH concerns. Funding of control structure construction will be entered into separate EPRs (...NR214) from these assessment and monitoring EPRs (...NR213).
Maintenance of Run-off Control Structures	$0.00	$0.00	Maintenance of Structures will be added to farmer leases to complete annually.
Annual Run-off Monitoring	$4,000.00	$2,000.00	Water sample testing. Sediment, depth measurements, etc.
TOTAL:	107,146.66	52,853.33	

Comment [MFW1]: On hold, pending assessment results.

Comment [MFW2]: On hold, pending assessment results.

Comment [MFW3]: On hold, pending assessment results.

Project Requested Funding: (Recurring Funds Project, with a Non-Annual Recurring Requirement within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO/NALFF	$119,368.47	$18,939.12	$19,317.90	$19,704.26	$20,098.34
NSA NWA	$58,882.11	$9,469.56	$9,658.95	$9,852.13	$10,049.17

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 6 July 2015

Project Numbers: 60191NR211; 32442NR211; 4275ANR211
Project Title: CHS MA NASO/NALFF - Landcover Mapping; CHS MA NASO DNA - Landcover Mapping; CHS MA NSA NWA - Landcover Mapping

Guidebook & Chapter: 12101
Legal Drivers:
Primary: Endangered Species Act
Secondary: Migratory Bird Treaty Act
Tertiary: EO_ (Invasive Species or Pest Control)
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2018, Split Quarters 2nd (85%) and 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* 15 months, once every 5 years or as deemed necessary due to major land or mission changes.

Project Description: *(What does this project entail?)* Produce an updated Vegetation Community Classification Raster Landcover Layer. Acquire updated high resolution satellite imagery in an effort to produce a raster landcover layer of vegetative community types; analyze imagery; conduct ground-truthing surveys; and provide maps, data, and final report. Utilize existing leaf-on and leaf-off Navy Imagery and Acquire Newer Imagery as necessary to meet project's 85% or greater accuracy level.

Project at a minimum should be equivalent to work completed for the FY2012 Awarded Vegetation Community Classification project; however, this project was not funded to allow for 85% or greater accuracy levels. Project should create layers that can be properly analyzed with and compared to the FY2012 Awarded project.

The intent of the project is to create scientifically suitable layers that can be used to analyze change over time, for which the data can be utilized to support a wide variety of INRMP goals and objectives.

Final products will include complete geodatabase, with linked datasheets, tables, photos, and metadata. Final products will include 2 maps of each installation (NASO, NALFF, NASO DNA, and NSA NWA) on photo-quality paper that have been laminated with dry-erase marker utilization quality laminate.

Project Purpose: *(Why is this project needed?)* Vegetation community layers are needed to identify specific community types on base which may be important to species of concern and thus warrant protection and possibly enhancement. Landcover vegetation community level layers should be updated at least every 5 years to identify changes in communities and to capture landcover changes

due to military training, development, forestry actions, natural vegetation successional changes, other ecosystem changes due to environmental factors such as disease outbreaks, storm damage, forestry actions, etc.

Utilizing GIS and satellite imagery to create landcover layers are time and funding efficient. These layers allow biologists to obtain a better understanding of their base's resources, by providing a view/analysis of areas of the base that are not easily accessible on foot. The other option to mapping these communities is to conduct a 100% on the ground physical mapping of the entire base, which requires a 10 fold field work effort and still some GIS data processing in the office.

Data created from this project will help the installation answer annual INRMP metrics questions related to ecosystems as well as maintaining INRMPs sufficient enough to obtain concurrence from regulatory partners during reviews for Operation and Effect.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project promotes protection of wildlife species and vegetation communities of concern. There is a number of Federal and State listed species of concern that either live or seasonally visit bases in the Hampton Roads Area. As such this project allows the Navy to maintain compliance with various Federal and State laws, regulations, policies, and conservation agreements (ESA, MBTA, MMPA, NMFA, Invasive and Pest Control, Sikes Act, INRMP, OPNAVINST M-5090.1, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

Funding this project not only helps to keep the base from receiving NOVs related to species of concern, it also provides a better understanding of the layout of the base, which can prove beneficial for military planners designing field training requirements and for development and placement of potential construction sites.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)*
Projects received funding in FY2012, but were only funded to utilize existing imagery and not the desired new imagery. Also, not enough funding was provided for ground truthing efforts to obtain an 85% or greater accuracy level. POM16 request was not promoted as originally requested.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA), Contract, Purchase Order, &/or Work Order and Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report and Geodatabase
5	PreFinal Report and Geodatabase
6	Final Report and Geodatabase (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs etc.)
9	Maps, Photo Quality Paper, Heavy Duty Laminate (for use with Dry Erase Markers)
10	Ground-truthing
11	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; to identify potential impacts to the military mission; and to reduce errors in existing and future natural resources predictive modeling efforts.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - Cost estimate was derived from utilizing the FY2012 funded similar projects, plus contractor quote adjustment for new imagery acquisition, plus anticipated inhouse fees with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% .
    - There is the potential to develop a cooperative agreement with other adjacent land owners (i.e., USFWS, VDGIF, Local GOV, etc.). The cost of acquiring imagery is typically cheaper for one large solid landmass, vs. conduct smaller individual imagery acquisitions.
    - This estimate has been split between each of the Oceana NR AOR bases, which cover 3 INRMPs (NASO/NALFF, NASO DNA, and NSA NWA) because the equipment services all 4 sites.
    - Due to equipment activation, imagery acquisition, field work, and computer analysis requirement, it is most cost effective to conduct the work for these bases at the same time.

Item	~2012 Cost Estimate
FY12 Contract Award (Equipment, Analyst, Field Crews, overhead, etc.)	$260,586.00
Inhouse Fees	$5,000.00
Estimated Unfunded Field-work to meet >85% Accuracy	$26,059.00
Imagery to meet >85% Accuracy	$104,025.00
TOTAL:	**$395,670.00**

Project Requested Funding: (Non-Recurring Funds Project within a given POM Cycle), *highlighted fund request is for the POM18 desired funding date, if not funded the out years are to provide an estimate of cost if to be funded at a later date.*

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$61,712.36	$62,946.60	$64,205.54	$65,489.65	$66,799.44
NSA NWA	$119,016.69	$121,397.02	$123,824.96	$126,301.46	$128,827.49
NASO/NALFF	$264,481.53	$269,771.16	$275,166.59	$280,669.92	$286,283.32

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 6 July 2015

Project Numbers: 60191NR209; 32442NR209; 4275ANR209
Project Title: CWA MA NASO/NALFF - Soil & Water Conservation - Erosion Control; CWA MA NASO DNA - Soil & Water Conservation - Erosion Control; CWA MA NSA NWA - Soil & Water Conservation - Erosion Control
Guidebook & Chapter: 12107
Legal Drivers:
Primary: Clean Water Act
Secondary: EO Wetlands Protection
Tertiary: Soil & Water Conservation Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 2nd (85%) and 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); NASO Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Assessments every 5 years, repairs as needed.

Project Description: *(What does this project entail?)* Conduct base wide erosion and sediment control assessment every 5 years as deemed necessary due to major land or mission changes. Identify areas in need of repair due to erosion. Identify causes for the erosion. Stop and repair the erosion problems.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Projects allows the base to maintain compliance with the: Clean Water Act, the Chesapeake Bay Preservation Act; Essential Fish Habitat protection; OPNAVINST M-5090.1; base INRMPs; Sikes Act; and numerous other plans and policies.

Erosion can lead to Notices of Violation associated with water quality testing. Erosion can damage wetland habitats, essential fish habitats, and other species of concern habitats. Erosion can create ideal habitat suitable for invasive species to grow. Erosion can also cause security and safety concerns. All of these concerns pose negative impacts to military training, which could lead to loss of land on which the military can train.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables: (Also see cost estimate section.)

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., etc.)
9	Maps
10	Ground-truthing
11	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. Navy staff will implement those portions of this EPR exhibit inhouse as identified (see cost estimate).

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - Estimates have been based off of contract vendor supplied quotes, and past costs of similar work. Basewide Assessments are planned to be completed every 5 years with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% . Next Scheduled Assessment Due 2018.
        - 2012 Awarded Project (Field Work & Final Assessment 2013)
            - Award + Inhouse Fee (~$1K/base)
                - NASO DNA = $27,377.19
                - NSA NWA = $15,589.07
                - NASO/NALFF = $64,000.00
    - The FY12 funded Erosion Control Plan for these installations identified several erosion issues to repair at each site. Due to the costs of repair a ranking system will be used to identify which project to Fund each year. A summary table of erosion control repair projects and estimated cost is below. The detailed cost estimates may be obtained from viewing the Final Erosion Control Plan completed in 2013. Since Erosion Control Repair Projects associated with this plan have not been funded to date and have received POM16/17 acceptable risk approved status the results from the 2012 Awarded project were utilized to estimate projected costs from 2019-2022. An estimated $1K/installation has been added for potential inhouse fees associated with contract oversight.

- Basewide Assessments are scheduled to occur every 5-10 years to identify new erosion sources.
- Warranties and Monitoring should be factored into any erosion repair action/project's SOW. In the event that the repair work fails, the entity hired to fix the issue (unless completed inhouse), should have to rectify the situation at no additional cost to the government.

Site	2013 Cost Estimate
NALFF Site 1	$116,225.00
NALFF Site 2	$30,627.00
NALFF Site 3	$267,068.00
NASO DNA Site 1	(2019) $9,211.00
NASO DNA Site 2	(2021) $950-7,500.00
NASO DNA Site 3	(2020) $7,000.00
NASO Site 1	$21,000.00
NASO Site 2	$950-7,500.00
NASO Site 3	$950-7,500.00
NASO Site 4	$17,000.00
NASO Site 5	$8,100.00
NASO Site 6	(2020) $74,000.00
NASO Site 7	$11,000.00
NASO Site 8	$28,000.00
NASO Site 9	$4,000.00
NASO Site 10	(2021) $63,000.00
NASO Site 11	$950-7,500.00
NASO Site 12	$950-7,500.00
NASO Site 13	$4,000.00
NASO Site 14	$950-7,500.00
NASO Site 15	$950-7,500.00
NASO Site 16	$16,000.00
NASO Site 17	(2019) $390,182.00
NASO Site 18	$950-7,500.00
NASO Site 19	$950-7,500.00
NASO Site 20	(2022) $33,662.00
NSA NWA Site 1	(2022) $7,067.00
NSA NWA Site 2	(2021) $6,000.00
NSA NWA Site 3	(2019) $91,000.00
NSA NWA Site 4	(2020) $4,100.00
NSA NWA Site 5	$9,300.00
NSA NWA Site 6	$4,100.00

Project Requested Funding: (Non-Annual Recurring Funds Project)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$30,500.00	$11,409.29	$9,117.60	$9,881.19	$0.00
NSA NWA	$17,367.26	$102,796.43	$5,812.47	$8,137.45	$9,565.39
NASO/NALFF	$71,300.23	$447,144.35	$85,477.47	$74,399.59	$41,100.24

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Comment [MFW1]: Agriculture, will see if can be funded under agricultural outlease.

Comment [MFW2]: Agriculture, will see if can be funded under agricultural outlease.

Comment [MFW3]: City Easement Ditch…City Should Repair.

Comment [MFW4]: Roadside/Fenceline

Comment [MFW5]: Lake Christine

Comment [MFW6]: Roadway (RedWing Lake)

Comment [MFW7]: Agriculture, will see if can be funded under agricultural outlease.

Comment [MFW8]: Flightline Ditch

Comment [MFW9]: Golf Course

Comment [MFW10]: Aeropines Mitigation Site

Comment [MFW11]: Golf Course

Comment [MFW12]: Golf Course

Comment [MFW13]: Golf Course

Comment [MFW14]: Golf Course

Comment [MFW15]: Weapons Ditch

Comment [MFW16]: Weapons Ditch

Comment [MFW17]: Runway Ditch

Comment [MFW18]: Runway Ditch

Comment [MFW19]: Fenceline, London Bridge Rd.

Comment [MFW20]: Owls Creek

Comment [MFW21]: Near VACAPES/VDOT Mit.

Comment [MFW22]: Near VACAPES/VDOT Mit.

Comment [MFW23]: Runway Ditch

Comment [MFW24]: Runway Ditch

Comment [MFW25]: Runway Ditch

Comment [MFW26]: Potters Road Fenceline/Roadway

Comment [MFW27]: Log Cabin Ditch

Comment [MFW28]: Mill Stream – UpStream

Comment [MFW29]: Mill Stream – UpStream

Comment [MFW30]: Mill Stream Instersection – Downstream

Comment [MFW31]: Eastern Boundary Ditch

Comment [MFW32]: Eastern Boundary Ditch

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 06 July 2015

Project Numbers: 60191NR206; 32442NR206; 4275ANR206
Project Title: FRC MA NASO/NALFF - Forest Management; FRC MA NASO DNA - Forest Management; FRC MA NSA NWA - Forest Management
Guidebook & Chapter: 12108
Legal Drivers:
Primary: USC1215:32 U.S.C 1251 et seq (forestry) Forest and Rangeland Renewable Resources Planning Act
Secondary: FRCSRA620 Forest Resources Conservation and Shortage Relief Act
Tertiary: Endangered Species Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2018-2022, Split Quarters 2nd (85%) and 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* 15 months for baseline forest inventories (once every 5 years for baseline inventories or as deemed necessary due to major land or mission changes); annually/seasonally for disease and storm damage inspections and general forest management requirements.

Project Description: *(What does this project entail?)* Conduct an inventory and assessment of urban, natural, and timber harvest forest conditions every 5 - 10 years or sooner as deemed necessary due to major land or mission changes. Conduct annual inspections and assessments of forest habitats to identify potential disease and insect outbreaks, and storm damage concerns. Utilize the inventories and assessments and inspections as guides to: establish and conduct routine pre-commercial thinning and maintenance; provide guidance to appropriate commands for hazard tree removal; and implement arboricultural treatments as recommended and appropriate.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Proper management of forest resources aides the military mission in multiple ways, to include but not limited to: creating realistic conditions for in field military training; creating noise buffers around ranges; creating visual and access buffers around sensitive training facilities; reducing/removing height obstructions associated with various mission requirements; reducing the potential for species of concern to become listed under the Endangered Species Act; etc.

Land changes include: timber harvests; building construction; severe weather conditions (drought, lightening fires, ice storms, hurricanes, tornadoes, etc.); disease outbreaks; etc. Stand condition analyses are needed to determine hazardous conditions, commercial value, and value to species of concern.

SIKES ACT, 10 USC 2665, DoDINST 7310.5 AND OPNAVINST M-5090.1 requires that Naval bases manage appropriate forested areas for multiple use and optimum sustainable yield of forest products consistent with other Natural Resources programs. Forest stand improvement methods are required at NASO, NALFF, NASO DNA, and NSA NWA to maintain existing forested stands. If project is not funded the bases will be out of compliance with one or more of the following: DoD and Navy policies, the 1990 Forest Suppression Memorandum of Agreement between Dept. of Agriculture and DoD, the Chesapeake Bay 2000 Agreement, the Clean Water Act phase II program, the Sikes Act, the Soil and Water Conservation Act, the Forest Resource Conservation and Shortage Relief Act, and/or the Forest and Rangeland Renewable Resources Planning Act of 1974 (or RPA).

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Preservation of existing urban resources and proper management of natural and commercial forest stands is important to meeting the nutrient reduction and non-point source pollution control objectives of the Chesapeake Bay Agreement, the Clean Water Act and other Federal and State plans, and policies. Proper management also promotes thermal protection of waterways, and benefits to morale and welfare.

Trees are natural energy efficiency promoters/increasers. Trees provide shading/cooling and insulating benefits to structures and people working outside. Properly managing trees and landscaping in the Urban areas of the bases additionally supports the Navy's Policy and Goals towards energy efficiency and the 26 Apr 1994 Presidential Memorandum regarding "environmentally economically beneficial practices on Federal landscaped grounds," which also requires use of native plants for federally landscaped grounds.

Additionally, protection of urban forest environments is a continuing requirement that is exacerbated by hurricanes and coastal storms. Urban forest management involves the removal and trimming of trees that pose safety threats, property damage, and disease outbreak. An update of the Urban forest hazard trees will allow the base to address these threats to human safety and property assets.

Proper natural and commercial forest management is: beneficial to a variety of species by providing various phases of vegetation succession; and improves the value of the timber, thus making them commercially more profitable. Timber harvesting activities promote these changes in succession, which mimics natural events that caused succession changes. Wildfires are an example of these natural events, which would clear areas of vegetation and create open areas. A variety of species require these conditions to survive, including species of concern (i.e., Endangered Species Act and Migratory Bird Treaty Act listed species). On many Military base, due to threat to human health, safety, equipment, and training, wildfires are typically suppressed and not allowed to create open areas. Urban development around and training missions on NASO, NALFF, NASO DNA, and NSA NWA require such suppression. Conducting timber harvests in addition to prescribed fire (where authorized…under separate EPR) allows these bases to provide this habitat conversion in support of species of concern initiatives.

In order to identify annual forest health conditions (disease outbreak, weather damage, unreported fire damage, etc.) field work is needed by qualified forestry technicians to visit the various stands and determine if there are potential forest health threats that require immediate or future management actions. In ability to conduct these surveys could result in a lack of proper forest management that could negatively impact legally protected or other species of concern on the installation.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* Funding for projects of this nature has typically been funded through the Forestry Reserve and other Forestry Program budgets. Unfortunately, due to current economic situations the funds available to the forestry program from commercial timber harvest and firewood salvage efforts has decreased and it is predicted that funds may not be available to fund these projects via these forestry programs. A baseline commercial forest inventory was completed in 2013/2014 for all 4 sites and urban forest inventories are anticipated to be completed 2015/2016. Despite requests, no forestry technicians or certified professional forester have been hired to directly support the installation's annual Forestry Program Management. POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA), Contract, Project Order, Work Order & Support Documentation
3	Quarterly Project Status Reports
4	Emergency/Immediate Action Notifications
5	Draft Final Report and Geodatabase
6	PreFinal Report and Geodatabase
7	Final Report and Geodatabase (Introduction, Study Area, Methods, Results, Conclusion,

	Recommendations, Literature Cited/References, Appendices)
8	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
9	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs, etc.)
10	Maps
11	Ground-truthing
12	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA or other work requirement documentation. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Estimates have been based off of FY2012-2015 awarded projects and 2015 OPM Salary/Location Pay Charts with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%.
  - POM18 does not have a requirement for the 10 year Non-Urban Forest Inventory baseline. This is not required until 2023. Costs for the year will increase by approximately 67% in 2023 to support contracting this baseline inventory, assuming there is no inhouse Navy support that can accomplish this requirement.
  - If technicians and certified forester support are not hired to annually conduct forestry program efforts, there is an additional requirement in 2021 for the POM 18 cycle to fund the 5yr, re-evaluation of the Urban Forest Inventory. If acceptable risk is determined for the EPR, it is requested that at a minimum year 2021 be funded.

Item:	~2015Cost Est. NASO & NALFF	~2015 Cost Est. NASO DNA	~2015 Cost Est. NSA NWA	Comments:
Forest Program Mngt.*	61,557.68	13,920.45	27,298.73	NAVFAC ML Core or LANT support for program management (contract mngt., applying for Forestry Reserve Funding, conducting as needed assessments, etc.). Also, could be used to hire certified professional forester to support the installation's forestry program management. Estimated at a GS11 Step 10 level. Funds split amongst the 3 INRMPs by installation size.
Arboricultural Treatments	13,310.39	3,957.14	7,200.06	Primarily focused on Urban Trees and Urban-Non-Urban Forest interface tree maintenance needs, to maintain healthy trees. Estimate derived from previous similar work.
Hazard Tree Removal	0.00	0.00	0.00	It has been recommended that the ENV program no longer fund Hazard Tree Removal in the Urban Areas of the base. It has been recommended that this cost should be provided by a combination of funds from Safety and Public Works. 2012 Original estimated cost was $113,704.00, but fluctuates annually. The EV program will fund the inventory of urban trees which would identify hazard trees. Hazard Tree Removals and Costs should be included in the Annual Urban Forest Inventory Assessment Updates.

Item:	~2015Cost Est. NASO & NALFF	~2015 Cost Est. NASO DNA	~2015 Cost Est. NSA NWA	Comments:
Forest Quality-Health Surveys/Inspections*	67,160.30	15,187.40	29,783.30	Disease, pest, and storm damage inspections. Fund 2 equivalent GS-5 Forestry Technicians (Forestry Technician Series, 0462). Technicians will conduct field work determining health conditions of both non-urban and urban forest resources throughout the year. Technician will update the Urban Forest Inventories annually after initial 2015 awarded baseline is completed. Amount based on OPM Forestry Technician funding at the GS 5 level. Funds split amongst the 3 INRMPs by installation size.
Non-Urban Forest Inventory	100,040.04	22,622.72	44,364.34	Occurs every 10 years or more frequently depending on mission changes and extent of storm damage, as a total forest baseline inventory and verification of Annual Forest Quality Surveys/Inspections. 2013 Baseline Awarded: Initial Contract Award $151,655.54; DN/FN UXO Mod. of $8,409.70; $5,000.00 Inhouse costs. Total Costs were, extrapolated out to each INRMP by acreage. Note, next required inventory not required until 2023.
Urban Forest Inventory	58,899.63	13,319.36	26,119.97	If technicians are not hired to conduct annual forest quality/health assessments, after initial baseline urban forest inventory a 5 year re-evaluation and consolidation of actions that have occurred over the 5 years (new construction, arbor day celebration planting, hazard tree removals, etc.) should be completed. 2015 Baseline GCE $97,088.97. 2015 Inhouse Fee $1,250. Total Costs were, extrapolated out to each INRMP by acreage.
TOTAL:	**92,160.00**	**27,395.43**	**49,850.10**	

*Forestry Program Navy Manpower Requests have been denied. Since these requests have been denied, a decision was made to reflect these costs in the EPR exhibit. If Navy billets are not established the intent is to contract or create a CA to implement these requirements. Past POM cycle amounts were more attributed to equipment/supply needs for the program and the amount of reach-back support that NAVFAC ML Core might be able to supply to the program. Given this information the POM 18 EPR funding levels are higher than past POMing funding requests.

Project Requested Funding: (Recurring Funds Project with Non-Annual Recurring components within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$35,020.03	$35,720.43	$36,434.84	$37,163.54	$37,906.81
NSA NWA	$68,082.91	$69,444.57	$70,833.46	$72,250.13	$73,695.13
NASO & NALFF	$150,426.11	$153,434.63	$156,503.32	$159,633.39	$162,826.06

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 06 July 2015

Project Numbers: 60191NR205; 32442NR205; 4275ANR205
Project Title: 4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection; 4 SAR MA NASO DNA - Species and Habitat of Concern Protection; 4 SAR MA NSA NWA - Species and Habitat of Concern Protection
Guidebook & Chapter: 12104
Legal Drivers:
Primary: Endangered Species Act
Secondary: Clean Water Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Annual, Split Quarters 2nd (85%) and 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* Annual as needed.

Project Description: *(What does this project entail?)*
Implement various habitat enhancement and restoration projects in support of Species of Concern and Habitats of Concern in accordance with the resource's management plan. Obtain appropriate surveys and assessments and monitoring of project areas.

Develop plans that benefit multiple species of concern.

(See project justification and cost estimate documents current proposed project details).

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Projects allows the base to maintain compliance with the: Endangered Species Act; Migratory Bird Treaty Act; Sustainable Fisheries Act Amendment to the Magnuson-Stevens Fishery Conservation and Management Act in 1996; the Chesapeake Bay Preservation Act; the Clean Water Act; Essential Fish Habitat protection; OPNAVINST M-5090.1; base INRMPs; Sikes Act; and numerous other plans including but not limited to the: Southern Watershed Area Management Plan (SWAMP); Lynnhaven River Watershed Restoration Plan (sub of Chesapeake); and Back Bay Watershed Restoration Plan (sub of southern).

The waterways of NASO, NALFF, NASO DNA, and NSA NWA connect to several watersheds which all have the potential to influence Essential Fish Habitat (EFH) within the Atlantic Ocean, and Chesapeake Bay.

These projects support wetland enhancement & protection, T&E species & habitat protection, soil and water protection, and recreational opportunity enhancement and protection.

Installations provide a unique mix of urban, suburban, and rural interfaces that provide both beneficial and detrimental habitat conditions to various species. For example, the installation's utility infrastructure provides nesting, perching, and roosting structures ideal to some species. This same infrastructure creates obstacles that kill some species (fires that burn nests, electrocution, "clothes-ligning"/direct impacts, etc.). Typically, when the is a negative encounter such as a fire there is a resulting loss of utility service. The loss in service negatively impacts the military mission by interrupting training and readiness activities, daily business, and security measures. Measures can be put into place to minimize negative wildlife interactions with utility infrastructure and minimize and avoid power outages.

Maintaining compliance with Federal and State Laws, Regs, and Conservation Goals, helps to ensure that DoD Lands will not be further restricted from military utilization, and helps to ease permitting requirements when new military actions are proposed.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)*

Proposed Deliverables: (Also see cost estimate section.)

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) Contract, Purchase Order, and/or Work Order & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., etc.)
9	Maps
10	Ground-truthing
11	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. Navy staff will implement those portions of this EPR exhibit inhouse as identified (see cost estimate).

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Estimates have been based off of contract vendor supplied quotes provided during the revision of the NASO/NALFF INRMP in 2008 and FY2012 - FY2015 funded projects with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0%.

Project:	2015 Est Cost:	Comments:
SIAs (NASO, NALFF, NASO DNA & NSA NWA)	0.00	Internal assessment, other projects will provide necessary information for management (invasives, erosion, nuisance, etc.)
Continue protection of potential Dismal Swamp southeastern shrew habitat. (NALFF & NSA NWA)	0.00	Internal assessment, other projects will provide necessary information for management (invasives, erosion, nuisance, etc.)
Control pine, sweetgum, and other competing species around the South out parcel Long-leaf pine area (NASO DNA and NASO)	0.00	Internal assessment, other projects will provide necessary information for management (invasives, erosion, nuisance, prescribed burn, etc.)
OC Pond Access Rd Repairs 5 year rotation with gravel (consult with regulators to see if we should just pave)…protect wetlands and other habitats and resources. (NASO)	0.00	Requested under separate EPR under erosion control. Actual Road Repairs are now FMD responsibility, CN worked to get funding for initial repairs in 2006/2007, once that was completed FMD was to take on maintenance requirements.
Evaluate restoring Mill Stream to restore floodplain function by installation of a water control structure above the Wilderness Road bridge. (NSA NWA)	0.00	On hold. Need to wait until after the Correctional facility is completed to identify structure placement and potential effects. Also, in the process of re-evaluating this as the most beneficial option…2012 and 2013 field work results from Erosion Control and Stream Assessments are being compared with the prior control structure finding to determine the most appropriate and beneficial restoration to be completed.
Landscape Parking lot on Regulus Ave. across from Build. 127 (NASO DNA)	0.00	After discussions with planning there are some future plans for this area to include a potential parking garage. Will coordinate to make this a "green structure."
Signs (Canebrakes, Dunes Wetland Mitigation, Interpretive Signs, Nesting Keep Out, etc.) (NASO, NALFF, NASO DNA, & NSA NWA)	10,000.00	As needed.
Posts (NASO, NALFF, NASO DNA, & NSA NWA)	3,500.00	As needed. Metal and Wood varying sizes.
Nuts & Bolds (NASO, NALFF, NASO DNA, & NSA NWA)	250.00	As needed. Varying sizes and types.
Shelving (NASO, NALFF, NASO DNA, & NSA NWA)	5,000.00	For storage of Signs and equipment associated with these projects.
Post hole pounder (NASO, NALFF, NASO DNA, & NSA NWA)	2,000.00	Custom Made, anticipate Shops or Brig to construct. Market research did not produce the size pounder required.

Project:	2015 Est Cost:	Comments:
Canebrake Study Habitat Enhancement.	10,000.00	Survey work and habitat enhancement projects. Survey work has been relocated under another EPR for NALFF due to State Listing tracking for ESA purposes. NWA surveys are no longer being funded, project has run its course. Habitat Enhancement still falls under this EPR due to mult. Species benefit.
Atlantic White cedar, Control pine, sweetgum, and other competing species at: the Coast Guard complex stand (NSA NWA); and the south runway stand. (NALFF)	2,000.00	Internal assessment, other projects will provide necessary information for management (invasives, erosion, nuisance, etc.). Planting is the only funding requirement
Brochures (Wetland Habitat, Dune Habitat, Fishing, Hunting, Trapping, Archery, Snakes, Bears, Feral Cats, Birding Checklists, Nature Trails, Invasive Species, etc.)	1,500.00	Printing & shipping costs.
Convert Mowed areas to "Natural Areas" (Warm season grass plots, wildflower plots, Bobwhite Quail Habitat, etc.)	8,000.00	Seed and equipment rental. Mngt covered under other EPRs and inhouse work.
Golf Course Ponds	8,000.00	Habitat alterations pending results from FY13 assessment. FY13 Project has been realigned under NR221 series EPRs. This EPR will address implementation of habitat alterations due to multi-species benefits.
Fish habitat enhancement (Lunker Lake, Sadler ponds, OC pond, Redwing Lake)	15,000.00	Assessment handled under separate EPR. This EPR is for implementation.
Maintain Access ways and protection corridors for Species of Concern and Habitat Restoration Sites.	2,000.00	
Develop Avian/Flying Mammal Protection Plans	141,400.00	NASO, NALFF, NASO DNA , and NSAHR NWA Contract ~$35,000ea; Inhouse ~$3,500ea. Every 5 years. Will work with Utility Departments to develop plans for Utilities to Implement. Request first year to fund 2018, if not sooner. Utilize USFWS and State Wildlife Agency(ies) guidance for development. Also, utilize other DOD plans for reference.
Conduct Dune Delineations	35,000	DNA Only. Every 5 years. Next years to funded 2017 and 2022.
Write in Rain Paper	100.00	Annual Recurring
Write in Rain Notebook	30.00	Annual Recurring
Write in Rain Pens	40.00	Annual Recurring
Camera Photo Download Docking Station	500.00	As needed.
Flagging	100.00	As needed, Possibly Annual Recurring.
Flags	400.00	As needed, Possibly Annual Recurring.
Unplanned Species and/or Habitat Projects that support the INRMP and that have INRM, and appropriate other signatory Agency(ies) concurrence as such…typically discussed during INRMP metrics annual reviews.	Unk.	Funding for this EPR can be utilized to fund other Species or Habitat Projects for NASO, NASO DNA, NALFF and/or NSA NWA that have been deemed to take precedence over the scheduled funding plan.

Project Requested Funding: (Recurring Funds Project within a given POM Cycle)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO/NALFF	$130,922.38	$46,567.31	$47,598.66	$48,448.63	$49,417.60
NASO DNA	$53,215.60	$10,530.57	$10,741.19	$10,956.01	$52,175.72
NSA NWA	$62,890.28	$20,651.01	$21,064.03	$21,485.31	$21,915.02

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 2 July 2015

Project Number: 60191NR204
Project Title: MBTA MA NASO/NALFF - Migratory & Breeding Bird Surveys
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Migratory Bird Treaty Act
Secondary: Bald and Golden Eagle Protection Act
Tertiary: Sikes Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2016-FY2020, Split Quarters 2nd (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); and Naval Auxiliary Landing Field (NALFF)

Project Duration: *(Estimated length of time and Start & End Dates)* 1 year, 2 months for each standard annual reporting cycle. 1 year, 5 months for each 5th year more detailed reporting cycle. Time estimates are subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys) and will be handled on a case by case basis.

Project originally requested to conduct the detailed reporting cycle every 3 years after further coordination with NAVFAC MIDLANT CORE Conservation Division staff the frequency was changed to every 5 years unless something occurs that would warrant an evaluation sooner, such as major landuse changes, major ecosystem impacts from storm damage, new/update species survey requirements, etc.

Project Description: *(What does this project entail?)* Conduct migratory and breeding bird surveys to establish bird population, activity (Feeding, Breeding, Stop-over, Flight Pattern, etc.), frequency and habitat utilization data.

Conduct seasonal (Winter, Spring, Summer, and Fall) bird surveys to determine use by migrating, breeding, and wintering birds in each habitat type (open grasslands, upland hardwood forest, pine forest, bottomland hardwood forest, etc.) and the airfield clear zones at NASO and NALFF. Migratory and breeding bird surveys should be repeated in 5 year intervals to show bird utilization trends and impacts to bird populations from military land use for those areas inside and outside of the airfield clearzone. Project should consist of day and night time surveys. In addition to traditional surveys data collection (population size estimates, species ID, habitat location, etc.) should included assessment of flight patterns (types of flocking/migrating species, numbers in flocks, flight directions, etc.).

The airfield clearzone areas should be surveyed annually and should also include a comprehensive night time component for bird utilization data of the airfield clearzone areas. This data will be used to analyze Bird Aircraft Strike Hazard (BASH) concerns, to determine what habitat management techniques should be implemented to reduce those concerns. Currently these annual surveys are being conducted under the AIROPS USDA BASH support agreement. Survey routes, techniques, etc. are

coordinated with the installation Natural Resources Manager (NRM) and all data is provided quarterly or upon request to the installation NRM. If this were to be removed from the AIROPS USDA Agreement, then this project would be an annually recurring project with an increased estimated budget of $30k+ annually.

Project may identify additional survey need requirements particularly if species with additional warranted protection requirements are identified (including: Federally Listed Species under various acts; and non-Federal T&E listed species that are federally and State recognized Species of Concern, which pose a mission threat or are in danger of potentially becoming a candidate for listing under the Endangered Species Act). If these needs are identified, then additional Projects will be requested at that time.

Project Survey Methodologies will be developed in coordination with the Installation Natural Resources Manager, DoD Coordinated Bird Monitoring Program, and INRMP signatory partners (USFWS and appropriate VA State Wildlife Agency).

Project Purpose: *(Why is this project needed?)* Currently, these bases do not have sufficient biological information to determine if they are negatively impacting bird species of concern. This lack of information puts the Navy at risk for violating several federal and state laws. In addition to federally mandated requirements, Navy and State Policies and Plans dictate that we should have a working knowledge of our impacts to wildlife. This EPR exhibit works to get the Navy in compliance with these requirements.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Surveys of bird utilization on the bases are necessary to understand how mission requirements will affect bird species of concern. MBTA, ESA, and BAGEPA listed species all utilize these bases and have the potential to have negative impacts on the mission. Not knowing the potential impacts to the species by military mission projects and training could cause a violation of anyone of these federal laws and result in a NOV, which would be costly and put additional restrictions on military training property. Knowing in advance what potential concerns there are would allow the command to plan around avoiding potential impacts and to plan for permitting and mitigation requirements, which may be needed to meet military training requirements.

Although BASH is a primary mission concern at NASO and NALFF, multi-year comprehensive bird surveys or bird utilization studies have not been conducted. Understanding usage and annual migration patterns in the various habitat types, including the airfield clear zones, is a vital step to reducing BASH hazard on the stations. Data to quantify and qualify potential take are required for obtaining and maintaining a bird depredation permit for clear zone management (BASH reduction efforts). Permits are managed through the Natural Resources program.

This is not just a Natural Resources wildlife concern this is a Safety Concern.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Quarterly Project Status Reports

4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., etc.)
9	Maps
10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. In general the data will be utilized to identify any trends in impact to bird species of concern given the various military missions, it will be used to identify potential habitat modification requirements to minimize bird strikes, it will be used to update Bird Depredation Permits where required, and it will be used to help in conducting planning level reviews of proposed projects and activities with consideration for impacts to wildlife and the mission.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - Cost estimation was derived from the FY2012 contracted previous surveys of a similar nature for each installation with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% .
        - 2012 Contract Award = $64,163.00
        - 2012 Inhouse Fee = $1,546.00
        - See Execution documents for details.

Project Requested Funding: (Non-Annual Recurring Funds Project)

BASE	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022
NASO/NALFF	$71,769.00	$73,204.00	$0.00	$0.00	$0.00	$79,239.00

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 2 July 2015

Project Number: 60191NR203; 32442NR203; 475ANR209
Project Title: CWA MA NASO/NALFF - Mitigation Site Monitoring; CWA MA NASO DNA - Mitigation Site Monitoring; CWA MA NSA NWA - Mitigation Site Monitoring

Guidebook & Chapter: 12105
Legal Drivers:
Primary: Clean Water Act
Secondary: Coastal Zone Management Act
Tertiary: EO 11990
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2016-2020, Split Quarters 2nd (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field (NALFF); NASO Dam Neck Annex (DNA); and Naval Support Activity Hampton Roads Northwest Annex (NSA NWA).

Project Duration: *(Estimated length of time and Start & End Dates)* Annual.

Project Description: *(What does this project entail?)* Conduct wetland mitigation site and project site wetland monitoring in accordance with issued legally mandated permit requirements. Surveys include but are not limited to: flora and fauna density, diversity and abundance assessments; hydrology assessments; etc. Any ground disturbing techniques will have prior coordination with base planning and environmental to ensure no threats to resources, utilities, and surveyor safety.

Project Purpose: *(Why is this project needed?)*
There have been several areas on base that have resulted in mitigation monitoring requirements due to Notices of Violations (NOVs) and new Construction permit requirements. The permits associated with the NOVs and Construction required wetland mitigation projects to be established.

There are several mitigation sites on NASO and NALFF; however currently, there is only 1 outstanding project (Aeropines), funded by the Navy, which has not completed the monitoring requirements established under its permit. Required to evaluate hydrology and vegetation at 1- (2006), 2- (2007), 3- (2008), 5- (2010), 7-(2012), and 10- (2015) years. Aeropines is slated to meet its permitted requirements in FY 2016.

There is one additional project (Wherry Housing) which has met its monitoring requirement, but has not yet received concurrence of completion by the state regulatory office.

There are several wetland mitigation sites at NASO DNA. We have not yet received a letter of concurrence by the state or USACE regulatory offices indicating that the Lovett's Marsh Mitigation

site has met its mitigation requirements; however monitoring of the site has been completed in accordance with permit requirements.

There are several mitigation sites on NSA NWA. One site, MOUS-P-131, has not received a letter of concurrence that the site has met the mitigation criteria. Quarterly photos of the site are taken and reporting continues until notice of compliance is received.

Annually, each installation has projects that require wetland site monitoring, remarking of wetland boundaries, and many time coordination with regulatory agencies regarding permits and mitigation requirements. The wetlands media manager at NAVFAC MIDLANT CORE who handles wetland permitting and mitigation is reimbursable and requires funding annually for these services.

Also, existing mitigation sites that have met there permitted requirements, need to be revisited to ensure that the sites are functioning as planned. If they are not functioning as planned conservation recommendations should be developed to make the sites functioning wetlands. (Unless it is specified directly as permit requirement, successional changes will not be considered a functioning wetland concern that would warrant additional conservation recommendation development, such as conversion of forested wetland to emergent wetland.)

Additional funding may be requested in future POM cycles as additional mitigation site monitoring becomes required. The Navy will first pursue obtaining mitigation banking credits or creating wetland off base in lieu of further restricting training property by constructing new wetlands on base. In some cases this is not possible and mitigation will be required on base. It is anticipated that there may be some wetland mitigation monitoring requirements established due to implementing the Clear Zone Management Plan (CZMP). The CZMP is in draft form and has an EA in development. Wetland impacts and mitigation requirements have not yet been finalized.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Not funding this exhibit may result in the issuance of another Notice of Violation and additional mitigation requirements may be issued. Additional funds may have to be redirected from some other mission requirement to fund this project. Additionally, additional land may have to be encumbered and removed from being utilized for military training.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:
Itemized list below is for a standard mitigation site monitoring project. For general wetland monitoring and coordination with regulatory agencies, that effort will be documented via multiple avenues such as consultation coordination documentation, permits, emails, etc.

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)

7	GIS Data Layers (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., etc.)
9	Maps
10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA. Grantee will provide quarterly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS layers, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. Final report will be submitted to the permit issuing regulatory agency in accordance with the wetland mitigation agreement.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Estimate was derived based on previous site mitigation monitoring conducted by GeoMarine Inc. (GMI) contracted and NAVFAC MIDLANT CORE Wetlands Media Manager inhouse support with the following applied annual inflation rates and rounded up to the nearest dollar: years 2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% .
  - Estimate does not include unknown/potential site mitigation requirements.

- **Estimate #1 (From POM16):**
  - **Contract Vendor & Inhouse Support Estimate (Previous Similar Project):**

BASE	~2012 TOTAL COST	~2015 COST (1.7% annual inflation est.)	~2016 COST (1.9% annual inflation est.)
NASO/NALFF	$9,411.00	$9,957.91	$2000.00
NASO DNA	$0.00	$0.00	$2000.00
NSA NWA	$0.00	$0.00	$2000.00

POM 18 Project Requested Funding: (Annual Recurring Funds Project)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO/NALFF	$2,080.80	$2,122.42	$2,164.86	$2,208.16	$2,252.32
NASO DNA	$2,080.80	$2,122.42	$2,164.86	$2,208.16	$2,252.32
NSA NWA	$2,080.80	$2,122.42	$2,164.86	$2,208.16	$2,252.32
TOTAL:	$6000.00	$6,114.00	$6,230.16	$6,348.54	$6,469.17

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 2 July 2015

Project Number: 60191NR202; 32442NR202; 4275ANR202
Project Title: CWA MA NASO/NALFF - Wetland Mapping Inventory; CWA MA NASO DNA - Wetland Mapping Inventory; CWA MA NSA NWA - Wetland Mapping Inventory
Guidebook & Chapter: 12105
Legal Drivers:
Primary: Clean Water Act
Secondary: Coastal Zone Management Act
Tertiary: EO 11990
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* FY2015 & 2016, Split Quarters 2nd (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO) & Naval Auxiliary Landing Field (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); and Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* …subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys).

Re-evaluations of Existing Baseline Inventory, every 5 years:
NASO = 6 months. (01 May 2015 – 01 Nov 2015)
NALFF = 6 months. (01 May 2016 – 01 Nov 2016)
NASO DNA = 6 months. (01 May 2016 – 01 Nov 2016)
NSA NWA = 6 months. (01 May 2016 – 01 Nov 2016)

Baseline inventory, every 10 years:
NASO = 6 months. (01 May 2021 – 01 Nov 2021)
NALFF = 6 months. (01 May 2022 – 01 Nov 2022)
NASO DNA = 6 months. (01 May 2022 – 01 Nov 2022)
NSA NWA = 6 months. (01 May 2022 – 01 Nov 2022)

Project Description: *(What does this project entail?)* Conduct the "5 year" baseline wetland inventory re-evaluation (finalized re-evaluation due 6 months prior to every 5 year baseline or re-evaluation completion date) and new "10 year" baseline wetland delineations. Re-evaluation includes verification of previous inventory boundaries and updating the boundaries as necessary to reflect changes in the wetland property boundaries. Baseline wetland delineations reassess the existing boundaries, identify new wetland areas, and remove new upland areas from within the boundaries of previously delineated wetland areas. Surveyors must map all parcels utilizing updated USACE standard wetland mapping protocols. The people who conduct these surveys should have experience in conducting wetland delineations in Southeastern VA and Northeastern NC as this area is notoriously difficult to survey accurately for wetlands, even for trained professionals conducting wetland delineations in other regions of the US. Any ground disturbing techniques will have prior coordination with base planning and environmental to ensure no threats to resources, utilities, and surveyor safety.

Note: If 5 year re-evaluations are not completed 6 months prior to existing wetland delineation's 5 year USACE expiration date, then a new baseline inventory/wetland delineation may be required, which will substantially increase the costs associated with that 5 year wetland delineation re-evaluation.

Only areas on bases that are not scheduled to be mapped under the baseline wetland mapping efforts, and thus not subject to 5 /10 year re-evaluations, are those properties that fall within agricultural leases. If the property is to be removed from agricultural production the property will then be evaluated for wetlands. Note: Main Base stormwater ditches that run through agricultural fields will be or have been assessed for inclusion in baseline wetlands inventories (shallow agricultural ditches have not been assessed).

Project Purpose: *(Why is this project needed?)* Substantial land alterations both natural and man-made can occur in a 5 and 10 year time spans. These alterations impact land classifications from wetland to upland and vice versa within this 5 year period. The changing classification potential warrants an updated mapping effort. USACE guidance and permitting requirements indicate that wetland inventories should be re-evaluated every 5 years for accuracy and adjusted accordingly.

Updating the data layers will provide the base staff with better information for reporting, protecting, and species of concern modeling purposes. This updated information should also help base staff, Navy HQ staff, DoD staff, etc. to make more informed property management decisions.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this program would allow the base to better plan projects and mission training assignments. Besides construction threats to wetlands and water quality there are also temporary training exercises which threaten the integrity of wetland habitats. Impacts to these habitats could result in Notices of Violation and costly regulatory mitigation requirements.

Providing a better map of known wetland areas will allow planners: to attempt to avoid wetland impacts; to plan for funding and conducting jurisdictional determinations; to plan for funding and processing required permits; to plan for and fund mitigation requirements; and to plan for and fund NEPA documentation and surveying requirements. Being able to better plan around potential wetland concerns will save time and money because there will be fewer unplanned delays and interruptions to contract awarded projects and military training exercises.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* Each installation has conducted an initial basewide wetland inventory between 2011 and 2012 with the exception of the agricultural parcels. Costly delays can occur if evaluations are not conducted 6 months prior to the established USACE Wetland Delineation expiration dates for each installation. POM 16/17 Acceptable Risk, approved without funding.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Quarterly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
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9	Maps

10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

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Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Estimate number one was provided by US Army Corps of Engineers (USACE) for re-evaluating an existing jurisdictionally determined baseline wetland inventory, rounded to the nearest dollar value. USACE is considered the federal technical expert in this field, but is not always available to provide such extensive in-field services. Original cost estimate was provided in accordance with how many man hours USACE thought they would spend on a given base re-evaluating lines. The Cost/acre estimate was derived given the provided man-hours cost estimate.
  - Estimate number two was provided by GeoMarine Inc. (GMI) for the re-evaluation of an existing jurisdictionally determined baseline wetland inventory. GMI is a current Navy contracted service provider, and has conducted wetlands mapping on these bases in previous years. This quote is a gross over-estimate of what the cost would be for a typical 5 year re-evaluation. This quote is more directed towards completing a totally new baseline survey, which may be required every 10 years.
  - Estimate number three was based off of a quote provide by the NAVFAC MIDLANT Regional Natural Resources office for the re-evaluation of an existing jurisdictionally determined baseline wetland inventory to be conducted by a contracted certified wetlands biologist. Both a 5yr re-evaluation and 10yr baseline estimate was provided.
  - POM 18 Estimates were derived utilizing estimate number three and it's associated FY2007-2012 awarded contract final costs and requested Inhouse fees with the following applied annual inflation rates and rounded up to the nearest dollar: years prior-2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% .

- **Estimate #1 (From POM16):**
  - **US Army Corps of Engineers Estimate (5yr re-evaluation):**

BASE	ACREAGE	~COST/ACRE	~2011 TOTAL COST	~2015 or 2016 Cost
NASO/NALFF	5732/2601	$3.00	$24,999.00	$27,373.91
NASO DNA	1764	$3.00	$5,292.00	$5,794.74
NSA NWA	3665	$3.00	$10,995.00	$12,039.53

- **Estimate #2 (From POM16):**
  - **Contract Vendor Estimate (~10yr baseline):**

BASE	ACREAGE	~COST/ACRE	~2011 TOTAL COST	~2015 or 2016 Cost
NASO/NALFF	5732/2601	$87.00	$724,971.00	$793,843.25
NASO DNA	1764	$ 87.00	$153,468.00	$168,047.46
NSA NWA	3665	$ 87.00	$318,855	$349,146.23

- **Estimate #3 (From POM16):**
  - **NAVFAC MIDLANT Estimate (5yr re-evaluation):**

BASE	ACREAGE	~COST/ACRE	~2011 TOTAL COST	~2015 or 2016 Cost
NASO	5732	$5.00	$28,660.00	$31,383.00
NALFF	2601	$5.00	$13,005.00	$14,511.00
NASO DNA	1764	$ 5.00	$8,820.00	$9,842.00
NSA NWA	3665	$ 5.00	$18,325.00	$20,447.00

  - **NAVFAC MIDLANT Estimate (~10yr baseline):**

BASE	ACREAGE	~COST/ACRE	~2011 TOTAL COST	~2020 Cost
NASO/NALFF	5732	$95.00	$544,540.00	$648,002.60
NASO/NALFF	2601	$95.00	$247,095.00	$294,043.05
NASO DNA	1764	$95.00	$165,000.00	$180,675.00
NSA NWA	3665	$ 95.00	$348,175.00	$381,251.63

POM18 Project Requested Funding: (Non-Annual Recurring Funds Project)…note, FY2016 and FY2017 are provided as place holders in the event that funding

BASE	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022
NASO/NALFF	$30,146.65	$13,925.83	$0.00	$0.00	$0.00	$0.00	$643,785.64	$297,972.12
NASO DNA	$0.00	$9,633.00	$0.00	$0.00	$0.00	$0.00	$0.00	$198,973.67
NSA NWA	$0.00	$20,014.96	$0.00	$0.00	$0.00	$0.00	$0.00	$419,864.59

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 02 July 2015

Project Number: 60191NR201; 32442NR201; 4275ANR201
Project Title: 1 S MA NASO/NALFF - Threatened & Endangered Species Inventory; 1 S MA NASO DNA - Threatened & Endangered Species Inventory; 1 S MA NSA NWA - Threatened & Endangered Species Inventory;
Guidebook & Chapter: 12104
Legal Drivers:
Primary: Endangered Species Act
Secondary: Sikes Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Non-Annual Recurring, FY2019 and FY2022 Split Quarters 1st (85%) & 4th (15%)

Project Location: *(Base)* Naval Air Station Oceana (NASO)/ Naval Auxiliary Landing Field (NALFF); NASO Dam Neck Annex (DNA); and Naval Support Activity Hampton Roads Northwest Annex (NSA NWA)

Project Duration: *(Estimated length of time and Start & End Dates)* 1 year, 6 months… subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys).

Project Description: *(What does this project entail?)* Conduct Presence/Absence Inventory of Federal and State Threatened and Endangered Species, Species At Risk (SAR) and Vegetation Communities of Concern. A complete updated list of known, potential T&E species (under all taxonomic groups), and SAR or watchlist species and vegetation communities will be developed and used to focus inventory surveying efforts. Surveys will be conducted utilizing standard techniques approved by USFWS, State Wildlife Programs, and DoD. Any ground disturbing techniques will have prior coordination with base planning and environmental to ensure no threats to resources, utilities, and surveyor safety.

Surveys will not be conducted for species that are covered by a more frequently conducted surveying effort that has already documented the presence of the species on the installation (e.g., sea turtle nesting surveys). Results from frequently conducted surveying efforts will be summarized and referenced in this report.

Project Purpose: *(Why is this project needed?)* Federal and State T&E/SAR species and community lists are not static. Species statuses change on those lists. Since most T&E inventories are focused towards looking for the specific species of concern listed at the time of the inventory surveys may not have been conducted which would have picked up species listed after the last inventory. Also, species themselves are generally not static: species move as landuse changes occur (human and wildlife competition for limited resources); weather & land conditions change and become favorable for certain species to "re-appear" (species lay dormant until that special trigger/niche is met); other wildlife bring in and establish a population of species of concern (raptors dropping fish into a water source, animals eating plants and dropping seeds, etc.); etc. Surveys are recommended to be conducted every 5 years. During this time frame, substantial land alterations both natural and man-made as well as species behavior/movement and inhabitation can change, all of which warrant an updated inventory.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Not funding this program would put the Navy at risk for being negligent to properly managing for species of concern on their bases. Not funding increases the

potential for violations of various Federal Laws to occur, including but not limited to the Endangered Species Act and the Sikes Act. Not properly managing for species of concern could: open the Navy and the Base to Lawsuits from the public; result in very costly mitigation and permitting requirements; and could stop or at least restrict military mission operations (resulting in loss of required military training and the associated costs with such a situation).

Funding this project could prevent most of the not-funding concerns. Funding this project would identify which species of concern are located on base and allow the Navy to better assess risks to military mission and allow the military to address the concerns accordingly and stop the need for an issuance of a military mission stopping violation. Also, funding a project which looks for both listed and species of concern for listing species will allow the base to manage on property, and develop off property partnerships to increase stability of species populations in an attempt to get species delisted or keep them from becoming listed (A GREAT Benefit to the Military Mission).

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)* NA. Project was last funded in FY2012 for NASO/NALFF and NSA NWA and FY2014 for NASO DNA. Project is Non-Annual Recurring, every 5 years. However, project may be required more frequently if laws change, species are added to the Endangered Species List, or if a catastrophic event causes major change on base or within the ecosystem.

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW)
2	Cooperative Agreement (CA) or Contract & Support Documentation
3	Monthly Project Status Reports
4	Draft Final Report
5	PreFinal Report
6	Final Report (Introduction, Study Area, Methods, Results, Conclusion, Recommendations, Literature Cited/References, Appendices)
7	Draft and Final GIS Data Layers/Geodatabase (In Navy Standard Format, i.e. WGS84)
8	Copies of All Associated Data Collected (Datasheets, sample collection info., photographs, etc.)
9	Maps
10	Expenditure/Financial Reports (SF-269 or SF-271)

Navy Utilization of Deliverables:

Navy staff will work with appropriate grantee staff to develop and obtain approvals of SOW and CA or conduct contract proposal bidding process. Grantee will provide monthly status reports and financial reports, which the Navy will utilize to track project status, and identify & address accordingly potential concerns. The submittal of draft and pre-final reports and GIS data will allow the Navy to ensure that they are receiving a product that meets the approved SOW requirements (a quality assurance check) prior to receiving a project that may or may not meet the needs of the Navy. The final product with the additional support data (GIS geodatabase, photographs, data sheets, etc.) will be utilized to: update the INRMP; update the GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; and to identify potential impacts to the military mission. (Grantee will also notify the Navy immediately if a species of concern is identified providing species name, GPS location, installation name, and photograph, if a camera is available and authorized for use.)

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
    - Estimate was derived from taking the FY2012, FY2013, and FY2014 awarded contract final costs and requested Inhouse fees with the following applied annual inflation rates and rounded up to the nearest dollar: years prior-2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% .
        - 2012-2014 Awarded Project:
            - PM = Emmett Carawan; Thad McDonald
            - Contract Awarded Amounts:
                - NASO/NALFF = $249,273.00
                - NASO DNA = $121,404.00
                - NSA NWA = $203,499.86
            - Inhouse Requested Fees:
                - NASO/NALFF (Carawan) = $10,974.00
                - NASO DNA (Carawan) = Details not provided to INRM.
                - NSA NWA (McDonald) = $5,000.00
            - See Contract Award Documentation and Inhouse Fee Request documentation for details.

"The costs vary widely between Bases due to a number of factors including 1) the number of possible species, 2) the amount of available habitat, and 3) the known diversity of the sites. Our costs are generally lower than most because we can draw on a diverse, experienced staff and we have relatively low overhead. We rarely subcontract work, having a team of botanists, zoologists, and ecologist that regularly conduct inventories for almost all groups of animals and plants." (VNHP)

Project Requested Funding: (Non-Annual Recurring Funds Project)

BASE	FY2018	FY2019	FY2020	FY2021	FY2022
NASO DNA	$0.00	$133,383.54	$0.00	$0.00	$0.00
NSA NWA	$0.00	$0.00	$0.00	$0.00	$250,860.99
NASO/NALFF	$0.00	$0.00	$0.00	$0.00	$313,832.13

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 02 July 2015

Project Number: 32442NR001
Project Title: 1 CR MA NASO DNA Threatened & Endangered Species Survey – Sea Turtle Lighting Assessments
Guidebook & Chapter: 12104
Legal Drivers:
Primary: Endangered Species Act
Secondary: SIKES Act
Tertiary: CZMA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN
Funding Need Date: *(What year & quarter will funding be needed?)* Non-Annual Recurring, FY2018, Split Quarters 1st (85%) & 4th (15%)

Comment [MFW1]: Likely to change to 2 BO. Current BO does not require this assessment; however to complete our BA for our programmatic BO it was required and hinted that this would be a recurring requirement. Frequency of recurring survey effort may also change upon issuing of the final programmatic BO.

Project Location: *(Base)* Naval Air Station Oceana - Dam Neck Annex (NASO DNA)

Project Duration: *(Estimated length of time and Start & End Dates)* Non-Annual Recurring (Recurring every 5 years). 10 months (01 March 2018 – 31 Dec 2018)…subject to change due to project delays (i.e. weather conditions and mission training precluding scheduled surveys).

Project Description: *(What does this project entail?)* Conduct lighting assessments associated with the following Threatened and Endangered species: Sea Turtles. Utilize the most current USFWS and VDGIF issued guidance regarding completing these assessments. See 2015 NASO DNA Sea Turtle Lighting Assessment as a reference/example. Assessments should be completed at a minimum every 5 years.

Between 5 year assessments, offending light sources identified during an assessment should be retrofitted, replaced with a more appropriate lighting source, or other management action (timing and frequency of light use altered) taken to minimize the potential negative impacts from artificial lighting to sea turtles. This action is considered replacement, retrofitting, or modification of equipment associated with the operation and/or maintenance of real property. Given this information per CNIC POM-18 Programming Guidance, lighting remediation would not be funded by the Environmental Program.

During an informal consultation in 2014 with USFWS, VDGIF and the NAVY regarding the installation's Sea Turtle Management Program it was determined that as part of the installation's Biological Assessment a Lighting Survey would be required. It was also indicated that lighting Assessments should be routinely completed to determine if there are artificial light sources that could negatively impact sea turtles and to determine if lighting remediation actions have sufficiently addressed previously identified offending light sources.

Compliant INRMP Dated: 9 June 2015.

Project Purpose: *(Why is this project needed?)* Conduct Lighting Assessments to support conservation of and provide guidance to be implemented on how to avoid negative impacts to nesting and hatching sea turtles protected under the Endangered Species Act. In accordance with the INRMP and USFWS and VDGIF Informal Consultations to minimize negative impacts to this T&E species.

Sea Turtles are confirmed to successfully nest and hatch on NASO DNA. Nesting period is typically from May-August. Hatching period is typically from July-October. Current guidance is that some sea turtles utilize instinct associated with natural lighting (the moon) to determine suitable nesting locations and to orient them to the water after hatching. Artificial lighting sources (non-moon lighting sources) have been shown to disorient sea turtles and lead them away from suitable nesting locations and lead them away from water after hatching resulting in death due to increased predator exposure and dehydration.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Maintains compliance with the Endangered Species Act and helps to prevents potential Notices of Violation and associated penalties, thus allowing those authorized military training and Morale and Welfare activities to continue on the beaches of NASO DNA.

Note, if no action is taken on remediation activities identified during assessment this could result in an NOV and be subject to legal penalties.

Project Delay: *(Project was POM'd for, approved, and funding was not received as scheduled? If so, how many years has project been delayed?)*

Proposed Deliverables:

ITEM:	DESCRIPTION:
1	Statement of Work (SOW).
2	Contract or Cooperative Agreement Award (CA).
3	Meetings, Monthly Updates, etc.
4	Equipment, Materials, and Supplies.
5	Services/Field Work/Assessments
6	Draft and Final Reports
8	Copies of all completed data sheets, photographs, spreadsheets, etc.
9	Draft and Final GIS Data Layers (In Navy Standard Format, i.e. WGS84) /GEODATABASE

Navy Utilization of Deliverables:
Navy staff will work with appropriate grantee staff/contractors to develop and obtain approvals of SOW and CA. Grantee will provide immediate notification of any nests and/or strandings to the NASO Navy Natural Resources Specialist upon observation. Assessment Grantee will document any offending light sources, provide type of light source/lighting structure/fixture, provide recommended retrofit or replacement solution of the offending light source, provide photographic documentation of the offending light source, and provide GPS information on the offending light source. Lighting Remediation Grantee will implement to the maximum extent practicable the recommendations identified during the lighting assessment(s) and coordinate these efforts with the installation Natural Resources Manager. The Navy will utilize this information to: update the INRMP; update the

GeoReadiness Center Files; develop appropriate survey and habitat restoration or protection requirements; report to appropriate regulatory agencies, and to identify potential impacts to the military mission or any other concerns.

Cost Estimations:

- **How was estimate derived?** *(Past Similar Project Costs; Contractor Estimate; Regulatory Agency Estimates; etc.)*
  - Cost estimate number for lighting assessment was based off of 2015 Lighting Assessment project Award and requested Inhouse fees with the following applied annual inflation rates and rounded up to the nearest dollar: years prior-2015 = 1.7%; year 2016 = 1.8%; and years 2017-2022 = 2.0% .
    - 2015 Awarded Project:
      - PM = Jessica Bassi
      - EPR Submitter = Jessica Bassi
      - Original EPR Title = Beachfront Lighting Survey and Biological Assessment for Sea Turtle Nest Management
      - Contract Awarded Amount = $54,001.00
      - Inhouse Requested Fees (Jessica Bassi) = $5,000.00
      - See Contract Award Documentation and Inhouse Fee Request documentation for details.

Project Requested Funding: (Recurring Funds Project within a given POM Cycle)

FY2018	FY2019	FY2020	FY2021	FY2022
0.00	$0.00	$65,014.14	$0.00	$0.00

Note: Recommend prior to each POM cycle obtaining a new cost estimate as the inflation rates and advances in technology change. This change can result in cost fluctuations well above or well below projected cost estimates.

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 30 July 2013

Project Number: 60161NR201; 32442NR201; 4275ANR201
Project Title: 1 S MA NASO/NALFF - Threatened & Endangered Species Inventory; 1 S MA NASO DNA - Threatened & Endangered Species Inventory; 1 S MA NSA NWA - Threatened & Endangered Species Inventory;
Guidebook & Chapter: 12104
Legal Drivers:
Primary: Endangered Species Act
Secondary: Sikes Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO)/ Naval Auxiliary Landing Field (NALFF); NASO Dam Neck Annex; and Naval Support Activity Hampton Roads Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Conduct Presence/Absence Inventory of Federal and State Threatened and Endangered Species. A complete updated list of known and potential T&E species (under all taxonomic groups) will be developed and used to focus inventory surveying efforts. Surveys will be conducted utilizing standard techniques approved by USFWS, State Wildlife Programs, and DoD. Any ground disturbing techniques will have prior coordination with base planning and environmental to ensure no threats to resources, utilities, and surveyor safety.

Project Purpose: *(Why is this project needed?)* Federal and State T&E species lists are not static. Species statuses change on those lists. Since most T&E inventories are focused towards looking for the specific species of concern listed at the time of the inventory surveys may not have been conducted which would have picked up species listed after the last inventory. Also, species themselves are generally not static: species move as landuse changes occur (human and wildlife competition for limited resources); weather & land conditions change and become favorable for certain species to "re-appear" (species lay dormant until that special trigger/niche is met); other wildlife bring in and establish a population of species of concern (raptors dropping fish into a water source, animals eating plants and dropping seeds, etc.); etc. Over a decade of time has passed since the last T&E species inventory. During this time frame, substantial land alterations both natural and man-made have occurred on NASO and NALFF, all of which warrant an updated inventory.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Not funding this program would put the Navy at risk for being negligent to properly managing for species of concern on their bases. Not funding increases the potential for violations of various Federal Laws to occur, including but not limited to the Endangered Species Act and the Sikes Act. Not properly managing for species of concern could: open the Navy and the Base to Lawsuits from the public; result in very costly mitigation and permitting requirements; and could stop or at least restrict military mission operations (resulting in loss of required military training and the associated costs with such a situation).

Funding this project could prevent most of the not-funding concerns. Funding this project would identify which species of concern are located on base and allow the Navy to better assess risks to military mission and allow the military to address the concerns accordingly and stop the need for an issuance of a military mission stopping violation. Also, funding a project which looks for both listed and species of concern for listing species will allow the base to manage on property, and develop off property partnerships to increase stability

of species populations in an attempt to get species delisted or keep them from becoming listed (A GREAT Benefit to the Military Mission).

Cost Estimations:

BASE	FY2012	FY2017	FY2022	FY2027	FY2032	FY2037
NASO/NALFF	$260,274.00	$285,000.03	$312,075.03	$341,722.16	$374,185.77	$409,733.41
NSA NWA	$208,499.86	$228,307.35	$249,996.54	$273,746.22	$299,752.11	$328,228.56
TOTAL:	$468,773.86	$513,307.38	$562,071.57	$615,468.38	$673,937.88	$737,961.97

BASE	FY2014	FY2019	FY2024	FY2029	FY2034	FY2039
NASO DNA	$105,840.00	$120,298.80	$131,727.19	$144,241.27	$157,944.19	$172,948.89
TOTAL:	$105,840.00	$120,298.80	$131,727.19	$144,241.27	$157,944.19	$172,948.89

POM18 Region Requested Support Information for Manpower Justifications:

Heavy

Complex NR/Mission Conflict

- NAS Oceana Bird/Animal Aircraft Strike Hazards
- NALFF Bird/Animal Aircraft Strike Hazards
- NASO Airfield Vegetation Height Obstruction Management
- NALFF Airfield Vegetation Height Obstruction Management
- Nesting Sea Turtle and Marine Animal Stranding Response (Ranges sometimes have to interrupt training to allow for sea turtle or stranding response)
- Zoonotic Disease, Human Health & Safety Concerns
- Venomous & Poisonous Wildlife, Human Health & Safety Concerns
- Coastal Dune Management, Facility Protection, and Military Training Needs
- Pier Management and protected marine species
- Invasive Plant Species Creating Security Hazards

Complex or Multiple Installation/Region or Consolidated INRMP/EA

- NAS Oceana and NALFF are part of a Consolidated INRMP and associated EA
- NASO Dam Neck Annex has a standalone INRMP and associated EA
- There are NOSCs (9) and other Special Areas to which either NASO ICO &/or NASO PWD Oceana have some level of facility oversight that is not included in the aforementioned INRMPs and EAs. The NOSCs are currently undergoing Natural Resources assessments by NAVFAC LANT to determine if significant Natural Resources exist that warrant an INRMP to be developed for that facility. At least 1 of 3 NOSCs that are not Navy Owned property, but leased, is covered under an existing Air Force INRMP and EA. The Navy also leases additional acreage from the Air Force at Dare County Bombing Range in NC, covered under another existing Air Force INRMP and EA.
- Project review for potential natural resources concerns oversight covers properties in multiple states: Virginia, North Carolina, Maryland, New Jersey and Deleware.

Multiple /Complex EPRs/INRMP Projects (>$750,000 a Year Total)

- Currently Maintains 52 EPRs between 2 INRMPs:
    - Annual Recurring Budgeted Costs = ~$975,416.00
    - Non-Annual Recurring Budgeted Costs = ~$6,038,000.00 (Per POM Cycle)

Large/Complex Habitat Management Program with Monitoring

- 1 Large Ecological Reserve Area
- We are reassessing the installation's prescribed fire program to aide with proper habitat management for multiple purposes: forest stand improvement, vegetation height/successional stage goals, species habitat improvements (canebrake rattlesnake, northern long-eared bat,

monarch butterfly, etc.). Prescribed fire program has a monitoring component as does species specific related actions.

- Actively enhancing Oceana Pond and other recreational fishing locations to be native self-sustainable recreational fishing areas.
- Managing over 15 Special Interest Areas on the installation identified during Natural Heritage-T&E Species and Vegetation Communities of Concern Inventories.
- Agricultural Outlease Program has an annual monitoring component.
- Forest Resources Program has both a commercial forest and urban forest management component which both require monitoring; however, this is not implemented on an annual basis as would be the ideal.

Large/Complex Mitigation Sites

- Currently maintain on installation (Associated with a Regulatory Action)
    - Wetland Mitigation Sites = 14+ sites
    - Dune Mitigation Sites = 4 sites
    - Forest = 1 site
- Currently maintained on installation (not associated with a permit driven regulatory action)
    - 3 Atlantic White Cedar Study/Restoration Sites
    - 2 Long-leaf Pine Study/Restoration Sites

Medium /Heavy and Recurring Soil Erosion Control Requirements

- Every 10 years the water resources of the installation are assessed for Erosion Control concerns that could negatively impact Natural Resources. The 2013 plan identified 26 sites recommended for repair. Estimated total cost of repairs = ~$1,167,575.00.
- Agricultural Outlease Program Requires the implementation of multiple Soil Conservation Plans.

100+ Plant & 50+ Wildlife Species Managed

- Flora = 247+
- Fauna = 401+
    - 171+ bird species confirmed of potential 275+
    - 44+ fish species
    - 46+ herp species
    - 40+ mammal species
    - 100+ invertebrate species

Large/Complex Invasive/Nuisance Species Program

- Invasive/Nuisance Flora Species Inventoried
    - Non-native species Actively Being Managed = 4 (Alligator weed, Golden bamboo, kudzu and phragmites)

    - Non-native species Pending Funding for Control = 31
- Invasive/Nuisance Fauna Species Actively Managed (Additional Species Likely pending completion of comprehensive non-native invasive fauna inventory):
    - Non-native species = 3 (Nutria, Feral swine, and Feral cats)
    - Native species = 9+ (coyote, raccoon, deer, beaver, fox, Canada geese, bear, squirrel, opossum, etc.)

5+ Listed Species and/or Critical Habitat

- Federal Listed Species of Concern
    - 10 Endangered/Threatened: Northern long-eared bat, breeding; Piping plover, migrant/potential breeder; Red knot, migrant; Loggerhead sea turtle, breeding; Kemps ridley sea turtle, breending; green sea turtle, potential breeder; loggerhead sea turtle, strandings; hawksbill sea turtle, strandings; Atlantic sturgeon, strandings; Shortnose sturgeon stranding; etc.)
    - 2 Proposed or Candidate for Listing (American eel, and Monarch Butterfly)
- State Listed Only Species of Concern
    - 4 Endangered/Threatened (Southeastern dismal swamp shrew, Rafinesque's big-eared bat, Canebrake rattlesnake, and long beach seedbox)
    - 5 Watchlist Species (Atlantic white-cedar, viviparous spikerush, baldwin's spikerush, mud plantain, and longleaf pine)

100+ Acres of Wetland Areas and Recurring Impacts

- ~3154 Acres of wetlands (Does not cover nearshore environment for which the installation may have influence but does not have ownership)
- Annually there are requests to covert wetlands for military mission requirements (permits and in some cases mitigation required)

Large/Complex Near Shore Management Requirements (10+ Miles of Shoreline)

- NASO DNA = ~4 miles of shoreline to the Atlantic Ocean
- NASO = ~2.3 miles of shoreline to Rudee Inlet/Owls Creek, with direct connection to Atlantic Ocean
- NALFF = ~1.3 miles Forested Submerged Banks of the North Landing River, directly connected to the River, but not immediately adjacent to the open water (unforested).

Large/Complex Forestry and/or Ag. Outlease Programs

- Forestry
    - There is over 3137 acres of potential commercial forest quality forest and over 500 acres of urban forest area. The installation currently does not actively manage forests specific for the purpose of timber sale. Most forest is managed specific to wildlife requirements and left in a more natural state. With this said there is a proposal to

convert over 1,200 acres of the aforementioned commercial forest quality forested area into a more traditional Timber Sale Management regime in order to better meet Airfield Height Obstruction Requirements and to minimize BASH concerns.
    - There have been a number of projects that required timber clearing and timber values to be assessed for monetary contribution to the Forestry Reserve Account over the years.
- Agriculture
    - 1562.2 acres of agricultural land managed via 5 real-estate lease agreements. Each lease has an associated soil conservation plan that must be implemented and monitored.

Established/Complex Outdoor Recreation Opportunities Including Hunting and Fishing

- Yes. (Involves Sikes Act Account, partnership with MWR)
    - Fishing (~500 fishermen)
        - 1 Mile of Saltwater Fishing Area at NASO DNA
        - Several Freshwater Fishing Locations at NASO and NASO DNA
    - Hunting Available at NASO, NASO DNA and NALFF (~500 Hunters, 11 Small Game Hunting Areas, 121 Big Game Hunting Areas)
        - Big Game, furbearer, small game, dove and waterfowl hunting.
        - Installation Hunter Indoctrination training required, and weapons qualifications required.
        - Bow, fire-arm, and trapping authorized.
    - 3 Educational Trails/Platforms over 2 miles total (2 at NASO DNA, 1 at NASO)
    - 2 Miles of Wildlife Viewing Beaches
    - 1 Watchable Wildlife Designated Area (Partnership with Virginia Aquarium and Marine Science Center)

Complex/Involved BASH Requirements

- Yes.
    - 2 Airfields are covered under the INRMP. Very active BASH program with Instruction/Plan. USDA-WS BASH support. Requires permitting, land management, wildlife management, etc.
    - 1 Aerial Bombing Range (Leased Property at DCBR)
    - 1 Drone Target Launch Facility (NASO DNA)
    - Multiple Helicopter Landing Sites are also found at 4 of the larger parcels for which PWD Oceana has oversight (e.g., NASO, NALFF, NASO DNA, and DCBR).

Large/Complex NEPA Support

- INRMP Associated NEPA Documents:
    - 2 INRMP EAs
    - 1 Aerial Spraying Invasive Plant Species EA with Mult Addendums/Supplemental EAs

    - 2 Airfield Obstruction Management Plan EAs (Not an NR driven EA; however encompasses a large amount of NR oversight with Timber Harvests & Mngt, Agriculture, Ditch Maintenance, Wetlands Permitting, Endangered Species, etc.)
    - Multiple CATEXs
- Average Number of non-NR Projects Reviewed for NR/EV concerns/year
    - Environmental Checklists = ~55
    - Site Work Induction Board = ~365
    - Work Permits = ~365
- Average Number of NEPA Documents Processed or Coordinated/year
    - CATEX = ~50
    - EA = >5 (currently coordinating on 8)
    - EIS = <1 (currently coordinating on 2)

Complex/Intense and Recurring Interaction with FWS and State Fish and Game Offices

- Yes, throughout the year. Annual INRMP Metrics, various partnership meetings, ecosystem management meetings, LCC meetings, feral animal meetings, conducting survey efforts, obtaining permits, general information sharing, training opportunities, NMFWA meetings, DoD PIF meetings, Bird Strike Committee Meetings, etc. (USFWS Region 5; VDGIF; USDA-WS; VDEQ; VDOF; City of Chesapeake; City of Virginia Beach; USACE; Back Bay NWR; Great Dismal Swamp NWR; Alligator River NWR; VAST; NOAA-NMFS; etc.)
    - INRMP Operation & Effect Signature Coordination
    - Maintain a USFWS Migratory Bird Depredation Permit for Multiple Properties
    - Maintain a USFWS Eagle Harassment Permit
    - Maintain a VDGIF Kill Permit
    - Maintain Recreational Hunting Program Deer Population Control Programs via VDGIF approved extended hunting seasons and additional deer harvest tags/limits (beyond State established seasons and limits).
    - Maintain a NOAA-NMFS Sturgeon Collection Permit
    - Preparing Sea Turtle Management USFWS/VDGIF Permit Package
    - Wetland Permitting & Mitigation Consultations
    - Coordinating Sea Turtle Management BA/BO
    - NLEB Consultations & Training Opportunities
    - Osprey Nest Removal Consultations
    - Prescribed Fire Planning
    - Urban Forestry Planning
    - USFWS Consultation Process Training
    - VDGIF State Listed Species Joint Survey Efforts
    - USFWS, VDGIF and Navy Conservation Law-Enforcement Coordination
    - Etc.

POM 16 Project Justification and Cost Estimates

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 30 July 2013

Project Number: 60161NR202; 32442NR202; 4275ANR202
Project Title: CWA MA NASO/NALFF - Wetland Mapping Inventory; CWA MA NASO DNA - Wetland Mapping Inventory; CWA MA NSA NWA - Wetland Mapping Inventory
Guidebook & Chapter: 12105
Legal Drivers:
Primary: Clean Water Act
Secondary: Coastal Zone Management Act
Tertiary: EO 11990
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO) & Naval Auxiliary Landing Field (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); and Naval Support Activity Norfolk - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Conduct the "5 year" baseline wetland inventory re-evaluation (finalized re-evaluation due 6 months prior to every 5 year baseline or re-evaluation completion date) and new "10 year" baseline wetland delineations. Re-evaluation includes verification of previous inventory boundaries and updating the boundaries as necessary to reflect changes in the wetland property boundaries. Baseline wetland delineations reassess the existing boundaries, identify new wetland areas, and remove new upland areas from within the boundaries of previously delineated wetland areas. Surveyors must map all parcels utilizing updated USACE standard wetland mapping protocols. The people who conduct these surveys should have experience in conducting wetland delineations in Southeastern VA and Northeastern NC as this area is notoriously difficult to survey accurately for wetlands, even for trained professionals conducting wetland delineations in other regions of the US. Any ground disturbing techniques will have prior coordination with base planning and environmental to ensure no threats to resources, utilities, and surveyor safety.

Note: If 5 year re-evaluations are not completed 6 months prior to existing wetland delineation's 5 year USACE expiration date, then a new baseline inventory/wetland delineation may be required, which will substantially increase the costs associated with that 5 year wetland delineation re-evaluation.

Only areas on bases that are not scheduled to be mapped under the baseline wetland mapping efforts, and thus not subject to 5 /10 year re-evaluations, are those properties that fall within agricultural leases. If the property is to be removed from agricultural production the property will then be evaluated for wetlands. Note: Main Base stormwater ditches that run through agricultural fields will be or have been assessed for inclusion in baseline wetlands inventories (shallow agricultural ditches have not been assessed).

Project Purpose: *(Why is this project needed?)* Substantial land alterations both natural and man-made can occur in a 5 and 10 year time spans. These alterations impact land classifications from wetland to upland and vice versa within this 5 year period. The changing classification potential warrants an updated mapping effort. USACE guidance and permitting requirements indicate that wetland inventories should be re-evaluated every 5 years for accuracy and adjusted accordingly.

Updating the data layers will provide the base staff with better information for reporting, protecting, and species of concern modeling purposes. This updated information should also help base staff, Navy HQ staff, DoD staff, etc. to make more informed property management decisions.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this program would allow the base to better plan projects and mission training assignments. Besides construction threats to wetlands and water quality there are also temporary training exercises which threaten the integrity of wetland habitats. Impacts to these habitats could result in Notices of Violation and costly regulatory mitigation requirements.

Providing a better map of known wetland areas will allow planners: to attempt to avoid wetland impacts; to plan for funding and conducting jurisdictional determinations; to plan for funding and processing required permits; to plan for and fund mitigation requirements; and to plan for and fund NEPA documentation and surveying requirements. Being able to better plan around potential wetland concerns will save time and money because there will be fewer unplanned delays and interruptions to contract awarded projects and military training exercises.

Cost Estimations:

BASE	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020
NASO	$31,383.00	$0.00	$0.00	$0.00	$0.00	$648,002.60
NALFF	$0.00	$14,511.00	$0.00	$0.00	$0.00	$0.00
NASO DNA	$0.00	$9,842.00	$0.00	$0.00	$0.00	$0.00
NSA NWA	$0.00	$20,447.00	$0.00	$0.00	$0.00	$0.00
TOTAL:	$31,383.00	$44,800.00	$0.00	$0.00	$0.00	$648,002.60

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 30 July 2013

Project Number: 60161NR203; 32442NR203; 475ANR209
Project Title: CWA MA NASO/NALFF - Mitigation Site Monitoring; CWA MA NASO DNA - Mitigation Site Monitoring; CWA MA NSA NWA - Mitigation Site Monitoring

Guidebook & Chapter: 12105
Legal Drivers:
Primary: Clean Water Act
Secondary: Coastal Zone Management Act
Tertiary: EO 11990
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field (NALFF); NASO Dam Neck Annex (DNA); and Naval Support Activity Hampton Roads Northwest Annex (NSA NWA).

Project Description: *(What does this project entail?)* Conduct wetland mitigation site and project site wetland monitoring in accordance with issued legally mandated permit requirements. Surveys include but are not limited to: flora and fauna density, diversity and abundance assessments; hydrology assessments; etc. Any ground disturbing techniques will have prior coordination with base planning and environmental to ensure no threats to resources, utilities, and surveyor safety.

Project Purpose: *(Why is this project needed?)*
There have been several areas on base that have resulted in mitigation monitoring requirements due to Notices of Violations (NOVs) and new Construction permit requirements. The permits associated with the NOVs and Construction required wetland mitigation projects to be established.

There are several mitigation sites on NASO and NALFF; however currently, there is only 1 outstanding project (Aeropines), funded by the Navy, which has not completed the monitoring requirements established under its permit. Required to evaluate hydrology and vegetation at 1- (2006), 2- (2007), 3- (2008), 5- (2010), 7-(2012), and 10- (2015) years. Aeropines is slated to meet its permitted requirements in FY 2016.

There is one additional project (Wherry Housing) which has met its monitoring requirement, but has not yet received concurrence of completion by the state regulatory office.

There are several wetland mitigation sites at NASO DNA. We have not yet received a letter of concurrence by the state or USACE regulatory offices indicating that the Lovett's Marsh Mitigation site has met its mitigation requirements; however monitoring of the site has been completed is accordance with permit requirements.

There are several mitigation sites on NSA NWA. One site, MOUS-P-131, has not received a letter of concurrence that the site has met the mitigation criteria. Quarterly photos of the site are taken and reporting continues until notice of compliance is received.

Annually, each installation has projects that require wetland site monitoring, remarking of wetland boundaries, and many time coordination with regulatory agencies regarding permits and mitigation requirements. The wetlands media manager at NAVFAC MIDLANT CORE who handles wetland permitting and mitigation is reimbursable and requires funding annually for these services.

Additional funding may be requested in future POM cycles as additional mitigation site monitoring becomes required. The Navy will first pursue obtaining mitigation banking credits or creating wetland off base in lieu of further restricting training property by constructing new wetlands on base. In some cases this is not possible and mitigation will be required on base. It is anticipated that there may be some wetland mitigation monitoring requirements established due to implementing the Clear Zone Management Plan (CZMP). The CZMP is in draft form and has an EA in development. Wetland impacts and mitigation requirements have not yet been finalized.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Not funding this exhibit may result in the issuance of another Notice of Violation and additional mitigation requirements may be issued. Additional funds may have to be redirected from some other mission requirement to fund this project. Additionally, additional land may have to be encumbered and removed from being utilized for military training.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$2000.00	$2,038.00	$2,076.72	$2,116.18	$2,156.39
NASO DNA	$2000.00	$2,038.00	$2,076.72	$2,116.18	$2,156.39
NSA NWA	$2000.00	$2,038.00	$2,076.72	$2,116.18	$2,156.39
TOTAL:	$6000.00	$6,114.00	$6,230.16	$6,348.54	$6,469.17

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 30 July 2013

Project Number: 60161NR204
Project Title: MBTA MA NASO/NALFF - Migratory & Breeding Bird Surveys
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Migratory Bird Treaty Act
Secondary: Bald and Golden Eagle Protection Act
Tertiary: Sikes Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); and Naval Auxiliary Landing Field (NALFF)

Project Description: *(What does this project entail?)* Conduct migratory and breeding bird surveys to establish bird population, activity (Feeding, Breeding, Stop-over, Flight Pattern, etc.), frequency and habitat utilization data.

Conduct seasonal (Winter, Spring, Summer, and Fall) bird surveys to determine use by migrating, breeding, and wintering birds in each habitat type (open grasslands, upland hardwood forest, pine forest, bottomland hardwood forest, etc.) and the airfield clear zones at NASO and NALFF. Migratory and breeding bird surveys should be repeated in 5 year intervals to show bird utilization trends and impacts to bird populations from military land use for those areas inside and outside of the airfield clearzone. Project should consist of day and night time surveys. In addition to traditional surveys data collection (population size estimates, species ID, habitat location, etc.) should included assessment of flight patterns (types of flocking/migrating species, numbers in flocks, flight directions, etc.).

The airfield clearzone areas should be surveyed annually and should also include a comprehensive night time component for bird utilization data of the airfield clearzone areas. This data will be used to analyze Bird Aircraft Strike Hazard (BASH) concerns, to determine what habitat management techniques should be implemented to reduce those concerns. Currently these annual surveys are being conducted under the AIROPS USDA BASH support agreement. Survey routes, techniques, etc. are coordinated with the installation Natural Resources Manager (NRM) and all data is provided quarterly or upon request to the installation NRM. If this were to be removed from the AIROPS USDA Agreement, then this project would be an annually recurring project with an increased estimated budget of $20k+ annually.

Project may identify additional survey need requirements particularly if species with additional warranted protection requirements are identified (including: Federally Listed Species under various acts; and non-Federal T&E listed species that are federally and State recognized Species of Concern, which pose a mission threat or are in danger of potentially becoming a candidate for listing under the Endangered Species Act). If these needs are identified, then additional Projects will be requested at that time.

Project Survey Methodologies will be developed in coordination with the Installation Natural Resources Manager, DoD Coordinated Bird Monitoring Program, and INRMP signatory partners (USFWS and appropriate VA State Wildlife Agency).

Project Purpose: *(Why is this project needed?)* Currently, these bases do not have sufficient biological information to determine if they are negatively impacting bird species of concern. This lack of information puts the Navy at risk for violating several federal and state laws. In addition to federally mandated requirements, Navy and State Policies and Plans dictate that we should have a working knowledge of our impacts to wildlife. This EPR exhibit works to get the Navy in compliance with these requirements.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Surveys of bird utilization on the bases are necessary to understand how mission requirements will affect bird species of concern. MBTA, ESA, and BAGEPA listed species all utilize these bases and have the potential to have negative impacts on the mission. Not knowing the potential impacts to the species by military mission projects and training could cause a violation of anyone of these federal laws and result in a NOV, which would be costly and put additional restrictions on military training property. Knowing in advance what potential concerns there are would allow the command to plan around avoiding potential impacts and to plan for permitting and mitigation requirements, which may be needed to meet military training requirements.

Although BASH is a primary mission concern at NASO and NALFF, comprehensive bird surveys or bird utilization studies have not been conducted. Understanding usage and annual migration patterns in the various habitat types, including the airfield clear zones, is a vital step to reducing BASH hazard on the stations. Data to quantify and qualify potential take are required for obtaining and maintaining a bird depredation permit for clear zone management (BASH reduction efforts). Permits are managed through the Natural Resources program.

This is not just a Natural Resources wildlife concern this is a Safety Concern.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$0.00	$99,505.00	$0.00	$0.00	$0.00
TOTAL:	$0.00	$99,505.00	$0.00	$0.00	$0.00

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 30 July 2013

Project Numbers: 60161NR205; 32442NR205; 4275ANR205
Project Title: 4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection; 4 SAR MA NASO DNA - Species and Habitat of Concern Protection; 4 SAR MA NSA NWA - Species and Habitat of Concern Protection
Guidebook & Chapter: 12104
Legal Drivers:
Primary: Endangered Species Act
Secondary: Clean Water Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Norfolk - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Implement various habitat enhancement and restoration projects in support of Species of Concern and Habitats of Concern in accordance with resources management plans. Obtain appropriate surveys and assessments and monitoring of project areas. (see cost estimate section for the exact projects).

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Projects allows the base to maintain compliance with the: Endangered Species Act; Migratory Bird Treaty Act; Sustainable Fisheries Act Amendment to the Magnuson-Stevens Fishery Conservation and Management Act in 1996; the Chesapeake Bay Preservation Act; the Clean Water Act; Essential Fish Habitat protection; OPNAVINST 5090.1C; base INRMPs; Sikes Act; and numerous other plans including but not limited to the: Southern Watershed Area Management Plan (SWAMP); Lynnhaven River Watershed Restoration Plan (sub of Chesapeake); and Back Bay Watershed Restoration Plan (sub of southern).

The waterways of NASO, NALFF, NASO DNA, and NSA NWA connect to several watersheds which all have the potential to influence Essential Fish Habitat (EFH) within the Atlantic Ocean, and Chesapeake Bay.

These projects support wetland enhancement & protection, T&E species & habitat protection, soil and water protection, and recreational opportunity enhancement and protection.

Maintaining compliance with Federal and State Laws, Regs, and Conservation Goals, helps to ensure that DoD Lands will not be further restricted from military utilization, and helps to ease permitting requirements when new military actions are proposed.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$23,072.12	$23,510.49	$23,957.19	$24,412.38	$24,876.21
NASO DNA	$19,329.36	$19,696.62	$20,070.85	$20,452.20	$20,840.79
NSA NWA	$14,185.98	$14,455.52	$14,730.17	$15,010.05	$15,295.24
TOTAL:	$56,587.46	$57,662.62	$58,758.21	$59,874.62	$61,012.24

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 30 July 2013

Project Numbers: 60161NR206; 32442NR206; 4275ANR206
Project Title: SIKES MA NASO/NALFF - Forest Management; SIKES MA NASO DNA - Forest Management; SIKES MA NSA NWA - Forest Management
Guidebook & Chapter: 12108
Legal Drivers:
Primary: Forest and Rangeland Renewable Resources Planning Act
Secondary: Soil & Water Conservation Act
Tertiary: Sikes Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Norfolk - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Conduct an inventory and assessment of urban, natural, and timber harvest forest conditions every 5 years or sooner as deemed necessary due to major land or mission changes. Conduct annual inspections and assessments of forest habitats to identify potential disease and insect outbreaks, and storm damage concerns. Utilize the inventories and assessments and inspections as guides to: establish and conduct routine pre-commercial thinning and maintenance; provide guidance to appropriate commands for hazard tree removal; and implement arboricultural treatments as recommended and appropriate.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Proper management of forest resources aides the military mission in multiple ways, to include but not limited to: creating realistic conditions for in field military training; creating noise buffers around ranges; creating visual and access buffers around sensitive training facilities; reducing/removing height obstructions associated with various mission requirements; reducing the potential for species of concern to become listed under the Endangered Species Act; etc.

Existing forest inventories are over 10 years old and there have been substantial changes to the land/forests since that survey. Land changes include: timber harvests; building construction; severe weather conditions (drought, lightening fires, ice storms, hurricanes, tornadoes, etc.); disease outbreaks; etc. Stand condition analyses are needed to determine hazardous conditions, commercial value, and value to species of concern.

SIKES ACT, 10 USC 2665, DoDINST 7310.5 AND OPNAVINST 5090.1C requires that Naval bases manage appropriate forested areas for multiple use and optimum sustainable yield of forest products consistent with other Natural Resources programs. Forest stand improvement methods are required at NASO, NALFF, NASO DNA, and NSA NWA to maintain existing forested stands. If project is not funded the bases will be out of compliance with one or more of the following: DoD and Navy policies, the 1990 Forest Suppression Memorandum of Agreement between Dept. of Agriculture and DoD, the Chesapeake Bay 2000 Agreement, the Clean Water Act phase II program, the Sikes Act, the Soil and Water Conservation Act, the Forest Resource Conservation and Shortage Relief Act, and/or the Forest and Rangeland Renewable Resources Planning Act of 1974 (or RPA).
.

Preservation of existing urban resources and proper management of commercial forest stands is important to meeting the nutrient reduction and non-point source pollution control objectives of the Chesapeake Bay Agreement, the Clean

Water Act and other Federal and State plans, and policies. Proper management also promotes thermal protection of waterways, and benefits to morale and welfare.

Trees are natural energy efficiency promoters/increasers. Trees provide shading/cooling and insulating benefits to structures and people working outside. Properly managing trees and landscaping in the Urban areas of the bases additionally supports the Navy's Policy and Goals towards energy efficiency and the 26 Apr 1994 Presidential Memorandum regarding "environmentally economically beneficial practices on Federal landscaped grounds," which also requires use of native plants for federally landscaped grounds.

Additionally, protection of urban forest environments is a continuing requirement that is exacerbated by hurricanes and coastal storms. Urban forest management involves the removal and trimming of trees that pose safety threats, and property damage. An update of the Urban forest hazard trees will allow the base to address these threats to human safety and property assets.

Proper commercial forest management is: beneficial to a variety of species by providing various phases of vegetation succession; and improves the value of the timber, thus making them commercially more profitable. Timber harvesting activities promote these changes in succession, which mimics natural events that caused succession changes. Wildfires are an example of these natural events, which would clear areas of vegetation and create open areas. A variety of species require these conditions to survive, including species of concern (i.e., Endangered Species Act and Migratory Bird Treaty Act listed species). On many Military base, due to threat to human health, safety, equipment, and training, wildfires are typically suppressed and not allowed to create open areas. Urban development around and training missions on NASO, NALFF, NASO DNA, and NSA NWA require such suppression. Conducting timber harvests allows these bases to provide this habitat conversion in support of species of concern initiatives.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	
NASO & NALFF	$45,099.92	$45,956.82	$46,830.00	$104,375.48	$48,609.54
NASO DNA	$13,405.96	$13,660.68	$13,920.23	$31,026.60	$14,449.20
NSA NWA	$24,394.86	$24,858.36	$25,330.67	$56,457.55	$26,293.24
TOTAL:	$82,900.75	$84,475.86	$86,080.90	$191,859.63	$89,351.97

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 30 July 2013

Project Numbers: 60161NR209; 32442NR209; 4275ANR209
Project Title: CWA MA NASO/NALFF - Soil & Water Conservation - Erosion Control; CWA MA NASO DNA - Soil & Water Conservation - Erosion Control; CWA MA NSA NWA - Soil & Water Conservation - Erosion Control
Guidebook & Chapter: 12107
Legal Drivers:
Primary: Clean Water Act
Secondary: EO Wetlands Protection
Tertiary: Soil & Water Conservation Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); NASO Dam Neck Annex (NASO DNA); NSA Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Conduct base wide erosion and sediment control assessment every 5 years as deemed necessary due to major land or mission changes. Identify areas in need of repair due to erosion. Identify causes for the erosion. Stop and repair the erosion problems.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Projects allows the base to maintain compliance with the: Clean Water Act, the Chesapeake Bay Preservation Act; Essential Fish Habitat protection; OPNAVINST 5090.1C; base INRMPs; Sikes Act; and numerous other plans and policies.

Erosion can lead to Notices of Violation associated with water quality testing. Erosion can damage wetland habitats, essential fish habitats, and other species of concern habitats. Erosion can create ideal habitat suitable for invasive species to grow. Erosion can also cause security and safety concerns. All of these concerns pose negative impacts to military training, which could lead to loss of land on which the military can train.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO & NALFF	$412,422.00	$70,074.00	$292,439.00	$129,475.00	$83,842.00
NASO DNA	$9,736.00	$14,651.00	$7,665.00	$7,798.00	$0.00
NSA NWA	$96,187.00	$30,913.00	$36,860.00	$10,360.00	$8,007.00
TOTAL:	$518,345.00	$115,638.00	$336,964.00	$147,633.00	$91,849.00

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR211; 32442NR211; 4275ANR211
Project Title: CHS MA NASO/NALFF - Landcover Mapping; CHS MA NASO DNA - Landcover Mapping; CHS MA NSA NWA - Landcover Mapping

Guidebook & Chapter: 12101
Legal Drivers:
Primary: Sikes Act
Secondary: Migratory Bird Treaty Act
Tertiary: EO_ (Invasive Species or Pest Control)
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Norfolk - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Acquire updated high resolution satellite imagery in an effort to produce a raster landcover layer of vegetative community types; analyze imagery; conduct ground-truthing surveys; and provide maps, data, and final report.

Project Purpose: *(Why is this project needed?)* Vegetation community layers are needed to identify specific community types on base which may be important to species of concern and thus warrant protection and possibly enhancement. Landcover vegetation community level layers should be updated at least every 5 years to identify changes in communities and to capture landcover changes due to military training and development and other ecosystem changes due to environmental factors such as disease outbreaks, storm damage, etc .

Utilizing GIS and satellite imagery to create landcover layers are time and funding efficient. These layers allow biologists to obtain a better understanding of their base's resources, by providing a view/analysis of areas of the base that are not easily accessible on foot. The other option to mapping these communities is to conduct a 100% on the ground physical mapping of the entire base, which requires a 10 fold field work effort and still some GIS data processing in the office.

Data created from this project will help the installation answer annual INRMP metrics questions related to ecosystems as well as maintaining INRMPs sufficient enough to obtain concurrence from regulatory partners during reviews for Operation and Effect.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project promotes protection of wildlife species and vegetation communities of concern. There is a number of Federal and State listed species of concern that either live or seasonally visit bases in the Hampton Roads Area. As such this project allows the Navy to maintain compliance with various Federal and State laws, regulations, policies, and conservation agreements (ESA, MBTA, MMPA, NMFA, Invasive and Pest Control, Sikes Act, INRMP, 5090.1C, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

Funding this project not only helps to keep the base from receiving NOVs related to species of concern, it also provides a better understanding of the layout of the base, which can prove beneficial for military planners designing field training requirements and for development and placement of potential construction sites.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$0.00	$191,698.00	$0.00	$0.00	$0.00
NASO DNA	$0.00	$88,827.00	$0.00	$0.00	$0.00
NSA NWA	$0.00	$108,842.00	$0.00	$0.00	$0.00
TOTAL:	$0.00	**$389,367.00**	$0.00	$0.00	$0.00

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR213; 4275ANR213
Project Title: CWA MA NASO/NALFF – Agricultural Monitoring; CWA MA NSA NWA – Agricultural Monitoring
Guidebook & Chapter: 12107
Legal Drivers:
Primary: Clean Water Act
Secondary: Soil & Water Conservation Act
Tertiary: Sikes Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Support Activity Norfolk - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)*
Conduct assessment of ditches, soil quality, water quality, erosion & sedimentation, etc. and determine if these fields meet the requirements to be classified as Prime & Unique. Develop a primary agricultural ditch/run-off management protocol including needed ditch clearing, ditch planting, ditch buffering requirements, and/or sediment control structure construction. Assessments should be conducted prior to ditch alterations (plan would establish ditch alteration requirements), during ditch alteration events (would monitor water quality and success of erosion control structures), and post ditch alteration events (would monitor water quality and sedimentation rates post ditch work and would establish a success rate of implementing the project).

Monitor run-off to assess impacts (success rate) of implementing the recommended ditch restoration and buffering plan.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)*
Sikes Act, CWA, CZMA, EO 11990 (Protection of Wetlands), 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1C, Chesapeake Bay Preservation Act and Federal Agreement, regional effort - Southern & Dismal Swamp watershed protection plans (SWAMP).

The Agricultural (Ag) lease program is one of very few profit generating program areas which brings in funding specifically for environmental program usage. The Ag lease program also saves the military hundreds of thousands of dollars annually in land maintenance costs (i.e., reducing mowing contract requirements). In the long run it is more cost efficient to the Navy to make sure that the ag leases are functioning properly and regulatory requirements are being met. Portions of the NASO AG program falls within the Chesapeake Bay Watershed and has the potential to negatively impact the restoration of the bay if proper land management is not implemented. The remaining portion of NASO and all of NALFF's and NSA NWA's ag fields fall within the Southern Watershed Protection Plan Area and these fields have the potential to negatively impact these watersheds as well.

Annually the big problem with the ag program is that they are not properly maintaining the 3 foot buffers from the top of the bank as dictated in the Soil and Water Conservation portion of the lease agreements. The only enforcement action we have is to deny contract renewal because there is nothing specified as an actual penalty in the lease agreement. Also due to current economic constraints, and decline in farming interest it is estimated that we may lose the ag lease program all together. Because of the decreasing interest in farmers bidding on properties in this region it makes it hard to deny the few farmers that bid the right to farm the land.

In an effort to prevent farmers from breaking the ditch buffer regulation the base NR specialist has recommended that ditches be brought up to "code" (clean the ditches, properly vegetate the ditches, and ditch buffers and installation of

run-off and sediment control structures to minimize buffer requirements and maximize farmable land). Once this recommendation is accomplished then the farmers will have no excuses for not properly implementing the requirements of the Soil and Water conservation agreement.

In order to assess the success of implementing such an action pre (which would include ditch buffering/restoration plan of action), during (assessments during ditch upgrade), and post ditch and buffering upgrade and run-off control structure assessments should be conducted.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/ NALFF	$98,789.96	$4,441.61	$4,526.00	$4,612.00	$4,699.63
NSA NWA	$48,608.85	$2,220.81	$2,263.01	$2,306.00	$2,349.82
TOTAL:	$147,398.81	$6,662.42	$6,789.01	$6,918.00	$7,049.44

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR214; 4275ANR214
Project Title: CWA MA NASO/NALFF – Agricultural Run-off Control Structures; CWA MA NSA NWA – Agricultural Run-off Control Structures
Guidebook & Chapter: 12107
Legal Drivers:
Primary: Clean Water Act
Secondary: Soil & Water Conservation Act
Tertiary: Sikes Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Support Activity Norfolk - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)*
Construct sediment and run-off control structures test sites recommended in the Agricultural Assessment and Management Plan. Sediment and run-off control structures should only hold water up to 48 hours in order to avoid and minimize potential Bird Aircraft Strike Hazards. 3 test sites are to be installed (1 at NASO; 1 at NALFF; and 1 at NSA NWA) in the main agricultural run-off/stormwater ditch of the most highly impaired agricultural field.

Assessments and monitoring should be conducted prior to ditch/agricultural alterations (plan would establish ditch alteration requirements), during ditch alteration events (would monitor water quality and success of erosion control structures), and post ditch alteration events (would monitor water quality and sedimentation rates post ditch work and would establish a success rate of implementing the project). Assessments/monitoring are covered under a separate EPR (...NR213).

Results from assessments/monitoring will be analyzed to determine the cost benefits to installing control structures for each of the agricultural field main run-off/stormwater ditches.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)*
Sikes Act, CWA, CZMA, EO 11990 (Protection of Wetlands), 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1C, Chesapeake Bay Preservation Act and Federal Agreement, regional effort - Southern & Dismal Swamp watershed protection plans (SWAMP).

The Agricultural (Ag) lease program is one of very few profit generating program areas which brings in funding specifically for environmental program usage. The Ag lease program also saves the military hundreds of thousands of dollars annually in land maintenance costs (i.e., reducing mowing contract requirements). In the long run it is more cost efficient to the Navy to make sure that the ag leases are functioning properly and regulatory requirements are being met. Portions of the NASO AG program falls within the Chesapeake Bay Watershed and has the potential to negatively impact the restoration of the bay if proper land management is not implemented. The remaining portion of NASO and all of NALFF's and NSA NWA's ag fields fall within the Southern Watershed Protection Plan Area and these fields have the potential to negatively impact these watersheds as well.

Annually the big problem with the ag program is that they are not properly maintaining the 3 foot buffers from the top of the bank as dictated in the Soil and Water Conservation portion of the lease agreements. The only enforcement action we have is to deny contract renewal because there is nothing specified as an actual penalty in the lease agreement. Also due to current economic constraints, and decline in farming interest it is estimated that we may lose

the ag lease program all together. Because of the decreasing interest in farmers bidding on properties in this region it makes it hard to deny the few farmers that bid the right to farm the land.

In an effort to prevent farmers from breaking the ditch buffer regulation the base NR specialist has recommended that ditches be brought up to "code" (clean the ditches, properly vegetate the ditches, and ditch buffers and installation of run-off and sediment control structures to minimize buffer requirements and maximize farmable land). Once this recommendation is accomplished then the farmers will have no excuses for not properly implementing the requirements of the Soil and Water conservation agreement.

In order to assess the success of implementing such an action pre (which would include ditch buffering/restoration plan of action), during (assessments during ditch upgrade), and post ditch and buffering upgrade and run-off control structure assessments should be conducted.

Structure installation should provide positive results to the Navy's overall stormwater monitoring and CWA permit reporting requirements and may allow for additional training opportunities to come on board in the future, or lift some restrictions that the bases currently have due to testing levels. Water quality should be increased, providing benefits on base and off (including the Chesapeake Bay and Southern Watersheds), thus meeting one of the Navy's Ecosystem Conservation Goals.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/ NALFF	$0.00	$230,520.00	$0.00	$0.00	$0.00
NSA NWA	$0.00	$115,260.00	$0.00	$0.00	$0.00
TOTAL:	$0.00	$345,780.00	$0.00	$0.00	

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR216; 32442NR216; 4275ANR216
Project Title: EO 13751 MA NASO/NALFF - Habitat Management - Prescribed Fire; EO 13751 MA NASO DNA - Habitat Management - Prescribed Fire; EO 13751 MA NSA NWA - Habitat Management - Prescribed Fire

Guidebook & Chapter: 12101
Legal Drivers:
Primary: EO 13751 Invasive Species
Secondary: Migratory Bird Treaty Act
Tertiary: Endangered Species Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Create and implement a cooperative agreement with appropriate agencies to supply Prescribed Burning and Wildfire Control for NASO, NALFF, NASO DNA, and NSA NWA.

Project Purpose: *(Why is this project needed?)* Current Navy staffing and training levels in the NAVFAC MIDLANT Hampton Roads area are inadequate to SAFELY accomplish desired prescribed burning and wildfire control. Prescribed burning is utilized for habitat management/restoration and invasive species control. This management and control technique is designed to address species of concern needs and requirements. NASO, NALFF, NASO DNA, and NSA NWA all have annual Prescribed Burning and Smoke Management Plans prepared by the base Natural Resources Specialist and approved by the base Commanding Officer to address species and habitat management objectives identified in the INRMP. In recent years 0% of the desired and planned burn areas have been treated due to weather conditions and inadequate staffing levels.

Existing prescribed burning plans need to be re-assessed for current validity and updated accordingly to meet current habitat management goals and objectives.

Project would adequately staff the Prescribed Fire program to complete prescribed burning and wildfire control goals and objectives and provide support complete field work for assessing and updating the base Prescribed Burning and Smoke Management Plans.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with Federal and State laws, regs., and policies and reduces the potential for incurring Notices of Violations (NOV). Improper management of known threats to species of concern, such as habitat degradation, can lead to potential NOV situations.

The prescribed burning program provides multiple benefits to species, the ecosystem and the military. In addition to the aforementioned species of concern benefits, prescribed burning: is considered to be more ecologically friendly particularly for nutrient recycling and plant regeneration; supports the reduction of Bird-Animal Aircraft Strike Hazards (BASH) concerns by altering vegetation structure to reduce site desirability for species that would or have posed BASH threats; reduces height obstructions associated with various military equipment requirements (i.e., Antenna arrays, Flight Ops, etc.); and reduces the risk of facilities being overrun by uncontrollable "wildfires."

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$70,774.65	$72,119.36	$73,489.63	$74,885.93	$76,308.77
NASO DNA	$35,386.81	$36,059.16	$36,744.29	$37,442.43	$38,153.83
NSA NWA	$35,386.81	$36,059.16	$36,744.29	$37,442.43	$38,153.83
TOTAL:	$141,548.27	$144,237.69	$146,978.20	$149,770.79	$152,616.44

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR218; 32442NR218; 4275ANR218
Project Title: EO 13751 MA NASO/NALFF - Invasive Species; EO 13751 MA NASO DNA - Invasive Species; EO 13751 MA NSA NWA - Invasive Species
Guidebook & Chapter: 12106
Legal Drivers:
Primary: EO 13751 Invasive Species
Secondary: National Invasive Species Act **Tertiary:** Soil and Water Conservation
ERL: 4 Act
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Develop an invasive species assessment and management plan (to be updated every 5 years); remove/control invasive species (as plan recommends upon approval), and conduct pre, during and post invasive species control monitoring (annually).

Assessment plans at a minimum will include: surveying for invasive species; providing a prioritized list of invasive species on base for removal; developing population estimates; mapping extent of species on base; providing management techniques and plan for the control/removal of the invasive species from the base; production of GIS layers associated with species distribution and management.

Annual Monitoring will be an assessment of implemented control techniques. This may include water quality testing; vegetation sampling or surveying; mapping of control area application boundaries prior to treatment; mapping of control area after treatment; etc.

Existing control treatments via herbicide and prescribed burning have already obtained environmental approval via a 2006 Environmental Assessment for the control of Phragmites and Kudzu. Currently, herbicide treatment for these species is the only control treatment option associated with this EPR. Prescribed burning is covered under a different EPR. Additional control treatments for other invasive species may be added at later dates upon the results of the comprehensive baseline assessment and monitoring plans.

Project Purpose: *(Why is this project needed?)*
To obtain compliance with and contribute to the goals of the: National Invasive Species Act, EO 13751 Invasive Species, Soil and Water Conservation Act, Clean Water Act, 5090.1C, Integrated Natural Resources Management Plan, Integrated Pest Management Plan, Endangered Species Act, Migratory Bird Treaty Act, Essential Fish Habitat, etc.

Neither NR Staffing Levels nor training/certifications are adequate to handle the severity of the invasive species problem on these 4 bases. NASO, NALFF, NASO DNA, and NSA NWA all have known invasive species issues that are or could potentially kill species of concern, damage habitats of concern, damage ditch and stream banks (promoting erosion and sediment control problems), and threaten base and military mission security. This project is needed to maintain compliance with a variety of Federal, State, and Navy laws, regulations, and policies.

Between the 4 bases 23 invasive plant species have been identified to occur on base. 7 known vertebrate/invertebrate invasive species are known to occur with an additional 2 suspected to occur. There is undoubtedly additional species that should be added to the list of invasive species. A project was funded in FY2012 that will provide us the updated species list, locations, and recommended control techniques. The final product is due 1st quarter FY2014.

The 2006 EA associated with this EPR for the control of phragmites and kudzu indicates that in addition to the aerial herbicide application that manual ground herbicide treatments will be used for treatment of stands that are not accessible by aircraft and prescribed burning will be used as a follow-up treatment for the control of this species. Unfortunately, adequately trained staffing levels and weather conditions have made it almost impossible to both conduct the manual spraying or conduct prescribed burns (prescribed fire is covered under a different EPR) on the frequency needed to control these species.

Due to security requirements along fence and building perimeters there is an annual mowing contract which cuts the vegetation away from the fence line out to 30ft. This mowing stops some invasive species. Unfortunately, this mowing is also spreading and increasing the threat of other invasive species such as Phragmites. Phragmites grows quickly and forms dense tall stands which: block the view of the security perimeter; chokes out the native plant and animal species; and clogs ditches vital to keep the base from flooding during storm events.

NR staff is observing similar levels of destruction occurring due to other species such as Kudzu, Wisteria, Tree-of-Heaven, Bamboo, and Sericea lespedeza.

Several of these species have invaded wetland mitigation sites and are threatening the integrity and the success of the wetland. If adequate control can not be maintained the site may fail to be approved by the permit/mitigation regulating agencies and may require renegotiations and additional mitigation to be conducted elsewhere.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with laws, regs., and policies reduces the potential for incurring Notices of Violations. NOVs could be issued for a number of reasons to include, but not limited to: knowingly allowing invasive species to negatively impact species of concern; and failing water quality testing, due to lack of proper erosion and sediment control. Internal to the navy additional NOVs can be issued for fire and security hazards.

Proper management of invasive species provides multiple benefits to species, the ecosystem and the military. This project: supports the reduction of Bird-Animal Aircraft Strike Hazards (BASH) concerns by altering vegetation structure to reduce site desirability for species that would or have posed BASH threats; reduces height obstructions associated with various military equipment requirements (i.e., Antenna arrays, Flight Ops, etc.); reduces the risk of facilities being overrun by uncontrollable “wildfires” or flooding; and reduces disease outbreaks.

Allowing invasive species to damage ditches and streams also poses health and safety threats to the base in that the damage by these species can clog vital storm water run-off structures. Damage of these water structures could cause flood and damage to the base, waste water treatment facilities, training facilities, homes, etc. Such devastation could make the base or portions of the base unusable for military training and displace people who live on or adjacent to the base. In addition pooling water creates ideal breeding habitats for a variety of mosquito species (some of which are classified as invasive species), which increase the threat of wildlife borne disease which can spread to humans and other wildlife.

Cost Estimations:

BASE	FY2015	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$88,381.95	$132,035.47	$91,677.84	$93,419.72	$95,194.69
NASO DNA	$18,709.86	$27,605.39	$19,407.58	$19,776.32	$20,152.07
NSA NWA	$38,871.79	$58,246.27	$40,321.38	$41,087.49	$41,868.15
TOTAL:	$145,963.60	$217,887.13	$151,406.79	$154,283.52	$157,214.91

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR219; 32442NR219; 4275ANR219
Project Title: SIKES MA NASO/NALFF - Wildlife Emergency Response; SIKES MA NASO DNA - Wildlife Emergency Response; SIKES MA NSA NWA - Wildlife Emergency Response
Guidebook & Chapter: 12999
Legal Drivers:
Primary: SIKES Act
Secondary: Endangered Species Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)*
Purchase of wildlife control equipment and supplies to support emergency wildlife calls supported by the Base and Region Natural Resources Program Staff. Refresher training/cert. for NR staff in support of Emergency Wildlife control calls is covered under a separate training EPR.

Project Purpose: *(Why is this project needed?)* NASO, NALFF, NASO DNA, and NSA NWA are all located with in the Hampton Roads Region of VA. Hampton Roads is a mix of urban, rural, and natural areas. This land fragmentation, coupled with urban sprawl, puts wildlife and humans in direct competition for the same limited resources and results in human-wildlife conflicts. In an attempt to minimize impacts to humans and wildlife the base Natural Resources staff, in coordination with USFWS and State & Local Wildlife Agencies, respond to emergency wildlife calls.

People who respond to these calls need to be supplied with appropriate equipment to safely and efficiently address these concerns.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project promotes safety of NR personnel, military, civilians, and wildlife. This project minimizes impacts to military training in two primary manners by: 1. expeditiously and safely addressing wildlife concerns; and 2. protecting species of concern, preventing potential Notices of Violation and mitigation costs/requirements. There is a number of Federal and State listed species of concern that either live or seasonally visit bases in the Hampton Roads Area. As such this project allows the Navy to maintain compliance with various Federal and State laws, regulations, policies, and conservation agreements (ESA, MBTA, MMPA, NMFA, Invasive and Pest Control, Sikes Act, INRMP, 5090.1C, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

Any call that can not be safely and efficiently handled by base NR staff will be turned over to State Wildlife Agency officials to address.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO & NALFF	$2,675.35	$2,726.19	$2,777.98	$2,830.76	$2,884.55
NASO DNA	$1,337.68	$1,363.10	$1,389.00	$1,415.39	$1,442.28
NSA NWA	$1,337.68	$1,363.10	$1,389.00	$1,415.39	$1,442.28
TOTAL:	$5,350.72	$5,452.38	$5,555.98	$5,661.54	$5,769.11

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR220; 32442NR220; 4275ANR220
Project Title: 4 SAR MA NASO/NALFF – Nuisance Wildlife Inventory, Assess & Remove; 4 SAR MA NASO DNA – Nuisance Wildlife Inventory, Assess & Remove; 4 SAR MA NSA NWA – Nuisance Wildlife Inventory, Assess & Remove
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Sikes Act
Secondary: Endangered Species Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Develop a nuisance wildlife assessment and management plan (revised every 5 years); remove nuisance wildlife, and conduct pre, during and post nuisance wildlife removal effort monitoring (annually).

Project Purpose: *(Why is this project needed?)* NASO, NALFF, NASO DNA, and NSA NWA all have nuisance wildlife issues that are killing species of concern, damaging habitat of species of concern, and damaging ditch and stream banks (promoting erosion and sediment control problems).

This project is needed to maintain compliance with a variety of Federal, State, and Navy laws, regs., and policies.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with laws, regs., and policies reduces the potential for incurring Notices of Violations. NOVs could be issued for a number of reasons to include, but not limited to: knowingly allowing nuisance wildlife to negatively impact species of concern; and failing water quality testing, due to lack of proper erosion and sediment control.

Allowing nuisance wildlife to damage ditches and streams also poses health and safety threats to the base in that the damage by nuisance wildlife can collapse and clog vital storm water run-off structures. Damage of these water structures could cause flood and damage to the base, waste water treatment facilities, training facilities, homes, etc. Such devastation could make the base or portions of the base unusable for military training and displace people who live on or adjacent to the base. In addition pooling water creates ideal breeding habitats for a variety of mosquito species (some of which are classified as invasive species), which increase the threat of wildlife borne disease which can spread to humans and other wildlife.

In addition controlling wildlife species in support of species of concern, water quality, human health & safety, and training land functionality there are also some residual beneficial side effect. Such benefits may include: increasing agricultural crop yields; reduction of emergency wildlife calls; and reduction of potential BASH concerns.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$60,552.04	$84,523.77	$62,853.01	$64,047.22	$65,264.12
NASO DNA	$12,818.00	$17,671.85	$13,305.09	$13,557.88	$13,815.48
NSA NWA	$26,631.57	$37,286.91	$27,643.56	$28,168.79	$28,704.00
TOTAL:	$100,001.60	$139,482.53	$103,801.66	$105,773.90	$107,783.60

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR221; 32442NR221; 4275ANR221
Project Title: EFH MA NASO/NALFF - Fisheries, Ditches & Streams; EFH MA NASO DNA - Fisheries, Ditches & Streams; EFH MA NSA NWA - Fisheries, Ditches & Streams
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Magnuson-Stevens Fishery Conservation and Management Act
Secondary: Clean Water Act
Tertiary: EFH
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); NASO Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Conduct an inventory and assessment of ditch, stream, pond, and lake functions (this includes wildlife that live in and contribute to the functionality of the water resource, i.e. fish population assessments) and hydrology. Develop a Habitat enhancement plan for these water resources. Purchase equipment, supplies, fish, plants, etc. to assist with this project.

Project Purpose & Impact/Benefit to Military Mission: *(Why is this project needed? How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Project allows the base to maintain compliance with: the Sustainable Fisheries Act Amendment to the Magnuson-Stevens Fishery Conservation and Management Act in 1996; the Chesapeake Bay Preservation Act; the Clean Water Act; Coastal Zone Management Act; Essential Fish Habitat protection; OPNAVINST 5090.1C; base INRMPs; Sikes Act; and numerous other plans Southern Watershed Area Management Plan (SWAMP); Lynnhaven River Watershed Restoration Plan (sub of Chesapeake); Back Bay Watershed Restoration Plan (sub of southern).

The waterways of NASO, NALFF, NASO DNA, and NSA NWA connect to several watersheds which all have the potential to influence Essential Fish Habitat (EFH) within the Atlantic Ocean, and Chesapeake Bay.

The fish stocking is intended to produce breeding populations of native fish to increase water resources and functionality (as appropriate). Since several of the water resources where fish are anticipated to need to be stocked are areas where recreational fishing is allowed this project also benefits the military community by allowing additional outdoor recreation opportunities, thus potentially increasing Morale and Welfare.

In addition the data is utilized to make more informed NEPA property management decisions in associated with DoD/military mission changes.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$17,411.65	$17,742.47	$133,533.94	$18,416.69	$18,766.61
NASO DNA	$5,046.09	$5,141.96	$31,017.41	$5,337.36	$5,438.77
NSA NWA	$8,599.34	$63,478.25	$8,926.12	$9,095.71	$9,268.53
TOTAL:	$31,057.08	$86,362.68	$173,477.46	$32,849.76	$33,473.90

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR222; 32442NR222; 4275ANR222
Project Title: MSFCA MA NASO/NALFF - Outdoor Recreation Program Requirements; MSFCA MA NASO DNA - Outdoor Recreation Program Requirements; MSFCA MA NSA NWA - Outdoor Recreation Program Requirements
Guidebook & Chapter: 12109
Legal Drivers:
Primary: Sikes Act
Secondary: MSFCA (originally planned to be Primary; however EPRweb does provide that option)
Tertiary: 5090.1C
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Maintain hunting, fishing, and nature: trails; boardwalks; fishing stations picnic shelters; ranges; elevated shooting stands/platforms; check-station; walk-in cooler; freezer; and brochures (i.e. mass production of rules & regulations pamphlets, maps, etc.).

Project Purpose: *(Why is this project needed?)* Maintenance of these items is required: to allow people to safely recreate on these bases; to allow people with physical disabilities to recreate; to ensure people have written documentation or rules/regs./procedures; to promote education opportunities; and to allow proper processing and checking of wildlife taken during recreational activities. Implementation of this project is conducted under the guides of the Sike's Act and in accordance with Navy, USFWS and State mandated policies regarding wildlife population management. The outdoor recreation program also supports objectives linked to the Endangered Species Act, Migratory Bird Treaty Act, an numerous other laws and policies linked to invasive species, water quality, and nuisance wildlife control.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project maintains upkeep of the arteries of the Natural Resources (NR) Outdoor Recreation program (ORP). The NR ORP supports a number of wildlife population management objectives, including but not limited to: deer herd population reduction; nuisance wildlife removal; invasive species removal; and bird aircraft strike hazard (BASH) reduction.

This program supports the military mission in 3 primary ways: 1. increasing Morale and Welfare by allowing outdoor recreation; 2. educating military regarding NR concerns and how they contribute; and 3. ensuring safety to allow military training to continue (BASH reduction).

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO & NALFF	$4,626.93	$1,577.73	$1,607.71	$1,638.25	$1,669.38
NASO DNA	$2,313.46	$788.88	$803.87	$819.14	$834.71
NSA NWA	$2,313.46	$788.87	$803.86	$819.13	$834.69
TOTAL:	$9,253.85	$3,155.48	$3,215.43	$3,276.53	$3,338.78

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Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR223; 32442NR223; 4275ANR223
Project Title: SIKES MA NASO/NALFF - Equipment Storage Structures; SIKES MA NASO DNA - Equipment Storage Structures; SIKES MA NSA NWA - Equipment Storage Structures
Guidebook & Chapter: 12999
Legal Drivers:
Primary: Sikes Act
Secondary: CWA
Tertiary: SWCA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads – Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)*

- Demolish metal temporary storage structure that is rusting and collapsing at the Natural Resources Center on NASO. Replace storage structure. (2014)
- Construct new equipment storage shed capable of housing tractors and associated equipment parts at NASO. (2015)
- Repair storm damaged tractor storage shed at NASO. (2014)
- Repair storm damaged tractor storage shed at NSA NWA. (2014)
- Maintain equipment storage structures. (annually)

Project Purpose: *(Why is this project needed?)* Existing storage structures are in disrepair and are not being utilized for their intended purposes. One structure is a safety hazard and needs to be demolished (needs to be replaced with a secure locking concrete storage shelter, vandals have been known to steal items from the Natural Resources Center). One structure is leaking during storm events and damaging equipment. One structure lost its doors during a storm event and now items can not be securely stored (due to location of this structure with out doors nothing can be stored in this structure). Even with the repair and replacement of these structures there is still not enough storage to properly store equipment from elemental damage. As such a new structure must be constructed to protect hundreds of thousands of dollars of equipment and extend the life cycle of this equipment.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* The equipment needing to be properly stored is utilized for various projects that support requirements under federal and state law and Navy policy. This equipment performs functions in support of Endangered Species work, Migratory Bird work, invasive species work, nuisance wildlife work, erosion control work, habitat enhancement work, the Sikes Act, etc.

Maintaining this equipment enables the Navy to continue supporting these efforts and help to keep the bases in compliance with these laws and regulations; as such, reducing the potential for NOVs to be

issued. This helps to save time and money enabling the military to continue training without interruption.

Protecting the equipment extends the life of the equipment and delays the need for costly repairs or even new equipment purchasing.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO & NALFF	$46,074.67	$918.63	$936.08	$953.87	$971.99
NASO DNA	$903.06	$918.63	$936.08	$953.87	$971.99
NSA NWA	$903.06	$918.63	$936.08	$953.87	$971.99
TOTAL:	$51,043.14	$2,755.89	$2,808.25	$2,861.61	$2,915.98

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR224; 32442NR224; 4275ANR224
Project Title: SIKES MA NASO/NALFF - Equipment Maintenance & Repair; SIKES MA NASO DNA - Equipment Maintenance & Repair; SIKES MA NSA NWA - Equipment Maintenance & Repair
Guidebook & Chapter: 12999
Legal Drivers:
Primary: Sikes Ac t
Secondary: EO_Invasive Species
Tertiary: SWCA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); and Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)*
Maintain and repair equipment to keep them in working in order to complete projects required under the Integrated Natural Resources Management Plan (INRMP). INRMP projects support Species and Habitats of Concern management, invasive species management, outdoor recreation, etc.

Project Purpose: *(Why is this project needed?)* Some equipment requires annual maintenance checks and repairs as needed. Other equipment may break while in use and will need repairs. This equipment is needed to support INRMP identified projects and maintain compliance with Federal, State, and Navy laws, regulations, and policies. Without working equipment the Navy cannot accomplish their INRMP and Permit requirements, and will be labeled non-compliant and possibly be issued Notices of Violation.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)*
Equipment repairs and maintenance are needed to maintain compliance with the: Sikes Act; Endangered Species Act; EO_Invasive Species; Migratory Bird Treaty Act; OPNAVINT 5090.1C; Clean Water Act; Soil & Water Conservation Act; etc.

The equipment needing to be properly maintained and repaired is utilized for various projects that support requirements under federal and state law and Navy policy. This equipment performs functions in support of Endangered Species work (issued biological opinion), Migratory Bird work, invasive species work, nuisance wildlife work, erosion control work, habitat enhancement work, the Sikes Act, outdoor recreation, environmental compliance inspection access, etc.

Maintaining this equipment enables the Navy to continue supporting these efforts and help to keep the bases in compliance with these laws and regulations; as such, reducing the potential for NOVs to be issued. This helps to save time and money enabling the military to continue training without interruption.

Proper maintenance and repair of the equipment extends the life of the equipment and delays the need for more costly repairs or even new equipment purchasing.

Without equipment the Natural Resources managed outdoor recreation program would likely have to shut down due to access and safety issues, thus reducing military morale and welfare.

Without this equipment the Military will have to pay additional funding to maintain areas (at a much greater cost) they utilize for training purposes because Natural Resources will not be able to maintain their dual purpose land management objectives.

Without this equipment the facilities will be endangered of wildfire intrusion because the Natural Resources program will not be able to maintain their firebreaks.

Without this equipment the facilities will be more likely to flood because invasive plant species management, which block the ditches and create security breaches, will have to be stopped until funding can be obtained.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/ NALFF	$12,288.12	$12,521.60	$12,759.51	$13,001.94	$13,248.97
NASO DNA	$2,601.51	$2,650.94	$2,701.30	$2,752.63	$2,804.93
NSA NWA	$5,404.78	$5,507.47	$5,612.11	$5,718.74	$5,827.39
TOTAL:	$20,294.40	$20,680.00	$21,072.92	$21,473.30	$21,881.30

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR225; 32442NR225; 4275ANR225
Project Title: SIKES MA NASO/NALFF - Conservation Law-enforcement Vehicle
Guidebook & Chapter: 12999
Legal Drivers:
Primary: SIKES Act
Secondary: ESA
Tertiary: CWA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* NAVFAC MIDLANT Installations throughout Hampton Roads IPT (11 installations)

Project Description: *(What does this project entail?)*
Fund Funding Shortfall to maintain current Conservation Law-enforcement Vehicle.

Project Purpose: *(Why is this project needed?)* The conservation law-enforcement vehicle services 11 installations in the Hampton Roads IPT; however, the vehicle is maintained under NAS Oceana's Transportation department. During the 2012/2013 fleet vehicle reduction NASO was only allotted so much money, which would have left the Natural Resources program without an adequate Conservation Law-enforcement vehicle. As such Oceana PWD reached back to NAVFAC MIDLANT Region Environmental Business Line to fund the remaining rental cost to maintain the existing vehicle as the vehicle services Oceana Command and Non-Oceana Command installations. Funds were allocated to meet the shortfalls in FY 2013 and the installation Natural Resources Manager was requested to submit an EPR for out years.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* There are key safety concerns associated with transporting equipment via an undersized truck. One mishap could harm personnel or others, could delay project implementation, and could delay military training missions. The truck is used to perform functions in support of Endangered Species work, Migratory Bird work, invasive species work, nuisance wildlife work, erosion control work, habitat enhancement work, the Sikes Act, etc. Without being able to properly transport equipment or gain access into off-road areas there could be delays in project implementation which could have potential negative impacts on species of concern.

Cost Estimations:

FY2016	FY2017	FY2018	FY2019	FY2020
$5,827.96	$5,938.69	$6,051.53	$6,166.50	$6,283.67

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR226; 32442NR226; 4275ANR226
Project Title: CHS MA NASO/NALFF - INRMP Updates and Planning; CHS MA NASO DNA - INRMP Updates and Planning; CHS MA NSA NWA - INRMP Updates and Planning
Guidebook & Chapter: 12103
Legal Drivers:
Primary: Sikes Act
Secondary: ESA
Tertiary: CWA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Acquire equipment and support necessary to keep INRMPs updated.

NASO/NALFF INRMP: Final Hard Copy Draft Aug 2008, pen and ink changes through 2012; Review for Operation and Effect Obtained Sept 2012. Project was funded in FY2012 to incorporate all pen and ink changes into the hard copy version of the INRMP.

NASO DNA INRMP: Final Hard Copy Draft Nov 2006, pen and ink changes through 2012; Review for Operation and Effect requested in 2007 and 2012. State Wildlife Agency reviewed in 2007, USFWS concurred if State concurred. State reviewed in 2012; however USFWS refused to review until the hard copy had been updated to incorporate the pen and ink changes within the document, since the original hard-copy was from 2006. Project was funded in FY2012 to incorporate all pen and ink changes into the hard copy version of the INRMP.

NSA NWA INRMP: Final Hard Copy Draft Nov 2006, pen and ink changes through 2012; Review for Operation and Effect requested in 2007 and 2012. State Wildlife Agency reviewed in 2007, USFWS concurred if State concurred. State reviewed in 2012; however USFWS refused to review until the hard copy had been updated to incorporate the pen and ink changes within the document, since the original hard-copy was from 2006. Project was funded in FY2012 to incorporate all pen and ink changes into the hard copy version of the INRMP.

Project Purpose: *(Why is this project needed?)* Existing equipment does not allow the functionality to properly update and produce planning level analyses for the INRMP. As such, equipment is needed that does not connect to the network; therefore not requiring some of the restrictions that interrupt and prevent completion of detailed analyses and mapping efforts. Additionally, the equipment that is issued does not possess the speed and storage capabilities necessary for data processing and storage.

Support to maintain and utilize the equipment and keep INRMP data updated in accordance with various Navy and INRMP identified requirements (e.g., Geographic Information System collection and metadata requirements, map updates, data updates, analyses, modeling, etc.).

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project will aide in making sure the bases are keeping in compliance with various Federal and State laws, regulations, policies, and conservation agreements (ESA, MBTA, MMPA, NMFA, Invasive and Pest Control, Sikes Act, INRMP, 5090.1C, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

INRMPs have a number of updates that are listed and approved by the annual INRMP metrics review teams (Navy, USFWS, and State Wildlife Agency representatives) as needed to be made to the INRMP plan, but current staffing levels and equipment are insufficient to accomplish the required updates. Update requirements have been building up since 2007 and have not been incorporated into a complete digital document. A running list of required updates and an updated project list have been made and are provided when copies of the INRMP are requested for review. Many updates require research, analysis, and data modeling to accomplish the completed desired results for the official INRMP document.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$8,464.719	$83,310.70	$8,789.434	$8,956.433	$9,126.605
NASO DNA	$4,232.359	$17,418.23	$4,394.717	$4,478.217	$4,563.303
NSA NWA	$4,232.359	$36,751.77	$4,394.717	$4,478.217	$4,563.303
TOTAL:	$16,929.438	$137,480.70	$17,578.868	$17,912.866	$18,253.211

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR228
Project Title: SIKES MA NASO/NALFF - Natural Resources Staff Certification Requirements;

Guidebook & Chapter: 12110
Legal Drivers:
Primary: SIKES Act
Secondary: ESA
Tertiary: FIFRA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); and Naval Support Activity Norfolk - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)*
Certification and re-certification requirements for maintaining key training for properly implementing INRMP identified program areas. This EPR is specifically for training required to obtain professional certifications in support of implementing INRMP program areas. Additional training, conferences, or meetings that are not required in support of a certification are not listed in this EPR exhibit, but should be identified in the individual's professional development plan and should be funded through a different funding pool.

Project Purpose: *(Why is this project needed?)* Adequately train personnel and maintain certifications that will allow staff to conduct INRMP identified projects in accordance with Federal and State Laws and Policies.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Not funding this exhibit could delay or prevent staff from receiving the training/certification required to legally implement INRMP program areas. As such this could delay mission critical operations until adequately trained personnel are hired to complete the various requirements.

Cost Estimations:

FY2016	FY2017	FY2018	FY2019	FY2020
$6,333.86	$6,677.58	$6,576.68	$6,933.50	$6,828.81

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Number: 60161NR231; 32442NR231; 4275ANR231
Project Title: CHS MA NASO/NALFF – Nearshore Environment and Climate Change Assessments; CHS MA NASO DNA – Nearshore Environment Assessment and Climate Change Assessments; CHS MA NSA NWA – Nearshore Environment Assessment and Climate Change Assessments
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Sikes Act
Secondary: NEPA
Tertiary: EFH/ESA/MMPA/MBTA
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana – Dam Neck Annex (NASO DNA); and Naval Support Activity Hampton Roads – Northwest Annex (NSA NWA).

Project Description: *(What does this project entail?)* Conduct research and analyses to produce a report to be incorporated into the INRMP on the history of climate change, the predictions for future climate change, and the associated impacts of this climate change in association with installation properties. Produce maps, timeline, etc., to depict the predicted climate change impacts. Identify military mission vulnerabilities and recommendations associated with predicted planning for climate change impacts (include, changes in property boundaries, sea level rise and impacts to infrastructure, etc.). Identify potential habitat and species of concern impacts associated with predicted planning for climate change impacts. Work/Coordinate with the South Atlantic Landscape Conservation Cooperative (SALCC), USGS, and other Navy partners working on Climate Change initiatives to ensure consistency amongst climate change terminology and estimations. Indentify potential climate change initiatives the Navy can support within the installation's contributing ecosystems (e.g., watersheds, joint venture boundaries, SALCC, bird conservation regions, etc.).

Where appropriate (currently, NASO and NASO DNA are the only installations with identified near shore environments) conduct a more detailed analysis/assessment of near shore environment associated with shore installations for inclusion in the INRMP. Identify and map (providing GIS layers and metadata) boundary of near shore environment. Provide property ownership information on the near shore environment lands and agreements between the property owner and the Navy. Provide species and habitat data information within the near shore environment. Provide near shore environment topography and tidal fluctuation information. Identify military training that currently impacts the near shore environment and how the environment is impacted. Identify potential conflicts with the military mission and the near shore environment. Indentify potential habitat conservation initiatives the Navy can support associated with the near shore environment.

Project recurs every 5 years unless a major change in mission or landuse/cover occurs.

Project Purpose: *(Why is this project needed?)*
Project need was identified in 2010 via the INRMP metrics annual review, indicating that the INRMP does not sufficiently address climate change or near shore environments. INRMP update list and project lists were updated to include this need.

Currently, these bases do not have sufficient biological information to determine if they are negatively impacting species and habitats within the near shore environment. Currently, these bases do not have a climate

change assessment that will allow them to plan for future climate change concerns. This lack of information puts the Navy at risk for violating several federal and state laws. In addition to federally mandated requirements, Navy and State Policies and Plans dictate that we should have a working knowledge of our impacts to wildlife. This EPR exhibit works to get the Navy in compliance with these requirements.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Assessments of Climate Change and near shore environments associated with bases are necessary to understand how mission requirements will affect species and habitats of concern and vice versa (how impact to species, habitats, and landscapes will impact the military mission). Various laws and regulations will be impacted by climate change (endangered species act, soil conservation act, clean water act, marine mammal protection act, essential fish habitat, etc.). The Sikes Act, National Environmental Policy Act, and Navy & DoD Policy (5090.1C, 4715.03, etc.) requires installations with INRMPs to have a working knowledge of climate change and near shore environments, which are to be included in the INRMPs. Knowing in advance what potential concerns there are would allow the command to plan around avoiding potential impacts and to plan for permitting and mitigation requirements, which may be needed to meet military training requirements.

Not having sufficient biological information related to Climate Change and Near shore environments levels the Navy vulnerable to lawsuits when this insufficient information is produced in NEPA documentation associated with military action projects. Obtaining sufficient information will help to avoid these situations or at least help the Navy to win or have such accusations overturned in a court of law.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$109,007.90	$0.00	$0.00	$0.00	$0.00
NASO DNA	$190,763.83	$0.00	$0.00	$0.00	$0.00
NSA NWA	$43,603.16	$0.00	$0.00	$0.00	$0.00
TOTAL:	$343,374.90	$0.00	$0.00	$0.00	$0.00

Project Justification & Cost Estimate Information

Prepared By: Michael Wright, Installation Natural Resources Specialist
Date Prepared: 31 July 2013

Project Numbers: 60161NR232; 32442NR232; 4275ANR232
Project Title: SIKES MA NASO/NALFF - Resource Protection Agreement; SIKES MA NASO DNA - Resource Protection Agreement; SIKES MA NSA NWA - Resource Protection Agreement
Guidebook & Chapter: 12101
Legal Drivers:
Primary: Sikes Act
Secondary: Endangered Species Act
Tertiary: Migratory Bird Treaty Act
ERL: 4
Navy Level: 1
Funding Sources: *(OM&N, 19G, Forestry, Legacy, Sikes, etc.)* O&MN

Project Location: *(Base)* Naval Air Station Oceana (NASO); Naval Auxiliary Landing Field Fentress (NALFF); Naval Air Station Oceana - Dam Neck Annex (NASO DNA); Naval Support Activity Hampton Roads - Northwest Annex (NSA NWA)

Project Description: *(What does this project entail?)* Create and maintain a cooperative agreement with the US Fish & Wildlife Service, the VA Department of Game & Inland Fisheries, and/or installation Security to supply Conservation Law-enforcement protection over the natural resources on Navy Property.

Project Purpose: *(Why is this project needed?)* Protection of Natural Resources via adequately staffed and trained Conservation Law-enforcement Officers (CLEOs) is required under the Sikes Act. The CLEO's would enforce a wide number of legal and policy requirements at these installations: CWA; CZMA; EO 11990 (Protection of Wetlands); ESA (e.g., enforcing/executing existing Biological Opinions for such species as the Federally Threatened Loggerhead Sea Turtle); MBTA (e.g., ensuring Migratory Bird depredation work is being carried out in accordance with permit requirements); SWCA; 32 CFR 190 (Natural Resources Management Program); DoDI 4715.03 (Environmental Conservation Program); OPNAVINST 5090.1C; Chesapeake Bay Preservation Act and Federal Agreement; DoD Instruction 4150.7 (Pest Management); EO 13751 (Invasive Species/ Exotic Organisms); and various other Federal and State laws (particularly related to hunting and fishing regulations, and state T&E listed species), regulations, policies, and conservation agreements (MMPA, NMFA, EFH, State Wildlife Action Plan, USFWS Strategic Plan, etc.).

Neither NR staff nor military police currently have the staffing and training levels too sufficiently and legally process and investigate natural resources legal actions. NASO, NALFF, NASO DNA, and NSA NWA all require conservation law-enforcement officer (CLEO) support. Each of these facilities is located within a highly urbanized area and receives a high amount of authorized and unauthorized human access (bases are not 100% fenced in, majority of natural areas are found outside of "secured" compounds). Each of these bases support species of concern, habitats of concern, and hunting & fishing programs. There have been known and suspected negative impacts to natural resources on each of these bases (i.e., vandalism, killing, filling wetlands, planting of non-native invasive species, harassment of Endangered Species and Migratory Birds, poaching, etc.).

Conservation Law-enforcement is a dangerous job (diseased animals, aggressive animals, hunters with loaded weapons, etc.) and should be done in such a manner that when an officer responds to an emergency situation or a situation where they think they may need to use force (i.e., weapons) they should have adequately trained back-up or someone to attend/investigate with them for safety purposes. Also, staffing should be at a level in order to avoid a situation where a single person is working or on call 24 hours 7 days a week. It is recommended that at a minimum the cooperative agreement provide for 3 adequately trained individuals to provide conservation law-enforcement support to NASO/NALFF, NASO DNA, and NSA-NWA. This way there is the ability to safely work emergency situations and to allow for at least one CLEO to have official time-off on a rotational basis.

Project Impact/Benefit to Military Mission: *(How would not funding this project affect the mission? What benefits does funding this project have to the mission?)* Funding this project aides the Navy in maintaining compliance with laws, regs., and policies and reduces the potential for incurring Notices of Violations. NOVs could be issued for knowingly and unknowingly allowing the occurrence of negative impacts to resources. It has been identified that current staffing levels and training/cert. levels are not adequate for implementing conservation law-enforcement actions, across all four bases, regarding natural resources. In effect one may draw the conclusion the Navy is knowingly allowing negative impacts to occur to resources based on the lack of providing enough adequately trained conservation law-enforcement professionals.

Cost Estimations:

BASE	FY2016	FY2017	FY2018	FY2019	FY2020
NASO/NALFF	$99,355.56	$101,243.31	$103,166.94	$105,127.11	$107,124.52
NASO DNA	$21,032.16	$21,431.77	$21,838.97	$22,253.92	$22,676.74
NSA NWA	$43,697.78	$44,528.03	$45,374.07	$46,236.17	$47,114.66
TOTAL:	$164,085.49	$167,203.12	$170,379.98	$173,617.20	$176,915.92

POM 16_Manpower_OC_EV_Request to Region

	POSITION INFO											
One employee per row	Administrative (Y/N)	Supervisory (Y/N)	Civilian (C) / Contractor (K) / Military (M)	Direct (D) / Reimbursable (R)	Existing position (E) / FY14 addition (A)	FY16 Cost ($)	FY17 Cost ($)	FY18 Cost ($)	FY19 Cost ($)	FY20 Cost ($)	Natural Resources	Notes
1	N	N	C	R	E	$109,341	$111,418	$113,535	$115,692	$117,890	100	GS 12, Multi-Media Manager - Natural Resources. Professional Position. Detailed to PWD Oceana EV. This position handles budgeting/acquisition oversight, Contract and Contractor Coordination, ensuring INRMP compliance, EV Checklist Reviews/NEPA/General Projects Induction Reviews, regulator and subject matter expert coordination, Installation Instruction Updates, Education & Outreach, Record Keeping, etc. This position oversees the complete installation Natural Resources Programs for the Oceana Command and NSAHR Northwest Annex managing/coordinating 3 INRMPs and the support personnel associated with the upkeep and implementation of the INRMPs.
2	N	N	C	R	E	$89,986	$91,696	$93,438	$95,213	$97,022	100	GS 9, Biological Science Technician(BST)/Conservation Law-enforcement Officer (CLEO). Non-professional Position. Detailed to PWD Oceana EV with regional responsibilities. Provides Hampton Roads regional CLEO support and biological science technician duties as requested/assigned and time allows.
3	N	N	C	R	E	$80,261	$81,786	$83,340	$84,923	$86,537	100	GS 9, Biological Science Technician. Non-professional Position. Detailed to PWD Oceana EV. Primary duty station is NASO, DNA, and NALFF, but does complete as assigned tasks for NWA. Provides BST duties as assigned and time allows.
4	N	N	C	D	A	$102,993	$104,950	$106,944	$108,975	$111,046	100	GS 11-12, Forester. Professional Position. Duty Stationed either at region or PWD Oceana EV. Neither region nor installations have a certified forester on staff. OPNAVINST 5090.1C stipulates that "All Navy installations with commercial forestry programs shall employ or use a professional forester to manage forest resources." NAS Oceana, NASO Dam Neck Annex, NALF Fentress, and NSA Norfolk-Northwest Annex all have INRMP identified forestry programs, and due to the nature of various activity initiate projects require commercial forestry management (i.e., timber sales, and timber value assessments, etc.).

POM 16_Manpower_OC_EV_Request to Region

	POSITION INFO											
One employee per row	Administrative (Y/N)	Supervisory (Y/N)	Civilian (C) / Contractor (K) / Military (M)	Direct (D) / Reimbursable (R)	Existing position (E) / FY14 addition (A)	FY16 Cost ($)	FY17 Cost ($)	FY18 Cost ($)	FY19 Cost ($)	FY20 Cost ($)	Natural Resources	Notes
5	N	N	C	D	A	$102,993	$104,950	$106,944	$108,975	$111,046	100	GS 11, Natural Resources Specialist-Team Lead for Specific NR Program Areas. Professional Position. Detailed to PWD Oceana EV. Coordinates with the NASO GS 12 Natural Resources Specialist/Manager to determine work plans, inspection requirements, and needs for program and staff, in addition to aiding in completing field work (surveys, inspections, nuisance/emergency wildlife response, etc.) for the 2 NASO Command Integrated Natural Resources Management Plans (INRMPs). Works with and oversees BSTs and volunteers in support of completing INRMP identified projects. Programmatic needs include, but are not limited to: Rare, Threatened & Endangered Species Management; Species & Habitats of Special Concern Management; Bird-Animal Aircraft Strike Hazards Management; Invasive Species Management; Prescribed Burning Management; Geographic Information Systems Management; Data Management; Wetland & other Water Resource Management (mapping, evaluating, restoring, mitigation, etc.); Emergency-Call&Nuisance Wildlife Management; Migratory Bird Management; Forest Management (inventory, silviculture, market assessment, disease, etc.); Vegetation Management; Agricultural Lands Management; Erosion & Sediment Control Management; General Fish & Wildlife Management (population, habitat, disease, etc.); NR Recreational Program Management (Hunting, Fishing, Trails, Archery, etc.); Climate Change; Ecosystem/Watershed Management; Conservation Law Enforcement; Coastal/Marine Management; Floodplain Management; In-field training of Support Staff Management; Data Analysis and Interpretation Management; etc.

POM 16_Manpower_OC_EV_Request to Region

	POSITION INFO											
One employee per row	Administrative (Y/N)	Supervisory (Y/N)	Civilian (C) / Contractor (K) / Military (M)	Direct (D) / Reimbursable (R)	Existing position (E) / FY14 addition (A)	FY16 Cost ($)	FY17 Cost ($)	FY18 Cost ($)	FY19 Cost ($)	FY20 Cost ($)	Natural Resources	Notes
6	N	N	C	D	A	$102,993	$104,950	$106,944	$108,975	$111,046	100	GS 11, Natural Resources Specialist for Specific NR Program Areas. Professional Position. Detailed to PWD Oceana EV. Coordinates with the NASO GS 12 Natural Resources Specialist/Manager and the NASO GS 11 Natural Resources Specialist - Team Leader to determine work plans, inspection requirements, and needs for program and staff, in addition to aiding in completing field work (surveys, inspections, nuisance/emergency wildlife response, etc.) primarily to support the NSAHR Northwest Annex Integrated Natural Resources Management Plan (INRMP), which is managed and supported out of the NASO Environmental Program Office. Works with and oversees BSTs and volunteers in support of completing INRMP identified projects. It is highly recommended that this position be required to maintain a Society of American Foresters (SAF) National Forester Certification. Programmatic needs include, but are not limited to: Rare, Threatened & Endangered Species Management; Species & Habitats of Special Concern Management; Bird-Animal Aircraft Strike Hazards Management; Invasive Species Management; Prescribed Burning Management; Geographic Information Systems Management; Data Management; Wetland & other Water Resource Management (mapping, evaluating, restoring, mitigation, etc.); Emergency-Call&Nuisance Wildlife Management; Migratory Bird Management; Forest Management (inventory, silviculture, market assessment, disease, etc.); Vegetation Management; Agricultural Lands Management; Erosion & Sediment Control Management; General Fish & Wildlife Management (population, habitat, disease, etc.); NR Recreational Program Management (Hunting, Fishing, Trails, Archery, etc.); Climate Change; Ecosystem/Watershed Management; Conservation Law Enforcement; Coastal/Marine Management; Floodplain Management; In-field training of Support Staff Management; Data Analysis and Interpretation Management; etc. Since 2007, annually the NSAHR Northwest Annex INRMP metrics have reflected a staffing shortfall and specifically the need to have an individual on-site at NSAHR Northwest Annex, per the Installation Commanding Officer (ICO).
TOTAL:						**$588,566**	**$599,748**	**$611,144**	**$622,755**	**$634,588**		
TOTAL In-Core:						**$279,588**	**$284,900**	**$290,313**	**$295,829**	**$301,450**		
TOTAL Above-Core:						**$308,978**	**$314,849**	**$320,831**	**$326,926**	**$333,138**		

Enclosure 3. INRMP Updates and Annual Metrics

DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:
5090
Ser N4/028
30 Jan 17

Mr. Robert Duncan
Executive Director
VA Department of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230-3916

Dear Mr. Duncan:

SUBJECT: FISCAL YEAR (FY) 2016 NATURAL RESOURCES/INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) METRICS SUMMARY REPORT

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f. A summary of the 7 INRMP Metrics focus area scores.

Enclosures (4) and (5) provide copies of each INRMP's current signature page and a summary list of the physical updates made to each INRMP since 2014.

Thank you for your participation in the NAS Oceana Natural Resources Program. My point of contact for this matter is the NAS Oceana Natural Resources Manager, Michael Wright, and she can be reached at (757) 433-3461 or via e-mail at michael.f.wright@navy.mil.

Sincerely,

C. P. VINCELETTE
Captain, U.S. Navy
By direction
Executive Officer

Enclosure: (1) FY 2016 Natural Resources/INRMP Metric Meeting Invitation
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NOAA Attn: Mr. Brian Hopper

DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:
5090
Ser N4/027
30 Jan 17

Ms. Amy Ewing
Environmental Services Biologist
VA Department of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230-3916

Dear Ms. Ewing:

SUBJECT: FISCAL YEAR (FY) 2016 NATURAL RESOURCES/INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) METRICS SUMMARY REPORT

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Executive Officer

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NOAA Attn: Mr. Brian Hopper

DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:
5090
Ser N4/026
30 Jan 17

Mr. Peter Acker
Wildlife Biologist
VA Department of Game and Inland Fisheries
3909 Airline Blvd.
Chesapeake, VA 23321-3305

Dear Mr. Acker:

SUBJECT: FISCAL YEAR (FY) 2016 NATURAL RESOURCES/INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) METRICS SUMMARY REPORT

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DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:
5090
Ser N4/025
30 Jan 17

Ms. Cynthia Schulz
Ecological Services Office
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, VA 23061-4410

Dear Ms. Schulz:

SUBJECT: FISCAL YEAR (FY) 2016 NATURAL RESOURCES/INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) METRICS SUMMARY REPORT

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Executive Officer

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DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:
5090
Ser N4/024
30 Jan 17

Ms. Sarah Nystrom
Ecological Services Office
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, VA 23061-4410

Dear Ms. Nystrom:

SUBJECT: FISCAL YEAR (FY) 2016 NATURAL RESOURCES/INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) METRICS SUMMARY REPORT

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DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:
5090
Ser N4/023
30 Jan 17

Mr. David O'Brien
Marine Habitat Resource Specialist
Chesapeake Bay Office
National Oceanic and Atmospheric Administration
P.O. Box 1346
Gloucester Point, Virginia 23062-1346

Dear Mr. O'Brien:

SUBJECT: FISCAL YEAR (FY) 2016 NATURAL RESOURCES/INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) METRICS SUMMARY REPORT

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DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:
5090
Ser N4/022
30 Jan 17

Mr. Brian Hopper
Section 7 Biologist
National Oceanic and Atmospheric Administration
177 Admiral Cochrane Dr.
Annapolis, MD 21401-7307

Dear Mr. Hopper:

SUBJECT: FISCAL YEAR (FY) 2016 NATURAL RESOURCES/INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) METRICS SUMMARY REPORT

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DEPARTMENT OF THE NAVY
NAVAL AIR STATION OCEANA
1750 TOMCAT BOULEVARD
VIRGINIA BEACH, VIRGINIA 23460-2191

IN REPLY REFER TO:
5090
Ser N4/021
30 Jan 17

Mr. William Barnhill
Section 7 Biologist Northeast Region
National Oceanic and Atmospheric Administration
55 Great Republic Drive
Gloucester, MA 09130-2276

Dear Mr. Barnhill:

SUBJECT: FISCAL YEAR (FY) 2016 NATURAL RESOURCES/INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN (INRMP) METRICS SUMMARY REPORT

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NOAA Attn: Mr. David O'Brien
NOAA Attn: Mr. Brian Hopper

-----Original Appointment-----
From: Wright, Michael F CIV NAVFAC MIDLANT, PWD Oceana
Sent: Wednesday, September 07, 2016 12:17 PM
To: Podbesek, Jennifer A CIV NAVFAC MIDLANT, PWD Yorktown; Austin, Taylor S CIV NAVFAC MIDLANT, EV; Olexa, Thomas J CIV NAVFAC MIDLANT, PWD Yorktown; Hammond, John; Waligora, Sharon L CIV NAVFAC MIDLANT, PWD Little Creek; Russell, Kyle B CIV NAVFAC MIDLANT, P)WD Little Creek; Chamberlain, Terry N CIV NAVFAC MIDLANT, PWD Oceana (terry.n.chamberlain@navy.mil); Hicks, Linda CIV NAVFAC MIDLANT, PWD NSA Hampton Roads; Pulver, John J CIV NAVFAC MIDLANT, PWD Yorktown; Hoskin, Sumalee; Edwards, Mark L CIV NAVFAC MIDLANT, PWD Oceana; Nystrom, Sarah <sarah_nystrom@fws.gov> (sarah_nystrom@fws.gov); Jones, Michael H CIV NAVFAC MIDLANT, EV; Carawan, Emmett; Crum, Pete CIV NAVFAC MIDLANT, EV; Bassi, Jessica CIV NAVFAC MIDLANT, EV; Waller, Blake; Markham, Jack J CIV NAVFAC MIDLANT, EV; McGrogan, Lawrence F CIV NAVFAC MIDLANT, PWD Oceana; chris.ludwig@dcr.virginia.gov; chris.turner@ncwildlife.org; Ewing, Amy; Engelmeyer, Todd; Coe; Boettcher, Ruth (DGIF; maria.dunn@ncwildlife.org; david.l.o'brien@noaa.gov; Acker, Pete; donald_schwab@fws.gov; Aherron, Mike (DOF) (mike.aherron@dof.virginia.gov); tim_craig@fws.gov; Kleopfer, John (DGIF) (John.Kleopfer@dgif.virginia.gov); Page, Daren K CIV NAS Oceana, N32; Chad.Boyce@dgif.virginia.gov; chad.thomas@ncwildlife.org; jeremy.mccargo@ncwildlife.org
Subject: 2016 Navy Natural Resouces Annual Metrics Meeting Request
When: Wednesday, October 12, 2016 9:00-14:00 (UTC-05:00) Eastern Time (US & Canada).
Where: NAS Oceana, VA Beach, VA Bldg 820, 2nd Floor, FEAD Conference Room

Hello Everyone,
It is that time again, to schedule our annual Integrated Natural Resources Management Plan (INRMP) metrics meeting for Naval Installations in the Hampton Roads/Tidewater Area of Virginia & North Carolina. The US Navy developed a standard method for the collection and reporting of business metric information for its installation natural resources programs. These metrics are used to keep the INRMPs current and inform stakeholders of new information since the previous year's review. The Navy's Mid-Atlantic Region is now in the process of generating annual metrics for its installations in Hampton Roads for 2016 and we are requesting your participation and feedback in this exercise.

Over the years our INRMP Metrics Team/Partnership has grown and evolved. Our meetings meet the basic requirement to come to mutual agreements on the Navy Natural Resources metrics questions' answers and provide findings and recommendations associated with the questions. Our meetings also go beyond this basic requirement and include discussions on: hot topic items of concern within our region's ecosystems/watersheds; partnering opportunities; updates being made to and updates needing to be made to the existing INRMPs; and other items of interest brought to the table.

We are planning this year's meeting to occur 12 Oct 2016. This meeting will involve reviewing Navy's 2016 assessments for its bases around Hampton Roads, that currently have Sikes Act Required INRMPs, including: NAS Oceana, NALF Fentress, NASO Dam Neck Annex, NWS Yorktown, NWSY Cheatham Annex, NSAHR Northwest Annex, JEB Little Creek and JEBLC Ft. Story.

The focus of the meeting is to: 1. come to mutual agreements on the responses to the questions in the attached guide for each INRMP; 2. allow the Navy and each Partner Agency to share programmatic updates; 3. provide an opportunity for partnership development and networking; and 4. provide a forum to share important conservation opportunities and information. Closer to the meeting date we will send out documentation to help familiarize everyone with the

INRMP Metrics Database and Associated Questions. For those of you that have attended these meetings in the past you will notice some slight differences as information/questions have been added, removed and updated to the INRMP Metrics Datacall. Also, the presentation will be slightly different because the Navy transitioned the INRMP Metrics to a new, still web-based, data call-station.

The meeting is expected to be held at NAS Oceana, Public Works Building 820, 953 Hornet Dr. Virginia Beach VA 23460-2190 between 9:00 am and 4:00 pm. We do not expect the meeting to last the entire scheduled 7 hours. We scheduled the full day in the event that someone would like to tour/conduct an infield site visit of one or more of the associated installations. Often we work through lunch to try and attempt to finish the meeting by 1300 or 1400 hours. The group will take a vote to either break for lunch or work thru lunch. I recommend packing a lunch to be safe.

We have established a conference call-in line for individuals that cannot meet in person, but would like to participate in the group's discussions: Call-in 1-877-718-5284; and Participant code 5430144. If you are unable to attend in person we can email you the metrics and you can respond with comments, concerns or questions via email. We hope you or one of your staff members will be able to participate. (If you are wondering why you are on this mailing list, one of your State Wildlife, USFWS, NOAA-NMFS or Navy cohorts recommended that you be invited to this meeting.)

Directions: [Take Interstate 64 to interstate 264 east; take the 1st Colonial BLVD exit; turn right onto 1st Colonial Blvd, which turns into Oceana Blvd; continue along Oceana Blvd, after the Horse stables turn right onto Tom Cat Blvd (if you end up at General Booth Blvd you've gone too far). Go to the main gate off of Tomcat Blvd to gain access. A list of Non-Navy attendees will be kept at this gate. Once you have gone through the gate, you will drive down Tomcat to the roundabout and turn left onto Hornet Drive, continue on Hornet Dr. past the softball fields to Building 820, parking is adjacent to the building. If there is no parking in the front of the building, drive around the block, there is a large parking area off of D Ave with a walkway that leads to Bldg 820. Visitor Parking in front of the building is 1st come 1st served.]

Please confirm within the next couple of weeks if you plan to attend this meeting and if you are interested in conducting an in-field site visit. Please let us know which installation you'd like to visit and what you'd like to accomplish on that site visit (specific natural resources item of interest).

If you have any trouble accessing the installation or calling in please call me, Michael Wright, on my cell phone at 757-373-8531 so that we can resolve the issue.

We are looking forward to sharing our updates, hearing your updates, and planning for the future.

Sincerely,
Mike
Michael Wright
Natural Resources Manager (NASO and NSAHR NWA)
DoD Partners in Flight Rep. (VA)

Office: 757-433-3461
Cell: 757-373-8531
Fax: 757-433-2719

Address:
Naval Air Station Oceana
Public Works Department
Environmental Program Division
ATTN: Natural Resources
953 Hornet Dr.
Bldg. 820, Suite 206
Virginia Beach, VA 23460-2190

****
ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) - WE "CARE"
Comply with the rules
Always improve
Reduce waste
Eliminate pollution

-----Original Message-----
From: Wright, Michael F CIV NAVFAC MIDLANT, PWD Oceana
Sent: Thursday, October 06, 2016 9:00 AM
To: Podbesek, Jennifer A CIV NAVFAC MIDLANT, PWD Yorktown; Austin, Taylor S CIV NAVFAC MIDLANT, EV; Olexa, Thomas J CIV NAVFAC MIDLANT, PWD Yorktown; 'Hammond, John'; Waligora, Sharon L CIV NAVFAC MIDLANT, PWD Little Creek; Russell, Kyle B CIV NAVFAC MIDLANT, P)WD Little Creek; Chamberlain, Terry N CIV NAVFAC MIDLANT, PWD Oceana; Hicks, Linda CIV NAVFAC MIDLANT, PWD NSA Hampton Roads; Pulver, John J CIV NAVFAC MIDLANT, PWD Yorktown; 'Hoskin, Sumalee'; Edwards, Mark L CIV NAVFAC MIDLANT, PWD Oceana; 'Nystrom, Sarah <sarah_nystrom@fws.gov> (sarah_nystrom@fws.gov)'; Jones, Michael H CIV NAVFAC MIDLANT, EV; Carawan, Emmett CIV NAVFAC MIDLANT, EV; Crum, Pete CIV NAVFAC MIDLANT, EV; Bassi, Jessica CIV NAVFAC MIDLANT, EV; Waller, Blake E CIV NAVFAC MIDLANT, EV; Markham, Jack J CIV NAVFAC MIDLANT, EV; McGrogan, Lawrence F CIV NAVFAC MIDLANT, PWD Oceana; 'chris.ludwig@dcr.virginia.gov'; 'chris.turner@ncwildlife.org'; 'Ewing, Amy'; 'Engelmeyer, Todd'; Coe, Adam M CIV NAS Oceana, N32; 'Boettcher, Ruth (DGIF'; 'maria.dunn@ncwildlife.org'; 'david.l.o'brien@noaa.gov'; 'Acker, Pete'; 'donald_schwab@fws.gov'; 'Aherron, Mike (DOF) (mike.aherron@dof.virginia.gov)'; 'tim_craig@fws.gov'; 'Kleopfer, John (DGIF) (John.Kleopfer@dgif.virginia.gov)'; Page, Daren K CIV NAS Oceana, N32; 'Chad.Boyce@dgif.virginia.gov'; 'chad.thomas@ncwildlife.org'; 'jeremy.mccargo@ncwildlife.org'
Subject: RE: 2016 Navy Natural Resouces Annual Metrics Meeting Request

Hello Everyone:

I have had several requests for additional information in association with next week's meeting.

Attached for your reference in preparation for next week's meeting:

1. Reporting Unit Report Example, FY2016: These are essentially the questions that the Navy must answer and from which reports to Congress are created regarding INRMP signatory Agency(s) compliance with the Sike's Act. Many of these questions are the same or similar to questions we have answered during previous INRMP Metrics reviews. With this said, there are some new questions and some questions have been further clarified.

2. NASO/NALFF & NASO DNA, and NSAHR NWA 2015 Annual INRMP Metrics Packages Submittals: For these installations most questions will be answered similarly from 2015 to 2016; however, there will be additional clarification on a few of the focus areas (e.g.,: Ecosystem Integrity, updated information allows us to sub-divided acreages not reported under a National Vegetation Classification (NVC) associated ecological system into the appropriate NVC ecological system; project funding updates; etc.).

3. FY2016 ESOH Data Call, Attachment #8 – Natural Resources, Specific to the INRMP Metrics: Helps to clarify the reporting requirements and processes. Provides an understanding of how the 7 INRMP Metrics focus areas are scored.

<<...>> <<...>> <<...>>

If you would like to have copies of the FY2015 INRMP Metrics Packages for any of the other installation's in Hampton Roads we can get those out to you as well.

Sincerely,

Mike

-----Original Appointment-----
From: Wright, Michael F CIV NAVFAC MIDLANT, PWD Oceana
Sent: Wednesday, October 12, 2016 3:49 PM
To: Wright, Michael F CIV NAVFAC MIDLANT, PWD Oceana; Nystrom, Sarah <sarah_nystrom@fws.gov> (sarah_nystrom@fws.gov); Waller, Blake E CIV NAVFAC MIDLANT, EV; Austin, Taylor S CIV NAVFAC MIDLANT, EV; Russell, Kyle B CIV NAVFAC MIDLANT, P)WD Little Creek; Olexa, Thomas J CIV NAVFAC MIDLANT, PWD Yorktown
Cc: Chamberlain, Terry N CIV NAVFAC MIDLANT, PWD Oceana; Hicks, Linda CIV NAVFAC MIDLANT, PWD NSA Hampton Roads; Waligora, Sharon L CIV NAVFAC MIDLANT, PWD Little Creek; Podbesek, Jennifer A CIV NAVFAC MIDLANT, PWD Yorktown
Subject: 2016 Hampton Roads Naval Facilities and USFWS Region 5 (VA Field Office) INRMP Metrics Briefing
When: Thursday, October 13, 2016 9:30-11:00 (UTC-05:00) Eastern Time (US & Canada).
Where: Conference Call

If you wish to attend this meeting please provide me, Michael Wright, the phone number on which you wish to be called and I will conference call you into the meeting.

Sincerely,
Mike
Michael Wright
Natural Resources Manager (NASO and NSAHR NWA)
DoD Partners in Flight Rep. (VA)

Office: 757-433-3461
Cell: 757-373-8531
Fax: 757-433-2719

Address:
Naval Air Station Oceana
Public Works Department
Environmental Program Division
ATTN: Natural Resources
953 Hornet Dr.
Bldg. 820, Suite 206
Virginia Beach, VA 23460-2190

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ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) - WE "CARE"
Comply with the rules
Always improve
Reduce waste
Eliminate pollution

Reporting Unit Metrics Q&A Report: NAS OCEANA

Introduction

Reporting Unit Metrics Q&A Report: NAS OCEANA

Welcome to the Annual Navy Natural Resources Conservation Metrics!

This site has been designed to help guide you step-by step through a series of questions that will inform decision- makers on the status of your Natural Resources program. Data is being collected for fiscal year 2016. Questions followed by an asterisk * are mandatory and must be completed before the data call can be approved and forwarded to DoD. The User Guide and Training Brief can be found here. The FY16 DoD Environmental Data call memorandum can be found here.

Note:

Please click "Save" located at the bottom of each page to add your draft answers to the database. After you save if you leave or are logged out of the system, your answers will be retained the next time you log in. Click on the buttons at the top to jump to a different section.

Getting Started...

Please add all participants and attendees that were involved in the Annual Navy Natural Resources Conservation Metrics. The drop down list includes all people currently using the CN Web system and those entered using the blue 'Add Personnel to List' button. If the person you need to add is not in the pull down list, click the blue 'Add Personnel to List' button and fill out the required fields, indicated by an asterisk.

Note: The Navy Lead is the Navy POC responsible for the completion of the Metrics for this installation/site.

Reporting Unit Metrics Q&A Report: NAS OCEANA

1. Aherron, Michael
Virginia Department of Forestry
757-510-6456
mike.aherron@dof.virginia.gov

Is this person the Navy Lead?

	Yes
X	No

2. Austin, Taylor
757-341-0446
taylor.s.austin@navy.mil

Is this person the Navy Lead?

	Yes
X	No

3. Boettcher, Ruth
Virginia Department of Game and Inland Fisheries
757-709-0766
ruth.boettcher@dgif.virginia.gov

Is this person the Navy Lead?

_____ Yes
__X__ No

4. Carawan, Emmett
757-341-0495
emmett.carawan@navy.mil

Is this person the Navy Lead?

_____ Yes
__X__ No

5. Chamberlain, Terry
757-433-3437
terry.n.chamberlain@navy.mil

Is this person the Navy Lead?

_____ Yes
__X__ No

6. Engelmeyer, Todd
Virginia Department of Game and Inland Fisheries
804-829-6580
todd.engelmeyer@dgif.virginia.gov

Is this person the Navy Lead?

	Yes
X	No

7. Hicks, Linda
757-836-1862
linda.hicks1@navy.mil

Is this person the Navy Lead?

	Yes
X	No

8. Meadows, Richard
CNRMA - NASO
****
richard.j.meadows@navy.mil

Is this person the Navy Lead?

_____ Yes
__X__ No

9. Nystrom, Sarah
U.S. Fish and Wildlife Service
804-824-2413
sarah_nystrom@fws.gov

Is this person the Navy Lead?

_____ Yes
__X__ No

10. O'Brien, David
NOAA
301-427-8325
david.o'brien@noaa.gov

Is this person the Navy Lead?

_____ Yes
__X__ No

11. Olexa, Tom
757-887-7521
thomas.olexa@navy.mil

Is this person the Navy Lead?

_____ Yes
__X__ No

12. Rockwell, Shawn
NAVFAC ML PWD-Oceana
****
shawn.rockwell@navy.mil

Is this person the Navy Lead?

_____ Yes
__X__ No

13. Russell, Kyle
123-456-7890
Kyle.B.Russell@navy.mil

Is this person the Navy Lead?

_____ Yes
__X__ No

14. Turner, Chris
North Carolina Wildlife Resources Commission
252-221-9961
chris.turner@ncwildlife.org

Is this person the Navy Lead?

_____ Yes
__X__ No

15. Vincelette, Chad
CNRMA - NASO
****
chad.vincelette@navy.mil

Is this person the Navy Lead?

_____ Yes
__X__ No

16. Waligora, Sharon
757-462-5350
sharon.waligora@navy.mil

Is this person the Navy Lead?

	Yes
X	No

17. Waller, Blake
757-341-2109
blake.waller@navy.mil

Is this person the Navy Lead?

	Yes
X	No

18. Wright, Michael
757-433-3461
michael.f.wright@navy.mil

Is this person the Navy Lead?

X Yes

_____ No

INRMP Status

Navy INRMP Status Check

Objective: This purpose of this section of the Natural Resources Conservation Metrics data call is to gather required information associated with the Natural Resources program, specifically the status of Integrated Natural Resources Management Plans (INRMP). These questions have been added here to collect information that will support the Defense Environmental Program Annual Report to Congress (DEPARC) and Office of the Secretary of Defense Environmental Management Review (EMR). By combining these questions with responses to the Metric's seven (7) focus areas, Natural Resources Managers are faced with fewer annual data calls. Questions followed by an asterisk * are mandatory and must be completed before the data call can be approved and forwarded to DoD.

1. Is an INRMP necessary for this installation/site(s)? *

X Yes
_____ No

2. Is there currently a compliant INRMP that covers this/these installation/site(s)? *

X Yes
_____ No
_____ INRMP - Under Revision
_____ INRMP Under Development (First Version)

2.a. Enter the name of First Compliant INRMP

Integrated Natural Resources Management Plan Naval Air Station Oceana and Naval Auxiliary Landing Field Fentress

2.b. Date of First Compliant INRMP (Usually Dated 2001/2002) Format: MM/DD/YYYY

11/15/2001

2.c. What type of NEPA Documentation was done for the first compliant INRMP?

X EA / FONSI

_____ EIS / ROD

_____ NEPA document is currently under development

2.d. When was the NEPA completed for the first compliant INRMP? Format: MM/DD/YYYY

11/16/2001

2.e Name of the most current INRMP that covers this/these installation/site(s) *

Integrated Natural Resources Management Plan Naval Air Station Oceana and Naval Auxiliary Landing Field Fentress

2.e.1 Date of the most current INRMP that covers this/these installation/site(s). Format: MM/DD/YYYY

This date records when the Regional Commander/Commanding Officer endorsed (signed) the most recent INRMP (with valid NEPA coverage) and/or completed a review for operation and effect.
*

6/9/2015

2.f. Select the species where the INRMP was used to exempt critical habitat designation under ESA Section 4(a)(3)(B)(i) on this/these site(s). Select all that apply. Leave blank if not applicable. See i-note for bug work around. Please gauge your responses for this reporting period only.

3. Has a 5-year INRMP review for operation and effect been completed for the most recent INRMP?

Comment: There were two different 5 year review time periods: USFWS reviewed 12//19/2012 and NMFS, VDGIF, & Navy last reviewed between 02/11 - 06/09/2015. USFWS will receive INRMP for 5 year O&E review post 2016 INRMP Metrics Briefing.

X Yes
____ No
____ N/A
____ In Progress

Enter the date that the 5-year INRMP review was completed. Format: MM/DD/YYYY

6/9/2015

3.a. If a 5-year INRMP review for operation and effect been completed, did the review result in an addendum/appendix, update or revision of the INRMP?

____ Addendum / Amendment
X Update
____ Revision

3.b. What is the expected completion date of the Addendum/Amendment, Update, Revision? Format: MM/DD/YYYY

8/25/2015

3.c. If a 5-year INRMP review for operation and effect has not been completed; please explain why a review for operation and effect has not been completed?

3.d. Was the Mutual DoD & USFWS Guidelines for Streamlined Review of INRMP Updates to secure FWS approval and state approval for updated INRMPs used?

Comment: They guidelines came out after the reviews were completed; however, the basic concepts refelected in the guidelines were followed.

_____ Yes

__X__ No

3.d.1 Did using the guidelines expedite the process?

_____ Yes

_____ No

3.d.2. Why not?

IF IT HAS BEEN MORE THAN 3 YEARS SINCE A REVIEW FOR OPERATION AND EFFECT, ADMINISTRATIVE PROCESS SHOULD BE UNDERWAY IN CASE THE INRMP NEEDS TO BE UPDATED/REVISED.

Reporting Unit Metrics Q&A Report: NAS OCEANA

4. Has USFWS concurrence been received on the most recent INRMP or review for operation and effect?

X Yes
____ No
____ In Progress

4.a. If question 4. is "Yes" or "In Progress", which USFWS Region(s) are applicable? (Choose all that apply)

X Northeast

4.b List the Field Office, if applicable, that did or will sign concurrence documentation

X Virginia Field Office - Gloucester, VA

4.c.If question 4. is "Yes", what is the date of concurrence? Format: MM/DD/YYYY

12/19/2012

4.d. If question 4. is "No", what is the reason for the delay?

4.e Was an ESA Section 7 Consultation completed with USFWS for the INRMP?

Comment: Via their Online Application (IPAC system). At time of their review there were no Federal T&E species known to breed on the installation. We will be submitting a new USFWS O&E request this year and a T&E consultation may be required as the NLEB was documented on the installation in 2015.

X Yes
____ No
____ N/A
____ In Progress

4.f. Which USFWS field office do you regularly conduct ESA Section 7 consultations with typically?

X Virginia Field Office - Gloucester, VA

4.g. Did the Threatened and Endangered Species Listing and Recovery personnel participate in the INRMP review, update or revisions?

X Yes
____ No
____ N/A

5. Has NOAA Fisheries (NMFS) concurrence been received on the most recent INRMP or review for operation and effect?

X Yes
____ No
____ N/A

5.a. If question 5. is "Yes", which NOAA Fisheries (NMFS) Region(s) are involved? (Choose all that apply)

X Greater Atlantic

5.b Select the Local Office, if applicable, that did or will sign concurrence documentation.

X Virginia Field Office - Gloucester Point, VA

5.c. If question 5. is "Yes", what is the date of concurrence? Format: MM/DD/YYYY

5/29/2015

5.d. If question 5. is "No", what is the reason for the delay?

5.e Was an ESA Section 7 Consultation completed with NOAA Fisheries (NMFS) for the INRMP?

Yes

X No

N/A

5.f. Did the Threatened and Endangered Species Listing and Recovery personnel participate in the INRMP review, update or revisions?

X Yes

No

N/A

Reporting Unit Metrics Q&A Report: NAS OCEANA

6. Has State fish and wildlife agency(ies) concurrence been received on the most recent INRMP or review for operation and effect?

X Yes
_____ No
_____ In Progress
_____ N/A

6.a. If question 6. is "Yes", which State fish and wildlife agency(ies)? (Choose all that apply)

X Virginia Department of Game and Inland Fisheries - Henrico, VA

6.a. If question 6. is "In Process", which State fish and wildlife agency(ies)? (Choose all that apply)

6.b. If question 6. is "Yes", what is the date of concurrence? Format: MM/DD/YYYY

2/26/2015

6.c. If question 6. is "No", what is the reason for the delay?

7. If this/these site(s) is/are located on lands affected by tribal treaty rights or other known rights; were Federally-recognized Tribe(s) consulted with to develop or revise the Integrated Natural Resource Management Plan?

Comment: We have coordinated the INRMP with the NAVFAC MIDLANT Cultural Resources Manager. A Cultural affiliations study was awarded in 2013 for the MIDLANT installations to determine which tribes may have an affiliation interests over MIDLANT Naval Property (excluding NOSCs). The 1st Federally recognized tribe in VA is located in New Kent County, the Pamunkey. There are at least 11 tribes in VA, many of which are seeking and may receive Federal Recognition. There are 40+ tribes with interest in MIDLANT installations, many are not federally recognized, but are state recognized. Once tribes are identified with interest over this installation's property, coordination will be conducted regarding the INRMP with those tribes and will be coordinated thru the NAVFAC MIDLANT EV2 Cultural Resources program manager.

	Yes
X	No
	N/A

8. Are migratory birds, specifically birds of conservation concern, adequately addressed in the INRMP for this installation to support the mission and needed NEPA analyses?

Comment: In the INRMP, we: discuss Migratory Birds as they pertain to the MBTA; discuss Birds of Conservation Concern (BCC) in a more general manner; identify which known species occur on the installation; identify potential species that could occur on the installation; identify if species are on BCC or other special status lists; provide more detailed information on individual ESA/SAR species; and provide Best Management Practices to minimize and avoid potential impacts to Migratory Birds. In the INRMP we do not provide installation specific nor greater landscape population level detailed information on each of the confirmed present BCC species nor do we provide population specific information on the remaining potential to occur species of the 36 BCC with a potential to occur on the installation. The INRMP provides links to USFWS, State Wildlife, and other NGO National databases/information sources as references to obtain greater landscape level information on specific BCC species. To obtain more installation specific population level information would require additional funding for surveys, monitoring, and analysis. The installation monitors the status of species and seeks funding to conduct additional survey efforts and provides more specific data in the INRMP on ESA-Endangered, Threatened, Candidate, and Watchlist species at both Federal and State levels.

	Yes
X	No

9. If the INRMP was updated/revised did the INRMP require new or supplementation NEPA?

Comment: Each INRMP project undergoes environmental review to ensure compliance with updates to EV laws and regulations. No new or supplementation EAs or EISs have been completed since the 2008 revision of the INRMP. The NAVFAC MIDLANT NEPA department has determined that these projects are covered by the NEPA documentation already in existance. Discussions have been initiated regarding NEPA and newly designated federally listed species that do or have the potential to occur on the installation.

	Yes
X	No

9.a. If so, what was the type of NEPA?

_____ CATEX
_____ EA / FONSI
_____ EIS / ROD

9.b. When was the NEPA completed? Format: MM/DD/YYYY

10. Has the Regional Commander / Installation Commanding Officer concurrence been received on the most recent INRMP or review for operation and effect?

X Yes
_____ No
_____ In Progress

10.a. If question 10. is "Yes", what is the date of concurrence? Format: MM/DD/YYYY

6/9/2015

10.b. If question 10. is "No", what is the reason for the delay?

Reporting Unit Metrics Q&A Report: NAS OCEANA

11. If the Regional Commander has final authority over whether this/these site(s)' INRMP is compliant has the Regional Commander concurred with/signed the most recent INRMP or review for operation and effect?

_____	Yes
_____	No
X	N/A

11.a. If question 11. is "Yes", what is the date of concurrence? Format: MM/DD/YYYY

11.b. If question 11. is "No", what is the reason for the delay?

12. Please select (all that apply) and upload these documents. *

X	New or Current INRMP
X	INRMP NEPA documentation
X	5-year operation & effect review letter(s)
X	Signed Correspondence with Regulatory Partners
X	Annual review briefs to Commanding Officer or Regional Commander
_____	INRMP Waiver Letter
_____	Final INRMP not available

12.1 Please upload the following documents where applicable: INRMP *

12||NAS Oceana INRMP 2015

12.2 Please upload the following documents where applicable: INRMP NEPA documentation *

Comment: See associated appendix

12||NAS Oceana INRMP 2015

12.3 Please upload the following documents where applicable: 5-year operation & effect review letter(s) *

Comment: See front signature page and associated appendix

12||NAS Oceana INRMP 2015

12.4 Please upload the following documents where applicable: Other Signed Correspondence with Regulatory Partners *

Comment: See front signature page and associated appendix

12||NAS Oceana INRMP 2015

12.5 Please upload the following documents where applicable: Annual review briefs to Commanding Officer and/or Regional Commander *

Comment: See associated appendix

12||NAS Oceana INRMP 2015

12.6 Please upload the following documents where applicable: INRMP Waiver Letter *

13. Please confirm if you uploaded or sent any INRMP Related document(s). *

X Uploaded to Conservation Website Document Library
_____ Uploaded through Army Safe Website
_____ Sending / Sent by US Mail
_____ Not Uploaded / Sent

Army SAFE – Safe Access File Exchange

https://safe.amrdec.army.mil/SAFE/

US Mail

Naval Facilities Engineering Command Headquarters

Attn: Tom Mayes – EV2

1322 Patterson Ave. SE, Suite 1000

Washington Navy Yard, DC

20374-5065

Goals and Objectives

Please enter all Goals and Objectives as listed in the INRMP for this/these site(s). Enter Goals in the Goals Tab and the Objectives in the Objective tab. Enter Goals first so they can be linked to recommendations.

Please enter a short or abbreviated Goal and Objective name when creating them. To create a new Goal or Objective, click on the appropriate tab button and then click the blue 'Manage Goals' and 'Manage Objectives' buttons. You will be able to add the full text of the Goal or Objective later by clicking on the row with the shore name.

Goals

Enter or review, as appropriate, the Reporting Unit's Goals as documented in the current INRMP.

1. Implement an ecosystem based natural resources program that provides for conservation of natural resources in a manner that is consistent with the military mission; integrates and coordinates all natural resources management activities; provides for sustainable multipurpose uses of natural resources; and provides for public access for use of natural resources subject to safety and military security considerations.

Please enter the full description of the Goal:

Please describe any Key Considerations or Issues associated with this Goal.

2. Implement an adaptive management based natural resources program that provides for the identification and assessment of military mission operations and facility requirements, analysis and assessment of risks to natural resources, completion of needs assessment surveys, monitoring and preparation of the needs assessment results, updating natural resources inventories to ensure information is current, reanalysis and reassessment of risks to natural resources, and incorporation of adjustments into the overall NRP, as necessary (DoD 2013).

Please enter the full description of the Goal:

Please describe any Key Considerations or Issues associated with this Goal.

3. Implement an ecosystem management program that maintains and improves the sustainability and native biodiversity of ecosystems, considers ecological units and timeframes, supports sustainable human activities, develops a vision of ecosystem health, develops priorities and reconciling conflicts, developscoordinated approaches to work toward ecosystem health, relys on the best science and data available, uses goals and objectives to monitor and evaluate outcomes, uses adaptive management, and implements activities through existing installation plans and programs.

Please enter the full description of the Goal:

Please describe any Key Considerations or Issues associated with this Goal.

4. Utilize existing tools to assess the potential impacts of climate change to natural resources. Identify significant natural resources that are likely to remain on DoD lands or that may in the future occur on DoD lands due to climate change. When not in conflict with mission objectives, take steps to implement adaptive management to ensure the long-term sustainability of those resources that are anticipated to be impacted by climate change.

Please enter the full description of the Goal:

Please describe any Key Considerations or Issues associated with this Goal.

5. Interact with the surrounding community to develop positive and productive community involvement, participation, and educational opportunities. Develop partnerships with state and federal natural resources agencies, local colleges and universities, and local conservation groups.

Please enter the full description of the Goal:

Please describe any Key Considerations or Issues associated with this Goal.

6. Maintain sufficient number of and training of professional NR management and NR law enforcement presonnel.

Please enter the full description of the Goal:

Please describe any Key Considerations or Issues associated with this Goal.

Objectives

Enter or review, as appropriate, the Installation/site(s) Objectives as documented in the current INRMP. Associate Objectives with goals as appropriate.

1. Integrate management of forests, fish & wildlife, land and outdoor recreation opportunities, as practicable and consistent with the militaty mission and established land uses.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

2. Utilize planting techniques that encourages root growth.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

3. Reduce deer herd size.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

4. Removal of feral animals from the environment

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

5. Silvicultural systems that produce stand structures that approach the complexity and diversity of natural forests

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

6. avoid or minimize impacts to wetlands to the greatest extent practicable, to mitigate any unavoidable impacts in accordance with state and federal regulations, and to enhance wetland habitats where feasible

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

7. reducing nutrients and toxins, protecting stream corridors, enhancing and protecting wetlands, protecting priority watersheds, identifying and controlling invasive species on priority sites, and expanding conservation landscaping on federal facilities

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

8. establishing or enhancing riparian forest buffers along unprotected waterways and enforcing the buffer zones in which building is prohibited; and enhancing and protecting wetlands on degraded sites

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

9. incorporating LID and LEED concepts that reduce the rate of runoff, filter out pollutants, and facilitate the infiltration of water into the ground. Features such as filter strips, rain gardens, dry wells, bayscapes, and water quality treatment wetlands should be incorporated into all new development plans, and existing development should be assessed to determine if retrofitting is feasible

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

10. maintain and enhance landscaped areas and urban forests, while minimizing the use of energy, water, chemical herbicides, and fertilizers

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

11. minimize BASH potential around Installation airfields

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

12. conserve and promote conservation of game and nongame fish, wildlife and their habitats; particularly habitats of state or federally listed rare, threatened, or endangered fish or wildlife species

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

13. maintain and enhance habitat for resident and migratory bird species in areas that do not conflict with the BASH Program

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

14. balance wildlife population levels with habitat-carrying capacity

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

15. provide recreational opportunities for the military community and personnel

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

16. maintaining a diversity of ecological communities and enhancing habitat value where practicable

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

17. support the conservation of migratory birds through habitat conservation and enhancement, and to avoid the incidental take of migratory birds through military readiness actions in accordance with the MBTA to the greatest extent practicable

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

18. reduce the attractiveness to birds and wildlife by minimizing food sources, nesting sites, androosting habitat within the airfield operations area

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

19. protect all known and potentially occurring federally listed species in compliance with the federal ESA, and to give special consideration to state-listed species and other rare species

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

20. maintain the health and integrity of a diversity of healthy and productive natural forested ecosystems that support a full complement of native wildlife species

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

21. provide for sustained multipurpose uses to the extent consistent with the mission and ecosystem management

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

22. protect unique and sensitive natural areas and habitats

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

23. protect soil and water resources

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

24. foster understanding and awareness of the environment through educational conservation programs

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

25. Review plans and proposed actions to ensure consistency with the Virginia CZM Program and help obtain a federal CCD as required by the CZMA

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

26. Continue to maintain partnerships with DoD SERDP and the South Atlantic LCC to identify potential climate change impacts to the Installation and adaptive management techniques that can be implemented to ensure the long-term stability of Installation natural resources

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

27. Continue to implement management measures that support watershed protection in accordance with the Chesapeake Bay agreements and goals of the Chesapeake Bay Program, and initiatives that establish or enhance riparian forest buffers along unprotected waterways

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

28. Coordinate with appropriate Installation and NAVFAC departments to identify additional areas to enhance or establish riparian buffers. Establish reduced mowing and no mowing zones along selected ditches and wetlands, and plant appropriate native trees and shrubs where practicable

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

29. Review plans for projects that have the potential to impact wetlands and/or water quality against Installation wetland delineation and water resources maps, and assist the proponent of an action in applying for, reviewing, and obtaining all required federal, state, interstate, and local certifications and permits required by point and nonpoint pollution control, groundwater protection, dredge and fill operations, stormwater management programs and wetlands protection permits for any actions that may impact water quality or wetlands

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

30. Update Installation wetland delineations every five years

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

31. Review erosion and sediment control plans and SWP3 for construction projects and actions that disturb 10,000 ft2 (929 m2) or one or more ac (0.4 or more ha), respectively

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

32. Conduct frequent site visits during construction to ensure compliance with sediment erosion and control plans and to ensure BMPs are being implemented

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

33. Implement LID and LEED practices and other sustainable development into planned projects to the extent practicable

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

34. Assist ERP RPM to identify potential impacts to natural resources caused by the release of contaminants, participate in the ERP decision-making process as appropriate, attend Restoration Advisory Board meetings, review and comment on ERP documents, and ensure response actions are undertaken in a manner that minimizes impacts to natural resources on the Installation

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

35. Manage oil and hazardous substances to protect water quality and other natural resources

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

36. Development and implement plans for removal of cattails and control of grass carp within wetland mitigation areas of the Installation where these species are impacting postrestoration success

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

37. Review all plans where tree removal is proposed to ensure compliance with this INRMP and associated instructions. Develop recommendations for tree protection measures or mitigation for lost trees, or assist with the selection of alternate sites

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

38. Review new and revised landscaping plans and contracts (including plant species lists) to ensure conformance with EO 13148, EO 13112, and Navy policy on beneficial landscaping. Promote the use of beneficial landscaping practices and the importance of using native species

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

39. Assist with hazardous tree recognition and removal

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

40. Participate in National Arbor Day Foundation’s Tree City USA program. Submit a recertification application, forest work plan, and proclamation in support of Arbor Day to the VDOF by 31 December each year

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

41. Coordinate an annual, joint Arbor Day–Earth Day celebration event. Utilize opportunities such as Earth Day and Arbor Day to plant additional native species at Installation sites identified by the NR personnel

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

42. Review all development plans and actions where tree removal and pruning is proposed and provide recommendations for tree protection, mitigation for lost trees, or selection of alternate sites.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

43. Continue to coordinate with VDOF to provide pruning and tree care instruction for the FEAD, Disaster Preparation Team, and others concerned with tree care. Offer training sessions on an as-needed basis.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

44. Continue to coordinate with MWR personnel on natural resources issues such as tree care and reducing nonpoint pollution at recreational facilities on an as needed-basis.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

45. Conduct a habitat assessment and species inventory of the nearshore environment at NASO.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

46. Manage SIAs and other habitats to support pollinators, and rare, threatened, and endangered plant and animal species known or with the potential to occur at the Installation.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

47. Manage airfield clear zones, and adjacent habitats, and agricultural outlease lands to minimize BASH risk.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

48. Arrange a consultation with the VDCR-DNH if changes in land use or management practices are proposed for any of the Installation SIAs to obtain recommendations for minimizing impacts to these resources.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

49. Assist with the removal of invasive plants and/or noxious weeds in identified infestation areas.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

50. Conduct a targeted field assessment to identify and treat all invasive species that currently occur at the SIAs, especially in locations where rare plants species have been observed to protect the continued existence of these plants.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

51. Oversee agricultural ditch maintenance practices to ensure adequate vegetative cover and 3-ft (1-m) buffers are maintained.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

52. Coordinate with NAVFAC Mid-Atlantic environmental staff on enforcement of conservation measures on agricultural outlease parcels, and provide oversight of agricultural outlease agreements.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

53. Complete ongoing forest inventories

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

54. Assist Cultural Resources Manager in resource protection management of cultural resources.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

55. Complete the Environmental Checklist (see Appendix A), as needed, for those natural resources management actions that may affect a regulated resource, or other Navy managed environmental resource. Conduct associated consultations and required mitigations, and acquire associated permits in coordination with the appropriate Navy environmental media manager.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

56. Conserve and promote conservation of game and nongame fish, wildlife and their habitats; particularly habitats of state or federally listed rare, threatened, or endangered fish or wildlife species known to occur at the Installation.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

57. Continue to implement natural resources management strategies and recommendations that also satisfy the goals and objectives of the Virginia SWAP in conserving the state's natural resources.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

58. Coordinate with the USFWS, NOAA NMFS, and/or VDGIF as required, when actions have the potential to affect federal or state listed fish and wildlife species.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

59. Maintain and enhance habitat for resident and migratory bird species and other wildlife in areas that do not conflict with the BASH Program.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

60. NR staff will coordinate with and obtain required permits from the appropriate state and federal agencies for any Installation activities that have the potential to impact terrestrial and marine resources.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

61. NR personnel will continue to maintain a database of all marine animal sightings and strandings (dead or live) that occur on NASO.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

62. NR personnel will receive training in the identification of marine mammals and sea turtles, and be available to assist other personnel in identification of these species when needed.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

63. Conduct period surveys to document changes in fish and wildlife species occurrences at the Installation, and to include surveys for newly listed (state and federal ESAs) species.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

64. Develop an inventory and monitoring program for any federally listed fish or wildlife species that are observed at the Installation.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

65. Implement protective measures for rare, threatened, and endangered wildlife species known to occur at the Installation, in consideration of military mission and BASH Program requirements.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

66. Implement protective measures for rare, threatened, and endangered migratory bird species that are identified at the Installation, including maintaining at least a ¼-mi (0.4-km) buffer around nesting sites, establishing fenced or posted wildlife protection areas, keeping pets leashed and cats indoors, controlling predators, managing native vegetation and controlling invasive vegetation at nest sites, providing artificial nest sites, implementing mowing restrictions for protection of ground-nesting species, and establishing and maintaining an emergency response plan for oil and chemical spills.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

67. Conduct annual inspections and maintenance of bird and bat nest boxes during the fall.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

68. Monitor nesting/roosting activity at bird and bat boxes throughout the nesting/roosting season.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

69. Implement management techniques established in the Installation BASH Program Plan (Appendix K) including CZ management and ensuring compatible land use in the vicinity of airfields on the Installation.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

70. Continue to work with Navy staff and USDA APHIS WS biologists to reduce the BASH potential around Installation airfields, and to conduct control and surveys for birds and white-tail deer in support of the BASH Program as needed.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

71. Continue to maintain USFWS migratory bird depredation and eagle take permits, and VDGIF kill permits for control of birds and mammals in support of the BASH Program.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

72. Implement mowing restrictions along forest edge habitat for protection of timber (canebrake) rattlesnake Coastal Plain population as recommended by VDGIF, and provide training to all mowing contractors for identification of this species. Observations of timber (canebrake) rattlesnake should be reported to the NRM.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

73. Develop and distribute an information sheet on conservation measures for protection of timber (canebrake) rattlesnake to all mowing contractors working at the Installation.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

74. Implement controlled burns to reduce fuel loads and enhance wildlife habitat in accordance with the Installation Prescribed Burn and Smoke Management Plan and the Installation BASH Program.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

75. Update the Prescribed Burn and Smoke Management Plan (2010) annually to reflect accomplishments and set new goals.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

76. Arrange a consultation with the VDCR-DNH if changes in land use or management practices are proposed for any of the Installation SIAs to obtain recommendations for minimizing impacts to these resources and the rare, threatened, and endangered species associated with these areas.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

77. Conduct a habitat assessment and species inventory of the nearshore environment at NASO.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

78. Balance wildlife population levels with habitat-carrying capacity, including cooperating with VDGIF to set annual hunting seasons and bag limits at the Installation.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

79. Continue to collect, summarize, and report deer harvest data annually to VDGIF to help assess deer population levels and herd condition.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

80. Assist with the removal of nuisance and invasive wildlife as needed.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

81. Implement management strategies developed upon results of the nutria and coyote surveys and the nuisance wildlife management plan that is currently being prepared for the Installation.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

82. Continue to provide recreational opportunities for the military community and NASO and NALFF personnel through implementation of the fishing and hunting programs, and other outdoor recreational activities.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

83. Have appropriate NR staff attend annual CLE refresher courses.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

84. Review all plans where tree removal is proposed to ensure compliance with this INRMP and associated instructions. Develop recommendations for tree protection measures or mitigation for lost trees, or assist with the selection of alternate sites.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

85. Review new and revised landscaping plans and contracts (including plant species lists) to ensure conformance with EO 13148, EO 13112, and Navy policy on beneficial landscaping.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

86. Promote the use of beneficial landscaping practices and the importance of using native species.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

87. Assist with hazardous tree recognition and removal.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

88. Conduct fire effects monitoring subsequent to each prescribed burn to assess whether objectives are being met.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

89. Maintain firebreaks and fire lines for each burn unit as needed.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

90. Coordinate timber harvesting or salvage operations with the NAVFAC Regional Forester as required.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

91. Coordinate with the NAVFAC Regional Forester to assess impacts of any proposed MILCON projects on forest and, where practicable, arrange timber sales.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

92. Monitor forest stands to control southern pine beetle and other insect and disease outbreaks.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

93. Continue to provide outdoor recreation opportunities for Installation personnel and their authorized guests to the maximum extent possible within the constraints of the military mission and capability of available natural resources.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

94. Continue to foster understanding and awareness of the environment through educational conservation programs and distribution of environmental education pamphlets and brochures, and posting notices and information on Navy websites and social media, including notices about relevant notices of disease outbreaks that may affect NASO and NALFF personnel and guests, and promotion of preventative measures to limit their spread and transmission.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

95. Assess the potential for providing adaptive equipment for disabled military personnel authorized to participate in hunting and fishing activities at the Installation.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

96. Evaluate the potential to develop a recreational fishery at Dump Pond, within the concrete disposal site north of Southern Boulevard.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

97. Participate in DoD Fish and Wildlife Law Enforcement training and Federal Phase 1 Law Enforcement training.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

98. Routinely patrol fishing and hunting areas of the Installation to ensure people recreating are complying with natural resources regulations and policies.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

99. Continue to pursue partnerships with local, state, and federal agencies and NGOs to offer recreational and research use of the Installation as appropriate.

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

100. enforcement of natural resources laws and regulations

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

101. no net loss in the capability of military lands to support the military mission of the Installation. Conserve the environment for the purpose of the military mission (no net loss in the capability of military installation lands to support the military mission of the installation).

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

102. limit or stabilize the population of deer on the installation

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

103. support the conservation of migratory birds through a number of measures including conservation objectives identified by PIF for the Mid-Atlantic Coastal Plain region

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

104. identifying and maintaining significant blocks of mixed upland forest, and considering the value of hardwood-dominated forests in management decisions;

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

105. preventing loss of forested wetlands

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

106. avoiding conversion of mixed forests or hardwood-dominated forests to pine monocultures

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

107. sing open spacing for plantings and conducting multiple thinnings in pine plantations to delay canopy closure and to promote growth of understory vegetation

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

108. shifting management of early successional habitats greater than 20 ac (8 ha) in size to grassland habitat, and converting smaller early successional parcels to shrubland

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

109. monitoring and controlling infestations of invasive species within freshwater, estuarine, and wetland habitats

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

110. identifying sensitive habitats in oil spill response plans

Select the INRMP Goal that this Objective applies to.

Enter full description of Objective.

Enter Key Considerations if applicable.

1 - Ecosystem Integrity

Focus Area Score 0.88

Per DoD Instruction 4715 and OPNAV Manual 5090 the goal of ecosystem management is to ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Ecosystems are functioning units of nature consisting of complex networks of relationships between land, water, and living resources and are subjected to various stressors ranging from human impacts to climate change, and as such, need to be managed in a way that allows for mitigation, adaptation, and long-term sustainability on a regional basis. The intent of this module is to define the ecosystems that occur on the installation/sites. The information will assess the integrity of these ecosystems and inform the annual Navy Natural Resource Conservation Metrics and reporting requirements.

Ecosystem classifications have been preloaded under the Ecosystem Integrity button. The list of ecosystems is comprised of (1) terrestrial ecosystems identified in Nature Serve's, "Ecological Systems of the United States: A Working Classification of US Terrestrial Systems" and (2) marine ecosystems identified in NOAA's Coastal and Marine Ecological Classification Standard. For additional information on these classification schemes, go directly to the Nature Serve's ecosystem online reference or view a list of terrestrial ecosystems by Land Cover Classes, Biogeographic Divisions, and Ecological Systems. Additionally, go directly to the CMECS Catalogue of Units, view their Standard or view a list of marine ecosystems, which only includes the Benthic Biotic, Surface Geology, and Water Column components of the classification scheme. Locally-defined ecosystems may be added to capture specific INRMP details and program management.

All questions followed by an asterisk * are mandatory and must be completed before the datacall can be approved and forwarded to DoD.

To start populating ecosystem information, click the gray 'Ecosystem' button on the upper right side of the screen.

Ecosystems

Focus Area Score 0.76

Please validate (add/delete) the list of ecosystems below, add as necessary if none are listed, and ensure that they are correct. To **ADD** an ecosystem to the site/installation click the blue 'Select EcoSystems' button in the upper left. If you need an ecosystem that is not listed contact Tom Mayes (tom.mayes@navy.mil) or Tammy Conkle (Tamara.Conkle@navy.mil). Click on an Ecosystem row to view or update answers about each Ecosystem.

1. Agricultural Land

1.1. Has the ecosystem been identified in the INRMP? *

- X Yes
- ____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

- ____ Fully Achieved
- X Somewhat Achieved
- ____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

- X Actions have had a positive effect on conditions
- ____ Actions have had a limited effect on conditions
- ____ Actions have not been effective

Reporting Unit Metrics Q&A Report: NAS OCEANA

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

- [X] Ecosystem fragmentation is the result of five (5) of the phenomena
- [ ] Ecosystem fragmentation is the result of four (4) of the phenomena
- [ ] Ecosystem fragmentation is the result of three (3) of the phenomena
- [ ] Ecosystem fragmentation is the result of two (2) of the phenomena
- [ ] Ecosystem fragmentation is the result of one (1) of the phenomena
- [ ] No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

- [ ] Completely Vulnerable
- [ ] Severely Vulnerable to Stress
- [ ] Highly Vulnerable to Stress
- [X] Moderately Vulnerable to Stress
- [ ] Slightly Vulnerable to Stress
- [ ] Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

- [ ] Not effectively managed
- [ ] Minimally effective management
- [X] Moderately effective management
- [ ] Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

- [ ] Condition is worse on the site(s)
- [X] Condition is similar both on and off the site(s)
- [ ] Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

1402.85

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

2. Altered Vegetation and Conifer Plantation

1.1. Has the ecosystem been identified in the INRMP? *

X Yes
____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

____ Fully Achieved
X Somewhat Achieved
____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions
____ Actions have had a limited effect on conditions
____ Actions have not been effective

Reporting Unit Metrics Q&A Report: NAS OCEANA

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
	Severely Vulnerable to Stress
X	Highly Vulnerable to Stress
	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
	Condition is similar both on and off the site(s)
X	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

432.8

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

3. Atlantic Coastal Plain Embayed Region Tidal Salt & Brackish Marsh

1.1. Has the ecosystem been identified in the INRMP? *

X Yes
____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

____ Fully Achieved
X Somewhat Achieved
____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions
____ Actions have had a limited effect on conditions
____ Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

- ____ Ecosystem fragmentation is the result of five (5) of the phenomena
- ____ Ecosystem fragmentation is the result of four (4) of the phenomena
- ____ Ecosystem fragmentation is the result of three (3) of the phenomena
- ____ Ecosystem fragmentation is the result of two (2) of the phenomena
- ____ Ecosystem fragmentation is the result of one (1) of the phenomena
- X No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

- X Completely Vulnerable
- ____ Severely Vulnerable to Stress
- ____ Highly Vulnerable to Stress
- ____ Moderately Vulnerable to Stress
- ____ Slightly Vulnerable to Stress
- ____ Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

- ____ Not effectively managed
- ____ Minimally effective management
- X Moderately effective management
- ____ Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

- ____ Condition is worse on the site(s)
- ____ Condition is similar both on and off the site(s)
- X Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

9.86

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

4. Atlantic Coastal Plain Small Brownwater River Floodplain Forest

1.1. Has the ecosystem been identified in the INRMP? *

- [X] Yes
- [ ] No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

- [ ] Fully Achieved
- [X] Somewhat Achieved
- [ ] Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

- [X] Actions have had a positive effect on conditions
- [ ] Actions have had a limited effect on conditions
- [ ] Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
	Severely Vulnerable to Stress
X	Highly Vulnerable to Stress
	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
	Condition is similar both on and off the site(s)
X	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

426.8

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

5. Estuarine Shallow Water

1.1. Has the ecosystem been identified in the INRMP? *

- [X] Yes
- [ ] No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

- [ ] Fully Achieved
- [X] Somewhat Achieved
- [ ] Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

- [X] Actions have had a positive effect on conditions
- [ ] Actions have had a limited effect on conditions
- [ ] Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

- ____ Ecosystem fragmentation is the result of five (5) of the phenomena
- ____ Ecosystem fragmentation is the result of four (4) of the phenomena
- ____ Ecosystem fragmentation is the result of three (3) of the phenomena
- ____ Ecosystem fragmentation is the result of two (2) of the phenomena
- ____ Ecosystem fragmentation is the result of one (1) of the phenomena
- X No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

- X Completely Vulnerable
- ____ Severely Vulnerable to Stress
- ____ Highly Vulnerable to Stress
- ____ Moderately Vulnerable to Stress
- ____ Slightly Vulnerable to Stress
- ____ Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

- ____ Not effectively managed
- ____ Minimally effective management
- X Moderately effective management
- ____ Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

- ____ Condition is worse on the site(s)
- X Condition is similar both on and off the site(s)
- ____ Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

70.73

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

6. Forest

1.1. Has the ecosystem been identified in the INRMP? *

X Yes
____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

____ Fully Achieved
X Somewhat Achieved
____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions
____ Actions have had a limited effect on conditions
____ Actions have not been effective

Reporting Unit Metrics Q&A Report: NAS OCEANA

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
X	Severely Vulnerable to Stress
	Highly Vulnerable to Stress
	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
	Condition is similar both on and off the site(s)
X	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

123.36

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

7. Freshwater Ponds and Lakes

1.1. Has the ecosystem been identified in the INRMP? *

X Yes
____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

____ Fully Achieved
X Somewhat Achieved
____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions
____ Actions have had a limited effect on conditions
____ Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
X	Severely Vulnerable to Stress
	Highly Vulnerable to Stress
	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
	Condition is similar both on and off the site(s)
X	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

46.24

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

8. Northern Atlantic Coastal Plain Basin Swamp & Wet Hardwood Forest

1.1. Has the ecosystem been identified in the INRMP? *

X Yes
____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

____ Fully Achieved
X Somewhat Achieved
____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions
____ Actions have had a limited effect on conditions
____ Actions have not been effective

Reporting Unit Metrics Q&A Report: NAS OCEANA

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
X	Severely Vulnerable to Stress
	Highly Vulnerable to Stress
	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
	Condition is similar both on and off the site(s)
X	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

25.69

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

9. Northern Atlantic Coastal Plain Stream & River

1.1. Has the ecosystem been identified in the INRMP? *

X Yes

_____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

_____ Fully Achieved

X Somewhat Achieved

_____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions

_____ Actions have had a limited effect on conditions

_____ Actions have not been effective

Reporting Unit Metrics Q&A Report: NAS OCEANA

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

- ____ Ecosystem fragmentation is the result of five (5) of the phenomena
- ____ Ecosystem fragmentation is the result of four (4) of the phenomena
- ____ Ecosystem fragmentation is the result of three (3) of the phenomena
- ____ Ecosystem fragmentation is the result of two (2) of the phenomena
- ____ Ecosystem fragmentation is the result of one (1) of the phenomena
- X No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

- X Completely Vulnerable
- ____ Severely Vulnerable to Stress
- ____ Highly Vulnerable to Stress
- ____ Moderately Vulnerable to Stress
- ____ Slightly Vulnerable to Stress
- ____ Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

- ____ Not effectively managed
- ____ Minimally effective management
- X Moderately effective management
- ____ Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

- ____ Condition is worse on the site(s)
- ____ Condition is similar both on and off the site(s)
- X Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

54.88

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

10. Scrubland

1.1. Has the ecosystem been identified in the INRMP? *

X Yes

_____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

_____ Fully Achieved

X Somewhat Achieved

_____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions

_____ Actions have had a limited effect on conditions

_____ Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
	Severely Vulnerable to Stress
	Highly Vulnerable to Stress
X	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
X	Condition is similar both on and off the site(s)
	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

426.13

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

11. South-Central Interior Small Stream & Riparian

1.1. Has the ecosystem been identified in the INRMP? *

- [X] Yes
- [ ] No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

- [ ] Fully Achieved
- [X] Somewhat Achieved
- [ ] Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

- [X] Actions have had a positive effect on conditions
- [ ] Actions have had a limited effect on conditions
- [ ] Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
X	Severely Vulnerable to Stress
	Highly Vulnerable to Stress
	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
	Condition is similar both on and off the site(s)
X	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

1.57

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

12. Southern Atlantic Coastal Plain Depression Pondshore

1.1. Has the ecosystem been identified in the INRMP? *

X Yes

_____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

_____ Fully Achieved

X Somewhat Achieved

_____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions

_____ Actions have had a limited effect on conditions

_____ Actions have not been effective

Reporting Unit Metrics Q&A Report: NAS OCEANA

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

- ____ Ecosystem fragmentation is the result of five (5) of the phenomena
- ____ Ecosystem fragmentation is the result of four (4) of the phenomena
- ____ Ecosystem fragmentation is the result of three (3) of the phenomena
- ____ Ecosystem fragmentation is the result of two (2) of the phenomena
- ____ Ecosystem fragmentation is the result of one (1) of the phenomena
- X No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

- X Completely Vulnerable
- ____ Severely Vulnerable to Stress
- ____ Highly Vulnerable to Stress
- ____ Moderately Vulnerable to Stress
- ____ Slightly Vulnerable to Stress
- ____ Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

- ____ Not effectively managed
- ____ Minimally effective management
- X Moderately effective management
- ____ Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

- ____ Condition is worse on the site(s)
- ____ Condition is similar both on and off the site(s)
- X Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

1.12

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

13. Southern Atlantic Coastal Plain Mesic Hardwood Forest

1.1. Has the ecosystem been identified in the INRMP? *

X Yes

_____ No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

_____ Fully Achieved

X Somewhat Achieved

_____ Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

X Actions have had a positive effect on conditions

_____ Actions have had a limited effect on conditions

_____ Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
	Severely Vulnerable to Stress
X	Highly Vulnerable to Stress
	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
	Condition is similar both on and off the site(s)
X	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

59.18

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

14. Southern Atlantic Coastal Plain Nonriverine Swamp & Wet Hardwood Forest

1.1. Has the ecosystem been identified in the INRMP? *

- [X] Yes
- [ ] No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

- [ ] Fully Achieved
- [X] Somewhat Achieved
- [ ] Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

- [X] Actions have had a positive effect on conditions
- [ ] Actions have had a limited effect on conditions
- [ ] Actions have not been effective

Reporting Unit Metrics Q&A Report: NAS OCEANA

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
X	Severely Vulnerable to Stress
	Highly Vulnerable to Stress
	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
	Condition is similar both on and off the site(s)
X	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

1688.66

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

15. Urban, High Density

1.1. Has the ecosystem been identified in the INRMP? *

- [X] Yes
- [ ] No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

- [ ] Fully Achieved
- [X] Somewhat Achieved
- [ ] Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

- [X] Actions have had a positive effect on conditions
- [ ] Actions have had a limited effect on conditions
- [ ] Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
	Severely Vulnerable to Stress
	Highly Vulnerable to Stress
X	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
X	Condition is similar both on and off the site(s)
	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

1485.75

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

16. Herbaceous

1.1. Has the ecosystem been identified in the INRMP? *

- [X] Yes
- [ ] No

1.2. If the ecosystem has been identified in the INRMP, to what degree are the INRMP goals and objectives being achieved? *

- [ ] Fully Achieved
- [X] Somewhat Achieved
- [ ] Not Achieved

1.3. What is the level of effect Natural Resources management actions have had on desired outcomes within the installation/site? *

- [X] Actions have had a positive effect on conditions
- [ ] Actions have had a limited effect on conditions
- [ ] Actions have not been effective

1.4. To what extent is the ecological system on the site(s) fragmented due to land or water conversion during the reporting period? *

	Ecosystem fragmentation is the result of five (5) of the phenomena
	Ecosystem fragmentation is the result of four (4) of the phenomena
	Ecosystem fragmentation is the result of three (3) of the phenomena
	Ecosystem fragmentation is the result of two (2) of the phenomena
	Ecosystem fragmentation is the result of one (1) of the phenomena
X	No fragmentation

1.5. To what degree is the ecological system vulnerable to stressors? *

	Completely Vulnerable
	Severely Vulnerable to Stress
	Highly Vulnerable to Stress
X	Moderately Vulnerable to Stress
	Slightly Vulnerable to Stress
	Not Vulnerable to Stress

1.6. Is the ecosystem effectively managed to sustain viable populations of species? *

	Not effectively managed
	Minimally effective management
X	Moderately effective management
	Effectively managed

1.7. How does the ecosystem's condition within the site(s) compare to the condition outside the site(s)? *

	Condition is worse on the site(s)
X	Condition is similar both on and off the site(s)
	Condition is better on the site(s)

1.8. How many acres of this ecosystem have been identified on the installation?

2044.98

Reporting Unit Metrics Q&A Report: NAS OCEANA

1.9. How many acres of this ecosystem were conserved, enhanced or restored this past fiscal year?

0

Encroachment

Focus Area Score 1.00

An Encroachment Action Plan (EAP) is the primary tool and process which results in the identification, quantification, mitigation, and prevention of the potential encroachment challenges to an installation or a range. NAVFAC provides planning, environmental, legal, real estate support, and program management oversight for the Commander, Navy Installations Command (CNIC) Encroachment Management program. Per OPNAVINST 11010.40, Navy natural resources managers shall coordinate with mission component commands, COs of Navy installations, range COs, range complex coordinators, enhanced readiness teams, community plans and liaison officers and others with roles and responsibilities for encroachment identification, quantification, mitigation, and prevention.

1.10. Are conservation easements, or buffers, in place to provide an ecosystem integrity benefit on the site(s)? *

Comment: We do have established wetland and stream buffers on base. There are easement and buffers that could be pursued that would benefit the ecosystem integrity requirement of the INRMP; however no EAP easements were added in FY2016. There are existing easements and buffers that already do this, but they are not considered conservation easements/buffers they are AICUZ. We are actively participating in encroachment and easement discussions and looking into how we can add a conservation component.

	No = opportunity exists, but easements/buffers have not been pursued
X	Yes
	N/A = no opportunity, development is immediately adjacent to installation

1.11. How many miles of shoreline habitat are conserved, enhanced or restored this fiscal year? (miles)

0

1.12. How many acres of aquatic habitat are conserved, enhanced or restored this fiscal year? (acres)

0

Reporting Unit Metrics Q&A Report: NAS OCEANA

Please enter Findings and Recommendations. Findings and Recommendations serve as additional clarification to the answers provided for this Focus Area, and they are encouraged in order to provide a better understanding of existing activities, issues to be addressed, and unique circumstances.

1. Findings

In a review of the FY15 final report that either some NASO DNA INRMP ecosystems mistakenly got reported with the NASO/NALFF INRMP ecosystems or some ecosystems identified during a desktop analysis in preparation for the final vegetation community analysis mistakenly was entered into the Metrics . The FY16 Metrics were updated to reflect the FY15 received Final Vegetation Classification applicable ecosystems.

Several Ecosystems will be altered in upcoming years to support mission requirements to reduce frequency interference due to vegetation height obstructions. An updated Prescribed and Wildland Fire Management Plan is being developed in support of enhancing Ecosystem integrity, supporting military mission & safety requirements, and supporting species of concern conservation. INRMP does not specifically discuss each of these ecosystems, INRMP just supplies a map identifying these ecosystems. INRMP does not identify stressors and threats to these ecosystems.

1. Recommendations

Continue efforts to document and enhance ecosystem integrity, ensuring to document ecosystem conversions that occur due to military mission requirements. Obtain new/updated Vegetation Community Layers after conversion requirements have been implemented. Prior to implementation of Ecosystem conversion and Prescribed/Wildland Fire Management Plan Implementation ensure coordination has been completed with USFWS, State Wildlife Agencies, and USACE. INRMP needs to be updated to discuss each of these ecosystems. INRMP needs to identify stressors and threats to these ecosystems. INRMP needs to identify health indicators for these ecosystems (in FY14, USFWS recommended utilizing Dead or Stressed Trees as an indicator of Wetland Forest Health). INRMP needs to identify the level of importance of each ecosystem within the Ecoregion (need to clearly define, is this watershed, or other scale designation) and how the installation's portion of this community/ecosystem contributes to the overall community (is this a noncontiguous/isolated parcel less than 10% of the total community type in the ecoregion; is this the only known occurrence of this community type in the ecoregion; etc.). Utilize the most current Vegetation Community/Ecosystem layers for the installation to target species specific surveying efforts.

2 - Listed Species Critical Habitat

Focus Area Score 0.82

Listed Species & Critical Habitat

Focus Area Purpose: Evaluates the extent to which federally listed species have been identified and the INRMP provides conservation benefits to these species and their habitats.

Supplemental Information: The intent of this Focus Area is to identify the federally listed species that occur on a Navy installation, as well as assess if an INRMP provides the conservation benefits necessary to preclude designation of critical habitat for a particular species. In addition, information is collected about Proposed and Candidate Species and also about State, Local and other Species of interest. The USFWS has defined criteria to determine if an INRMP provides adequate special management or protection. These criteria must be detailed in the INRMP to demonstrate that designation of critical habitat is not necessary and that the installation is implementing the necessary measures to protect and conserve the habitat. The list of available species is derived from USFWS and NMFS data sources tracking the status of species worldwide plus those entered by navy users. Species are automatically placed into the correct table based upon species population code and its status. If a species status changes over the year users will not need to manually move the species from one type of table to the other, i.e. Threatened and Endangered, Proposed and Candidate, and State, Local, and other.

Instructions: Please create and or review the site(s) list of species for each of the three groups of species statuses and ensure that they are correct. To **ADD** a species to the site select a species status tab button, click the blue 'Select Species button', type the filters you wish to filter on and click the blue 'Filter Results' button for the filtered species list. Clicking the blue Common Name of a species will take you to ECOS's web site for the selected species. Clicking the row of the species population applicable to the site(s) and pressing the blue 'Save Selected Species' button will add the species to the site(s) list of species. Note you do not need to be in any specific species status tab, the system will automatically place the species correctly. Also from the blue 'Select Species' button on each of the three specific species status tabs you can view more about the species, delete it from the site(s) and also manage which sites the species resides using the blue 'Manage' button.

Select the name of the preloaded species to answer the questions for the current reporting period. To propose adding a species that is not in the database list or to propose a change or delete a species from the list click the main menu 'Species' then the submenu 'Search / Update'; from there you can propose all the above.

Please answer the questions for each of the species selected from the preloaded list for each of the three species status tab buttons. Questions are tailored to the species status. Last, please answer the questions in the 'Unoccupied Critical Habitat' tab button.

Questions followed by an asterisk * are mandatory and must be completed before the datacall can be approved and forwarded to DoD.

Federal Status Codes

(E) Endangered. A species in danger of extinction throughout all or a significant portion of its range.

(T) Threatened. A species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

(C) Candidate. A species under consideration for official listing for which there is sufficient information to support listing.

SAE, E(S/A) Endangered due to similarity of appearance. A species that is endangered due to similarity of appearance with another listed species and is listed for its protection. Species listed as E(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation.

SAT, T(S/A) = threatened due to similarity of appearance. A species that is threatened due to similarity of appearance with another listed species and is listed for its protection. Species listed as T(S/A) are not biologically endangered or threatened and are not subject to Section 7 consultation.

(EXPE, XE) Experimental essential population. A species listed as experimental and essential.

(EXPN, XN) Experimental non-essential population. A species listed as experimental and non-essential. Experimental, nonessential populations of endangered species (e.g., red wolf) are treated as threatened species on public land, for consultation purposes, and as species proposed for listing on

private land.

(PE) Proposed endangered. Species proposed for official listing as endangered.

(PT) Proposed threatened. Species proposed for official listing as threatened.

(PEXPE, PXE) Proposed experimental population, essential. Species proposed for official listing as experimental and essential.

(PEXPN, PXN) Proposed experimental population, non-essential. Species proposed for official listing as experimental and non-essential.

PSAE, PE (S/A) Proposed endangered, due to similarity of appearance. Species proposed for official listing as endangered due to similarity of appearance with another listed species.

PSAT, PT (S/A) Proposed threatened, due to similarity of appearance. Species proposed for official listing as threatened due to similarity of appearance with another listed species.

(EE) Emergency Endangered - A temporary (240) day listing for emergency purposes when species is at significant, immediate risk.

(SC) Species of Concern - Species that have not been petitioned or been given E, T, or C status but have been identified as important to monitor.

(RT) Resolved Taxon - Species that have been petitioned for listing and for which a Not Warranted 12 month finding or Not Substantial 90-day finding has been published in the Federal Register. Also includes species that have been removed from the candidate list.

(UR) Under Review - Species that have been petitioned for listing and for which a 90 day finding has not been published or for which a 90 day substantial has been published but a 12 Month finding have not yet been published in the Federal Register. Also includes species that are being reviewed through the candidate process, but the CNOR has not yet been signed.
(NL) Not Listed.

State Codes

(SE) State listed as Endangered – Species is in imminent danger of extinction within the state.

(ST) State listed as Threatened - State population listed as Threatened

(StC) State Candidate – Candidate species for listing at the state level

(SCD) State Candidate (Delisting) - Candidate species for de-listing at the state level

(SSC) State Species of Special Concern - Species identified by any state that have not been petitioned or been given E, T, or C status but have been identified as important to monitor.

Other Codes

(TER-E) Territory listed as Endangered – Species is in imminent danger of extinction within the territory.

(TER-T) Territory listed as Threatened – Species population is listed as threatened within the territory.

(TER-C) Territory Candidate – Species population is listed as a Candidate species for listing within the territory.

(TER-D) Territory Candidate (Delisting) – Species population is listed as a candidate species for De-listing within the territory.

(TER-SC) Territory Species of Special Concern – Species identified by any territory that have not been petitioned or been given E, T, or C status but have been identified as important to monitor.

(BCC) Birds of Conservation Concern

IUCN Red List

Threatened and Endangered Species

Focus Area Score **0.63**

Please validate (add/delete) the list of species below, add as necessary if none are listed, and ensure that they are correct. To **ADD** a species to the site/installation, select a species tab button, then click the blue 'Select Species' button in the upper left. Click on a species row to view or update answers about each species.

1. Northern Long-Eared Bat :: Myotis septentrionalis

2.1. Have surveys been completed for this species on the site(s)? *

- [X] Yes
- [ ] No
- [ ] Extirpated
- [ ] Not Warranted

2.1.a. What is date when surveys were completed? Format: (MM/DD/YYYY)

5/26/2016

2.1.b. Why are surveys not required for this species?

- [ ] Only transits nearshore waters
- [ ] Only transits migratory flyway
- [ ] Occasional sighting during migration
- [ ] Occasional sighting based on seasonal conditions
- [ ] Other

2.2. Do existing surveys provide adequate data on habitat conditions on the site(s)? *

- X Yes
- ___ No
- ___ Not Warranted

2.3. Do existing surveys provide adequate data on population presence and numbers on the site(s)? *

- ___ Yes
- X No
- ___ Not Warranted

2.4. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species? *

- ___ None
- ___ Minimal
- X Moderate
- ___ Good
- ___ Excellent
- ___ N/A

PLEASE GAUGE YOUR RESPONSES FOR THIS REPORTING PERIOD ONLY.

2.5. Has critical habitat been proposed for the species during the reporting period on the site(s) (per Federal Register [FR] Final Rule)? *

- ___ Yes
- ___ No
- X N/A (Critical habitat designation was not proposed)
- ___ CH determination currently under review

2.5.a. Did the Navy respond?

_____ Yes
_____ No

2.5.b. Please upload response to document library.

2.6. Has the critical habitat been designated for this species during the reporting period on the site(s)? *

_____ Yes
_____ No
__X__ N/A (Critical habitat has not been designated)

2.6.a. If critical habitat was proposed for this species but has not been designated during the reporting period on the site(s), under which provision of the ESA (Sec. 4) was exemption/exclusion granted? *

_____ National Security (Exclusion) (4(b)(2))
_____ INRMP (Exemption) (4(a)(3)(B))
_____ N/A (Critical habitat designation was not proposed)

2.6.b. Why not? *

_____ National Security (Exclusion)
_____ INRMP (Exemption)
_____ N/A (Critical habitat designation was not proposed)

2.6.c. Date critical habitat was designated? Format: (MM/DD/YYYY)

2.6.d. Effective date of critical habitat? Format: (MM/DD/YYYY)

2.6.e. Acreage of critical habitat designated?

2.7. If a previously designated critical habitat exemption/exclusion exists for this species on the site(s), are critical habitat management projects clearly identified in the INRMP? *

_____ Yes
_____ No
__X__ N/A

2.8. If a previously designated critical habitat exemption/exclusion exists for this species on the site(s), are critical habitat management projects clearly identified in the EPRWeb? *

_____ Yes
_____ No
__X__ N/A

2.9. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

Comment: No Tree Removal in the months of June & July. This is already part of the INRMP.

X Yes

_____ No

2.10. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices. *

Comment: Species has been confirmed on NALFF. We are consulting with Contractors that completed the acoustic survey efforts regarding if the species was confirmed present at NASO or if it just had an increased potential to occur. The species was confirmed west of NASO at NALFF (mist net) and east of NASO at NASO DNA (acoustic).

X Confirmed

_____ Potentially

_____ Offsite within 5 mi of installation

_____ Offsite not within 5 mi of installation

_____ Confirmed in nearshore waters

_____ Within 5 miles nearshore waters

Proposed and Candidate Species

Please validate (add/delete) the list of species below, add as necessary if none are listed, and ensure that they are correct. To **ADD** a species to the site/installation, select a species tab button, then click the blue 'Select Species' button in the upper left. Click on a species row to view or update answers about each species.

State, Local, and other Species

Please validate (add/delete) the list of species below, add as necessary if none are listed, and ensure that they are correct. To **ADD** a species to the site/installation, select a species tab button, then click the blue 'Select Species' button in the upper left. Click on a species row to view or update answers about each species.

1. Atlanticbluet :: Enallagma doubledayi

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
__X__ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
__X__ No

2.19. Estimate this installation's total management responsibility for the population of this species.

0

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
X Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

	Yes
X	No
	N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

	High
	Medium
X	Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

	Confirmed
	Potentially
X	Offsite within 5 mi of installation
	Offsite not within 5 mi of installation
	Confirmed in nearshore waters
	Within 5 miles nearshore waters

2.27. Provide any other comments below:

2. Bald eagle :: Haliaeetus leucocephalus

2.17. What is the current status of the species?

	(SE) State listed as Endangered
	(ST) State listed as Threatened
	(StC) State Candidate
	(SCD) State Candidate (Delisting)
	(SCC) State Species of Special Concern
	(TER-E) Territory listed as Endangered
	(TER-T) Territory listed as Threatened
	(TER-C) Territory Candidate
	(TER-D) Territory Candidate (Delisting)
	(TER-SC) Territory Species of Special Concern
X	(BCC) Birds of Conservation Concern
	IUCN Red List
	SAE, E(S/A) Endangered due to similarity of appearance
	SAT, T(S/A) = threatened due to similarity of appearance
	(EXPE, XE) Experimental essential population
	(EXPN, XN) Experimental non-essential population
	(PEXPE, PXE) Proposed experimental population, essential
	(PEXPN, PXN) Proposed experimental population, non-essential
	PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
	PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
	(EE) Emergency Endangered
	(SC) Species of Concern
	(RT) Resolved Taxon
	(UR) Under Review
	(NL) Not Listed
	Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

	Yes
X	No

2.19. Estimate this installation's total management responsibility for the population of this species.

1

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

X Yes
_____ No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
_____ Moderate
X Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

- [X] Yes
- [ ] No
- [ ] N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

- [X] High
- [ ] Medium
- [ ] Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

- [X] Confirmed
- [ ] Potentially
- [ ] Offsite within 5 mi of installation
- [ ] Offsite not within 5 mi of installation
- [ ] Confirmed in nearshore waters
- [ ] Within 5 miles nearshore waters

2.27. Provide any other comments below:

3. Baldwin's spikerush :: Eleocharis baldwinii

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
_____ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
_____ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

_____ Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

_____ Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
_____ No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
_____ Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
_____ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

_____ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

4. Beach, Virginian pinweed :: Lechea maritima virginica

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

X Yes
_____ No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

5. Black-crowned Night-Heron :: Nycticorax nycticorax

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

1

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
X Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

__X__ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

6. Comet Darner :: Anax longipes

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
__X__ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
__X__ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

	Yes
X	No
	N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

	High
	Medium
X	Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

X	Confirmed
	Potentially
	Offsite within 5 mi of installation
	Offsite not within 5 mi of installation
	Confirmed in nearshore waters
	Within 5 miles nearshore waters

2.27. Provide any other comments below:

7. Dismal Swamp (=southern bog) lemming :: Synaptomys cooperi helaletes

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
__X__ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
__X__ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
X Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

8. Dismal Swamp southeastern shrew :: Sorex longirostris fisheri

2.17. What is the current status of the species?

	(SE) State listed as Endangered
X	(ST) State listed as Threatened
	(StC) State Candidate
	(SCD) State Candidate (Delisting)
	(SCC) State Species of Special Concern
	(TER-E) Territory listed as Endangered
	(TER-T) Territory listed as Threatened
	(TER-C) Territory Candidate
	(TER-D) Territory Candidate (Delisting)
	(TER-SC) Territory Species of Special Concern
	(BCC) Birds of Conservation Concern
	IUCN Red List
	SAE, E(S/A) Endangered due to similarity of appearance
	SAT, T(S/A) = threatened due to similarity of appearance
	(EXPE, XE) Experimental essential population
	(EXPN, XN) Experimental non-essential population
	(PEXPE, PXE) Proposed experimental population, essential
	(PEXPN, PXN) Proposed experimental population, non-essential
	PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
	PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
	(EE) Emergency Endangered
	(SC) Species of Concern
	(RT) Resolved Taxon
	(UR) Under Review
	(NL) Not Listed
	Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

	Yes
X	No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
_____ Moderate
X Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

A 2014 Natural Heritage
Inventory did not reconfirm presence; however, presence had been previously confirmed.

9. Furtive Forktail :: Ischnura prognata

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

10. Great blue heron :: Ardea herodias

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

__X__ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

11. Least, Virginia trillium :: Trillium pusillum virginianum

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
__X__ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
__X__ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

	Yes
X	No
	N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

	High
	Medium
X	Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

	Confirmed
X	Potentially
	Offsite within 5 mi of installation
	Offsite not within 5 mi of installation
	Confirmed in nearshore waters
	Within 5 miles nearshore waters

2.27. Provide any other comments below:

Highly Suitable Habitat Identified in 2014.

12. Little brown bat :: Myotis lucifugus

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
__X__ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
__X__ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

__X__ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

13. Loblolly/Beach Heather :: Hudsonia tomentosa

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
X Minimal
_____ Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

14. Long Beach seedbox :: Ludwigia brevipes

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
X Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

15. Longleaf pine :: Pinus palustris

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
X Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
__X__ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

Moderate Concern as trees may one day intersect with the Airfield Obstruction zone and may need to be cut or require additional consultations if listed.

16. Monarch butterfly :: Danaus plexippus plexippus

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
_____ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
_____ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

_____ Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

_____ Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
_____ No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
_____ Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
_____ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

_____ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

17. Mud plantain :: Alisma subcordatum

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

18. Non-riverine Wet Hardwood Forest Community :: Non-riverine Wet Hardwood Forest Community

2.17. What is the current status of the species?

	(SE) State listed as Endangered
	(ST) State listed as Threatened
	(StC) State Candidate
	(SCD) State Candidate (Delisting)
X	(SCC) State Species of Special Concern
	(TER-E) Territory listed as Endangered
	(TER-T) Territory listed as Threatened
	(TER-C) Territory Candidate
	(TER-D) Territory Candidate (Delisting)
	(TER-SC) Territory Species of Special Concern
	(BCC) Birds of Conservation Concern
	IUCN Red List
	SAE, E(S/A) Endangered due to similarity of appearance
	SAT, T(S/A) = threatened due to similarity of appearance
	(EXPE, XE) Experimental essential population
	(EXPN, XN) Experimental non-essential population
	(PEXPE, PXE) Proposed experimental population, essential
	(PEXPN, PXN) Proposed experimental population, non-essential
	PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
	PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
	(EE) Emergency Endangered
	(SC) Species of Concern
	(RT) Resolved Taxon
	(UR) Under Review
	(NL) Not Listed
	Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

	Yes
X	No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

X Yes
_____ No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

__X__ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

A Portion of this community is located within the Airfield Obstruction Management Plan's vegetation control area.

19. Rafinesque's big-eared bat :: Plecotus rafinesquii

2.17. What is the current status of the species?

- [X] (SE) State listed as Endangered
- [ ] (ST) State listed as Threatened
- [ ] (StC) State Candidate
- [ ] (SCD) State Candidate (Delisting)
- [ ] (SCC) State Species of Special Concern
- [ ] (TER-E) Territory listed as Endangered
- [ ] (TER-T) Territory listed as Threatened
- [ ] (TER-C) Territory Candidate
- [ ] (TER-D) Territory Candidate (Delisting)
- [ ] (TER-SC) Territory Species of Special Concern
- [ ] (BCC) Birds of Conservation Concern
- [ ] IUCN Red List
- [ ] SAE, E(S/A) Endangered due to similarity of appearance
- [ ] SAT, T(S/A) = threatened due to similarity of appearance
- [ ] (EXPE, XE) Experimental essential population
- [ ] (EXPN, XN) Experimental non-essential population
- [ ] (PEXPE, PXE) Proposed experimental population, essential
- [ ] (PEXPN, PXN) Proposed experimental population, non-essential
- [ ] PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- [ ] PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- [ ] (EE) Emergency Endangered
- [ ] (SC) Species of Concern
- [ ] (RT) Resolved Taxon
- [ ] (UR) Under Review
- [ ] (NL) Not Listed
- [ ] Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- [ ] Yes
- [X] No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
_____ Moderate
X Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

__X__ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

20. Silky camellia :: Stewartia malacodendron

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
X Minimal
____ Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

- ____ Yes
- X No
- ____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

- ____ High
- ____ Medium
- X Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

- X Confirmed
- ____ Potentially
- ____ Offsite within 5 mi of installation
- ____ Offsite not within 5 mi of installation
- ____ Confirmed in nearshore waters
- ____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

21. Southeastern Cane Borer Moth :: Papaipema sp. 3

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
__X__ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
__X__ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

22. Southeastern myotis :: Myotis austroriparius

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

__X__ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

23. spoonleaf sundew :: Drosera intermedia

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
X Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

24. Spotted sandpiper :: Actitis macularius

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

____ Yes
X No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
X Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

__X__ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

Migrant. Not confirmed to nest on site.

25. Timber rattlesnake :: Crotalus horridus

2.17. What is the current status of the species?

- [X] (SE) State listed as Endangered
- [ ] (ST) State listed as Threatened
- [ ] (StC) State Candidate
- [ ] (SCD) State Candidate (Delisting)
- [ ] (SCC) State Species of Special Concern
- [ ] (TER-E) Territory listed as Endangered
- [ ] (TER-T) Territory listed as Threatened
- [ ] (TER-C) Territory Candidate
- [ ] (TER-D) Territory Candidate (Delisting)
- [ ] (TER-SC) Territory Species of Special Concern
- [ ] (BCC) Birds of Conservation Concern
- [ ] IUCN Red List
- [ ] SAE, E(S/A) Endangered due to similarity of appearance
- [ ] SAT, T(S/A) = threatened due to similarity of appearance
- [ ] (EXPE, XE) Experimental essential population
- [ ] (EXPN, XN) Experimental non-essential population
- [ ] (PEXPE, PXE) Proposed experimental population, essential
- [ ] (PEXPN, PXN) Proposed experimental population, non-essential
- [ ] PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- [ ] PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- [ ] (EE) Emergency Endangered
- [ ] (SC) Species of Concern
- [ ] (RT) Resolved Taxon
- [ ] (UR) Under Review
- [ ] (NL) Not Listed
- [ ] Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- [ ] Yes
- [X] No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
____ Moderate
X Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
__X__ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

Hunting Program prohibits take of squirrels to minimize impacts to Canebrake rattlesnakes. Confirmed at NALFF, not at NASO.

26. tri-colored bat :: Perimyotis subflavus

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
__X__ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
__X__ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
____ Minimal
X Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

__X__ High
_____ Medium
_____ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

27. Viviparous spikerush :: Eleocharis vivipara

2.17. What is the current status of the species?

- ____ (SE) State listed as Endangered
- ____ (ST) State listed as Threatened
- ____ (StC) State Candidate
- ____ (SCD) State Candidate (Delisting)
- X (SCC) State Species of Special Concern
- ____ (TER-E) Territory listed as Endangered
- ____ (TER-T) Territory listed as Threatened
- ____ (TER-C) Territory Candidate
- ____ (TER-D) Territory Candidate (Delisting)
- ____ (TER-SC) Territory Species of Special Concern
- ____ (BCC) Birds of Conservation Concern
- ____ IUCN Red List
- ____ SAE, E(S/A) Endangered due to similarity of appearance
- ____ SAT, T(S/A) = threatened due to similarity of appearance
- ____ (EXPE, XE) Experimental essential population
- ____ (EXPN, XN) Experimental non-essential population
- ____ (PEXPE, PXE) Proposed experimental population, essential
- ____ (PEXPN, PXN) Proposed experimental population, non-essential
- ____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
- ____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
- ____ (EE) Emergency Endangered
- ____ (SC) Species of Concern
- ____ (RT) Resolved Taxon
- ____ (UR) Under Review
- ____ (NL) Not Listed
- ____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

- ____ Yes
- X No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
_____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
_____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

_____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

_____ None
_____ Minimal
X Moderate
_____ Good
_____ Excellent
_____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

_____ Yes
__X__ No
_____ N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

_____ High
_____ Medium
__X__ Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

__X__ Confirmed
_____ Potentially
_____ Offsite within 5 mi of installation
_____ Offsite not within 5 mi of installation
_____ Confirmed in nearshore waters
_____ Within 5 miles nearshore waters

2.27. Provide any other comments below:

28. Yaupon :: Ilex vomitoria

2.17. What is the current status of the species?

_____ (SE) State listed as Endangered
_____ (ST) State listed as Threatened
_____ (StC) State Candidate
_____ (SCD) State Candidate (Delisting)
__X__ (SCC) State Species of Special Concern
_____ (TER-E) Territory listed as Endangered
_____ (TER-T) Territory listed as Threatened
_____ (TER-C) Territory Candidate
_____ (TER-D) Territory Candidate (Delisting)
_____ (TER-SC) Territory Species of Special Concern
_____ (BCC) Birds of Conservation Concern
_____ IUCN Red List
_____ SAE, E(S/A) Endangered due to similarity of appearance
_____ SAT, T(S/A) = threatened due to similarity of appearance
_____ (EXPE, XE) Experimental essential population
_____ (EXPN, XN) Experimental non-essential population
_____ (PEXPE, PXE) Proposed experimental population, essential
_____ (PEXPN, PXN) Proposed experimental population, non-essential
_____ PSAE, PE (S/A) Proposed endangered, due to similarity of appearance
_____ PSAT, PT (S/A) Proposed threatened, due to similarity of appearance
_____ (EE) Emergency Endangered
_____ (SC) Species of Concern
_____ (RT) Resolved Taxon
_____ (UR) Under Review
_____ (NL) Not Listed
_____ Other (add to comments)

2.18. Does the Navy manage 95% or more of this species population?

_____ Yes
__X__ No

2.19. Estimate this installation's total management responsibility for the population of this species.

2.20. Have surveys been completed for this species on the site(s)?

X Yes
____ No

2.21. Do existing surveys provide adequate data on habitat conditions on the installation?

X Yes
____ No

2.22. Do existing surveys provide adequate data on population presence and numbers on the installation?

____ Yes
X No

2.23. To what extent are quantifiable goals, objectives, and monitoring requirements in place to address the conservation needs of the species?

____ None
X Minimal
____ Moderate
____ Good
____ Excellent
____ N/A

2.24. Have any conservation recommendations pertaining to this species been identified during the reporting period that should be considered for incorporation in the INRMP?

	Yes
X	No
	N/A

2.25. What is the level of concern with regard to impacts to military readiness/mission capabilities with the management of the species?

	High
	Medium
X	Low

2.26. Provide a location status for this species from the choices provided below. See i-Note if your selection window clips the choices.

X	Confirmed
	Potentially
	Offsite within 5 mi of installation
	Offsite not within 5 mi of installation
	Confirmed in nearshore waters
	Within 5 miles nearshore waters

2.27. Provide any other comments below:

Unoccupied Critical Habitat

Focus Area Score 1.00

2.28. Has unoccupied critical habitat for any federally listed species been designated on the site(s)? *

_____ Yes
__X__ No
_____ N/A (Critical habitat designation was not proposed)

2.28.a. For which species?

2.29. Have management projects/actions addressing unoccupied critical habitat been clearly identified in the INRMP? *

_____ Yes
_____ No
__X__ N/A

2.30. Have management projects/actions addressing unoccupied critical habitat been clearly identified in the EPRWeb? *

_____ Yes
_____ No
__X__ N/A

Please enter Findings and Recommendations. Findings and Recommendations serve as additional clarification to the answers provided for this Focus Area, and they are encouraged in order to provide a better understanding of existing activities, issues to be addressed, and unique circumstances.

2. Findings

INRMP information regarding the above referenced species is dated. Other Federally listed species (e.g. sea turtles, manatee, sturgeon, etc.) are known to occur in the nearshore environment of NASO; however, they have not been documented to occur on installation property (the Navy conducts after storm event surveys to see if any of these species have stranded on Navy property). Upland Sandpiper was identified via a BASH Strike Report associated with NASO. It is unclear if the bird actually occurred on the installation or was struck within the airspace adjacent to the installation. The species is not known to nest on site and is a potential for migratory occurrence.

2. Recommendations

Update INRMP with better goals, objectives and conservation criteria. Many of the goals, objectives, and conservation criteria are currently located in reference documents within the INRMP appendices. These should be clearly implemented into the INRMP.

3 - Recreation Use and Access

Focus Area Score 0.88

Focus Area Purpose: Evaluate the availability and adequacy of public recreational use opportunities, such as fishing and hunting, and access for handicapped and disabled persons, given security and safety requirements for the installation.

Comment on this Focus Area and associated Questions: Select this link below each question if you would like to elaborate on the answer provided. This is also a good way to document the assumptions made by all partners that contributed to the answer.

3. Are there Natural Resources related recreational opportunities on the reporting unit?

- [X] Yes
- [ ] No: Landscape doesn't support recreational opportunities
- [ ] N/A: Not available due to mission, security, safety, or environmental constraints

3.1. Does the INRMP adequately identify outdoor recreational activities? *

- [ ] Not Adequately Addressed
- [ ] Minimally Addressed
- [ ] Moderately Addressed
- [X] Completely Addressed

3.1.a. Please indicate the type(s) of outdoor recreation activities addressed in the INRMP and offered on the installation.

- [X] Hunting
- [X] Fishing
- [X] Trapping
- [X] Hiking
- [X] Archery
- [X] Wildlife watching
- [X] Fresh watersports
- [ ] Marine watersports
- [X] Day use-picnic
- [X] Camping

3.1.b. Where mission, security, safety, and environmental constraints allow, the INRMP indicates use and access areas on the installation. *

X Yes
_____ No
_____ N/A

3.2. If recreational opportunities are available, are they offered to the public? *

X Yes
_____ No
_____ N/A (recreational opportunities are not available due to landscape or security constraints)

3.3. If recreational opportunities are available, are they offered to military or DoD civilian personnel? *

X Yes
_____ No
_____ N/A (recreational opportunities are not available due to landscape or security constraints)

3.4. If recreational opportunities are available, are they accessible by disabled veterans/Americans? *

X Yes
_____ No
_____ N/A (recreational opportunities are not available due to landscape or security constraints)

3.5. Are fees collected for outdoor recreational opportunities? *

X Yes
_____ No
_____ N/A (recreational opportunities do not include hunting and fishing, and/or the collection of fees)

3.5.a. How much was collected during the reporting period?

Comment: Hunting & Fishing Awaiting FY16 report from MWR to populate this question, reported is from FY15. FY16 is estimated to be about the same amount of funding. Program Permits and Permit sales apply to the following installations: NASO, NASO DNA, NALFF, NSAHR NWA, JEBLC, and JEBLC-FS.

8399

3.6. Are recreational facilities in good condition? *

- X Yes
- ____ No
- ____ N/A (recreational opportunities are not available due to landscape or security constraints)

3.7. Are sustainable harvest goals in the INRMP effective for the management of the species' population? *

- ____ Not Effective
- ____ Minimal Effectiveness
- X Moderate Effectiveness
- ____ Effective
- ____ Highly Effective
- ____ N/A = (recreational opportunities do not include hunting and fishing)

3.8. To what extent did the installation develop and provide public outreach/educational awareness, e.g. environmental educational opportunities, natural resource field trips/tours, pamphlets? *

- ____ No Public Outreach Provided
- ____ Low Outreach
- X Moderate Outreach
- ____ Good Outreach
- ____ Excellent Outreach
- ____ N/A

3.9. Is there an active conservation law enforcement program (CLEP) on the installation? *

Comment: A Conservation Law-Enforcement Program Assessment has been completed for the following installations: NASO, NASO DNA, NALFF, and NSAHR NWA. The results from this report are on hold for release and inclusion/updates to the INRMP until appropriate briefings have been provided installation Commanding Officers.

- [X] Yes
- [ ] No
- [ ] N/A (INRMP or Natural Resources Program does NOT identify Conservation Law Enforcement as part of the program. Recreational opportunities do not include hunting and fishing)

3.10. How many total work-hours per year are dedicated to law enforcement? (Includes full-time and part-time personnel)

Comment: We have a single regional individual servicing 11 installations. 1 billet. He puts in a lot of overtime. See Findings for additional information.

2503

3.11. Does the law enforcement program include federal (Non-Navy Civilian), state, or local or contractor personnel? (Select all that apply)

- [X] Federal (Non-Navy Civilian)
- [X] State
- [X] Local
- [ ] Contractor
- [X] Military

3.12. Please describe the funding sources used by the Law Enforcement Program.

- [X] O&MN
- [ ] O&MNR
- [ ] MIS
- [ ] GWOT
- [ ] OPN
- [ ] ER,N
- [ ] RDT&EN
- [ ] Other

3.13. Are Law Enforcement personnel routinely supporting other programs? (Ex. Cultural Resources)

X Yes
_____ No

3.14. Do you have any inter-jurisdictional agreements for conservation law enforcement with other military departments, Federal, tribal, state or local law enforcement, or land management agencies?

_____ Yes
X No

3.15 Have conservation law enforcement officers completed the FLETC Land Management Police Training Program or equivalent?

Comment: Unsure how to answer this question. What is considered an equivalent? Our current CLEO has not taken FLETC LMPT ; however, he has taken NEC 9545 Navy Law Enforcement Specialist Phase I (Base Police Law-enforcement training), NEC 9545 Navy Law Enforcement Specialist Phase II (Comman Specific Law-enforcement training, NEC 9575 Correctional Custody Specialist Ashore, has completed 3/4 ths of the City of Chesapeake's Police Academy, has taken MBTA training for DoD, has taken a variety of CECOS and ECATTS environmental courses, and has taken the NMFWA Conservation Officer Refresher Training, when offered and travel approved, and qualifies on his weapons biannually with the Navy Security department. Our current CLEO has been woking in law-enforcement for 16 years (between military police and the Natural Resource CLEP), 13 of which have been as a CLEO.

X Yes
_____ No
_____ N/A

3.16. Is a Conservation Law Enforcement Plan included in your INRMP and/or ICRMP?

Comment: his is a Yes & No Answer. Conservation law-enforcement is identified in the INRMP, but the region has not provided a regional CLEP plan for inclusion in the document, that identifies CLEO training requirements and specific CLEP obligations (roles & responsibilities). We have updated the INRMP to include a copy of the DoDI 5525.17 regarding the DoD CLEP dated 17 Oct 2013. We also on occassion reference the US Marine Corps CLEP instructions.

X Yes
_____ No

3.17. Please provide a brief description of the installation's Conservation Law Enforcement Program.

One NAVFAC Mid-Atlantic Conservation Officer, who also serves as the regional BST, is currently responsible for conservation law enforcement for the Hampton Roads Navy installations including NAS Oceana, NALF Fentress, NSAHR Northwest, NASO Dam Neck Annex, JEB Little Creek, JEBLC Fort Story, NWS Yorktown, Cheatham Annex, NS Norfolk, NSA Hampton Roads, and Lafeyette River Annex. The Regional Conservation Officer serves as game warden and has arrest authority at these installations. Law enforcement is solely the responsibility of the Navy; however, Navy enforcement personnel cooperate with federal and state game wardens as needed to enforce federal and state wildlife laws. The Conservation Officer is required to be trained in law enforcement and federal and state wildlife regulations, and must attend annual wildlife law enforcement refresher training in order to stay abreast of changes in regulations and enforcement policies. The conservation officer occassionally identifies and works law-enforcement issues associated with the cultural resources program and other environmental programs outside of the natural resources program.

Please enter Findings and Recommendations. Findings and Recommendations serve as additional clarification to the answers provided for this Focus Area, and they are encouraged in order to provide a better understanding of existing activities, issues to be addressed, and unique circumstances.

3. Findings

Currently there is no educational outreach coordinator. Outreach is subject to limited availability of Natural Resources Staff. Outreach was supplied through classroom training, public speaking, phone conversation, and handouts. (i.e., hunting, fishing, wildlife interactions, snakes, etc.).

The regional conservation law enforcement program is understaffed to adequately cover the needs of 11+ installations with regards to Natural, Cultural, and other Environmental Resources Law enforcement Coverage/Protection/Management/etc. At 2013 INRMP Metrics review the VDGIF biologist associated with the NWS Yorktown INRMP provided a real life example on an Army installation in VA where he, installation security, state and federal wildlife agents conducted an intense study to determine the level of conservation law enforcement infractions occurring on the base, within one month. They found that in one month they observed and addressed numerous conservation law enforcement infractions on just a portion In 2014 USFWS indicated that there is no way 1 officer can adequately service a range of resources that covers 11+ installations. The Navy did indicate that resource specialists in Natural and Cultural resources (though limited as well in numbers) are cross trained to identify issues and when issues are observed the Conservation Officer is notified and he responds.

The Virginia Feral Hog Action Team is coordinated by VDGIF and the Navy NRM is an active member of the team. Feral Swine are not a recreational hunting program species in VA. A single report of a potential feral hog at NALFF was submitted in FY15; however, no evidence was found to confirm the sighting. In FY16, a single potential trail camera sighting of a feral hog was submitted near the FY15 sighting at NALFF. Unfortunately, confirmation of the species was still unable to be confirmed.

The following was documented during the FY15 INRMP Metrics Review: In reference to State Endangered Canebrake rattlesnake, VDGIF meeting participant indicated that on an adjacent State Owned VDGIF managed property (Caviler WMA) they are being required when mowing hunting trails to have a scout ahead of the mower, the mower, and then a scout behind the mower identifying if a snake was struck. If a single snake is taken, then the mowing actions are no longer permitted, until further approvals are obtained. This is the 1st year VDGIF will be implementing this practice at this site.

3. Recommendations

Continue to support hunting, fishing and educational outreach programs.
Hire an Outreach Coordinator for the region.
Create an adequately staffed and more robust Conservation Law Enforcement Program.
Consider funding a project to determine the level of Conservation Law Enforcement infractions occurring on the installation.
Update recreational fishing program management practices.
Create joint installation Hunting and Fishing instructions for NAS Oceana, NASO Dam Neck Annex, NALF Fentress, and NSAHR Northwest Annex.
Continue to stay active in CWD management and avoidance.
Continue to stay active in Feral Swine Management and Removal.
Follow up with VDGIF regarding hunting trail maintenance program.

4 - Sikes Act Cooperation

Focus Area Score 0.81

Focus Area Purpose: Determine to what degree USFWS, State Fish and Wildlife Agency and, when appropriate, NOAA Fisheries Service (NMFS), partnerships are cooperative and result in effective INRMP development, review for operation and effect, and mutual agreement.

Comment on this Focus Area and associated Questions Select this link below each question if you would like to elaborate on the answer provided. This is also a good way to document the assumptions made by all partners that contributed to the answer.

4. Select which Sikes Act parterns work with this installation/site(s)? *

- [X] USFWS
- [X] State
- [X] NOAA Fisheries Service

4.1. Was USFWS invited to participate in the annual INRMP/Natural Resources Program review? *

- [X] Yes
- [ ] No

4.1.a. By what method was the agency invited to participate in the annual INRMP/Natural Resources Program review?

- [X] Telephone call
- [X] Electronic mail
- [ ] Official letter
- [ ] Other

4.1.b. Did the agency respond to the invitation to participate in the annual INRMP/Natural Resources Program review? *

- [X] Yes
- [ ] No

4.1.c. How many attempts were made to invite the agency to participate in the annual INRMP/Natural Resources Program review?

_____ 0-3
__X__ 4-6
_____ 7-10
_____ >10

4.1.d. Did the agency participate in the annual INRMP/Natural Resources Program review? *

__X__ Yes
_____ No

4.1.e. If the agency participated in the annual INRMP/Natural Resources Program review, was it recognized as a review for operation and effect? *

_____ Yes
__X__ No

4.1.f. If the agency did not participate in the annual review, what type of correspondence was received from the agency to inform the site(s) that they were not able to participate?

_____ Telephone call
_____ Electronic mail
_____ Official letter
_____ Other

4.1.g. If the agency did not participate in the annual INRMP/Natural Resources Program review, was a separate meeting held/correspondence sent as a review for operation and effect?

_____ Yes
_____ No

4.1.g.a. What date? Format: MM/DD/YYYY

4.1.h. Was a report of the previous year's annual INRMP/Natural Resources Program review submitted to the agency during this reporting period? *

- [X] Yes
- [ ] No

4.2. Was the state invited to participate in the annual INRMP/Natural Resources Program review? *

- [X] Yes
- [ ] No

4.2.a. By what method was the agency invited to participate in the annual INRMP/Natural Resources Program review?

- [ ] Telephone call
- [X] Electronic mail
- [ ] Official letter
- [ ] Other

4.2.b. Did the agency respond to the invitation to participate in the annual INRMP/Natural Resources Program review? *

- [X] Yes
- [ ] No

4.2.c. How many attempts were made to invite the agency to participate in the annual INRMP/Natural Resources Program review?

- [X] 0-3
- [ ] 4-6
- [ ] 7-10
- [ ] >10

4.2.d. Did the agency participate in the annual INRMP/Natural Resources Program review? *

- [X] Yes
- [ ] No

4.2.e. If the agency participated in the annual INRMP/Natural Resources Program review, was it recognized as a review for operation and effect? *

- [ ] Yes
- [X] No

4.2.f. If the agency did not participate in the annual review, what type of correspondence was received from the agency to inform the site(s) that they were not able to participate?

- [ ] Telephone call
- [ ] Electronic mail
- [ ] Official letter
- [ ] Other

4.2.g. If the agency did not participate in the annual INRMP/Natural Resources Program review, was a separate meeting held/correspondence sent as a review for operation and effect?

- [ ] Yes
- [ ] No

4.2.g.1. What date? Format: MM/DD/YYYY

4.2.h. Was a report of the previous year's annual INRMP/Natural Resources Program review submitted to the agency during this reporting period? *

X Yes
_____ No

4.3. Was the NOAA Fisheries Service invited to participate in the annual INRMP/Natural Resources Program review? *

X Yes
_____ No

4.3.a. By what method was the agency invited to participate in the annual INRMP/Natural Resources Program review?

_____ Telephone call
X Electronic mail
_____ Official letter
_____ Other

4.3.b. Did the agency respond to the invitation to participate in the annual INRMP/Natural Resources Program review? *

X Yes
_____ No

4.3.c. How many attempts were made to invite the agency to participate in the annual INRMP/Natural Resources Program review?

- [X] 0-3
- [ ] 4-6
- [ ] 7-10
- [ ] >10

4.3.d. Did the agency participate in the annual INRMP/Natural Resources Program review? *

- [X] Yes
- [ ] No

4.3.e. If the agency participated in the annual INRMP/Natural Resources Program review, was it recognized as a review for operation and effect? *

- [ ] Yes
- [X] No

4.3.f. If the agency did not participate in the annual review, what type of correspondence was received from the agency to inform the site(s) that they were not able to participate?

- [ ] Telephone call
- [ ] Electronic mail
- [ ] Official letter
- [ ] Other

4.3.g. If the agency did not participate in the annual INRMP/Natural Resources Program review, was a separate meeting held/correspondence sent as a review for operation and effect?

- [ ] Yes
- [ ] No

4.3.g.1. What date? Format: MM/DD/YYYY

4.3.h. Was a report of the previous year's annual INRMP/Natural Resources Program review submitted to the agency during this reporting period? *

- [X] Yes
- [ ] No

4.4. The USFWS, state fish and wildlife agency, and when appropriate NOAA Fisheries Service, are familiar with and have reviewed the INRMP. *

- [X] Yes (All that apply) - These partners are familiar with and have reviewed the site(s)' INRMP.
- [ ] Two or more partners are familiar with and have reviewed the site(s)' INRMP.
- [ ] One or more partners are familiar with and have reviewed the site(s)' INRMP.
- [ ] No - Partners did not review the site(s)' INRMPs or INRMP updates, nor did they participate in other regular communications.

4.5. The USFWS, state fish and wildlife agency and, when appropriate, NOAA Fisheries Service are engaged in the INRMP development and implementation. *

- [X] The sites(s) engaged the USFWS, state fish and wildlife agency and, when appropriate, NOAA Fisheries Service and these efforts are well documented.
- [ ] The site(s) engaged the USFWS, state fish and wildlife agency and, when appropriate, NOAA Fisheries Service and these efforts are not documented.
- [ ] Partners were non-responsive to site(s) communications and/or are not familiar with the INRMP.
- [ ] The site(s) did not engage the USFWS, state fish and wildlife agency or NOAA Fisheries Service; therefore these partners did not review INRMPs or INRMP updates, nor did they participate in other regular communications.

4.6. What is the level of collaboration/cooperation between Sikes Act partners? *

- [ ] None
- [ ] Minimal collaboration/cooperation
- [ ] Satisfactory collaboration/cooperation
- [X] Effective collaboration/cooperation
- [ ] Highly effective collaboration/cooperation

4.7. How well are site(s) natural resource management goals and objectives aligned with conservation goals of Sikes Act partners, e.g. USFWS/NOAA Fisheries Service regional goals and State Fish and Wildlife Agency reginal goals (e.g. State Wildlife Action Plans (SWAPs)? *

_____	Not aligned
_____	Somewhat aligned
X	Completely aligned

Please enter Findings and Recommendations. Findings and Recommendations serve as additional clarification to the answers provided for this Focus Area, and they are encouraged in order to provide a better understanding of existing activities, issues to be addressed, and unique circumstances.

4. Findings

INRMP was made compliant in June 2015 having received all required agency signatures. INRMP does require an updated USFWS Operation and Effect Signature by 19 Dec 2017.

Coordination was maintained throughout the year with USFWS Region 5, VDGIF and NOAA-NMFS. The team (VDGIF, USFWS, NOAA-NMFS and NAVY) attempts to meet at least once a year to discuss Natural Resources Management concerns, updates, and opportunities. For the 2nd year USDA-WS was invited as an active participate in this coordinate meeting effort. For the 1st year State Fisheries Biologists, Sea Turtle Program Coordinator, and Foresters were also invited to participate. For the 1st time the USFWS Wildland Fire Coordinator was invited to participate. The USFWS Fisheries biologist that used to coordinate with the installation has retired and a new person had not been selected as of the INRMP Metrics meeting invitation.

During FY16 Partners Meeting a number of partnership opportunities and recommendations were discussed.

VDGIF would like to see the installation participate in the State's the 2018 Colonial Waterbird Survey Effort, and possibly the State's Breeding Bird Atlas program. VDGIF announced that the Agency Strategic Plan will be coming out for review and recommends the Navy participate in that process. VDGIF reports that hunting program has been loosing about 3-3.5% of the hunting population since 1980s, which is resulting in resources and population control reductions. VDGIF would like to see the Navy promote and further participation in the State's Hunter Apprentice Programs. VDGIF would like the Navy to continue is efforts to control nutria and mentioned that VDGIF now has a conservation canine that is trained to find and remove nutria (they also obtain additional trained dogs via contract).

VDOF would like to see the installation increase efforts for invasive species monitoring and control along forest edges and within forest. Japanese stilt grass was identified as a target invasive species for control. Another species of particular concern was the Emerald Ash Bore, it is likely in our are, but not confirmed (targets bottom-land areas).

NMFS Final Critical habitat determination for Atlantic Sturgeon estimated to be announced June 2017; however, it is not anticipated that this installation will be impacted by this determination.

USFWS staff is down to 2 people in Permits from 6. Rusty patched bumble bee is proposed for listing and may pop up in iPAC as a historical record for our area, but it is not currently known to occur on installation. USFWS would like the installation to promote positive pollinator projects and partnerships. A fairly substantial list of invertebrate/pollinator species is anticipated to be issued for USFWS T&E listing review (petitioned and USFWS Initiated species

4. Recommendations

VDOF recommends treating Emerald Ashe Bore beetle infestations immediately upon observation, as an infestation will be 100% fatal to the bottomland forest trees.

Increase efforts and better promote existing projects that support pollinator species.

Continue Partnership Efforts.

In addition to the required INRMP signatory agency partners, continue to invite the VDOF, USDA, and other partners that contribute to the success of the INRMP.

Reporting Unit Metrics Q&A Report: NAS OCEANA

5 - Team Adequacy

Focus Area Score 0.82

Focus Area Purpose: Assess the adequacy of the natural resources team (professionally trained natural resources management and/or installation support personnel) in accomplishing INRMP/Natural Resources Program goals and objectives at each installation.

Comment on this Focus Area and associated Questions Select this link below each question if you would like to elaborate on the answer provided. This is also a good way to document the assumptions made by all partners that contributed to the answer.

5.1. Is there a Navy professional Natural Resources Manager designated by the Regional Commander/Installation Commanding Officer? *

X Yes

_____ No

5.2. Is there an on-site Navy professional Natural Resources Manager? *

X Yes

_____ No

5.3. Is there adequate installation staff assigned or available to properly implement the INRMP/Natural Resources Program goals and objectives? *

Comment: Installation has to reach back to NAVFAC MIDLANT and in some cases to LANT. Navy is currently having to contract our work that could be completed by Navy personnel, if adequately staffed. We need someone well versed in developing cooperative agreements, grants, and associated acquisitions.

_____ Sufficient

X Insufficient

_____ None

5.3.a. How many staff members are available?

3

5.3.b. How many staff members are required?

5

5.4. How well do higher echelon offices support the installation natural resources program? (e.g. reach back support for execution, policy support, etc.) *

Comment: Would like all higher echelon offices to keep the installation in the loop and have them participate in the review of contract documents before accepting/awarding a contractor's proposal. Would like all higher echelon offices to cross coordinate contractor product and proposal reviews with appropriate media experts/program managers before accepting/awarding a contractor's proposal or accepting a contactor's "final" product. (The same coordination should also be made on Cooperative Agreements and other such documents.) Forestry and Agricultral Program coordination is a particular concern.

- ____ No Support
- ____ Minimal Support
- X Satisfactory Support
- ____ Well Supported
- ____ Very Well Supported

5.5. The team is enhanced by the use of contractors. *

- ____ Disagree
- ____ Somewhat Agree
- ____ Neutral
- X Agree
- ____ Strongly Agree
- ____ N/A (no contractor support)

5.6. The team is enhanced by the use of volunteers. *

	Disagree
	Somewhat Agree
	Neutral
	Agree
X	Strongly Agree
	N/A (No volunteer support)

5.7. The Natural Resources team is adequately trained to implement the goals and objectives of the INRMP.

X	Professionals received adequate supplemental training
	Professionals have not received adequate training
	Professionals have not received any training

Please enter Findings and Recommendations. Findings and Recommendations serve as additional clarification to the answers provided for this Focus Area, and they are encouraged in order to provide a better understanding of existing activities, issues to be addressed, and unique circumstances.

5. Findings

When staff have not been adequately trained to cover a subject matter of concern, if a question arises regarding compliance concerns then other Navy, USFWS, State or other agency subject matter experts are consulted.
NASO Installation natural resources (NR) staff are aiding to support short staffing at the regional level and other local installations. Note: NAS Oceana NR personnel (1 Natural Resources Specialist and 2 Biological Science Technicians) help support the Hampton Roads area bases and are assigned to specifically handle (Oceana, Dam Neck Annex, Fentress, and Northwest Annex). One of these technicians is dual hatted supporting the region as a conservation law-enforcement officer and BST at ~11 installations.
Because of staffing levels at the installation and an attempt to maintain consistence of the programs throughout the region, NAVFAC MIDLANT CORE EV22 manages the Agricultural and Forestry programs for the installation. Regional staffing levels are not adequate to cover needs such as a professional forester, outreach coordinator, and individuals well versed in developing cooperative agreements, grants, and associated contracts.
Installation program enlists the support of over 20 regular gratuitous service program (GSP) supporters in order to accomplish its INRMP goals and objectives. At times the base signs upwards of 100 GSPs in a given year.
NAVFAC MIDLANT EV22 is attempting to implement previous recommendations to staff their program with multiple media specialist with the hiring of: 1 Natural Resources and Cultural Resources Supervisor; 1 Agriculture & Forestry Program Manager; 1 Marine Environment Program Manager; 1 T&E/INRMP Program Manager; 1 BASH/Nuisance Wildlife Program Manager and 1 Wetlands Program Manager. NAVFAC MIDLANT EV22, NAVFAC MIDLANT EV4 and Installation Staff do not agree on some INRMP identified projects/program management criteria (e.g., Agricultural mngt, Forest mngt., Vegetation Community Layer update frequency, nuisance wildlife inventory frequency, etc.) .
Proper coordination amongst varying levels of Navy Staff could improve.

5. Recommendations

Need to ensure installation Forestry Management Team includes at least one staff member that meets the OPNAVINST M-5090.1 standard to be designated as a professional certified forester (either meets and has obtained Society of American Forester Certification requirements or has received a professional forester certification by the State in which work is being conducted). Need to hire or train current staff to be well versed in cooperative agreement, grant, and contract development/acquisitions processes.
Need to adequately staff the region and installations for Conservation Law Enforcement, Biological Science Technician, and Natural Resources Manager Support.
Hire NR staff to sit at the Region that specialize in each of the program areas relevant to INRMPs (i.e. forestry, agriculture, T&E species, wetlands, permits, fire, invasive species, BASH, etc.) and better define the roles and responsibilities between region and installation staff (keeping in mind existing Position Descriptions). Need to coordinate staffing and roles & responsibilities planning and implementation with NAVFAC MIDLANT EV2 and installation environmental program directors and installation natural resources managers prior to execution of such plans.
Need to develop an official/formalized conservation law-enforcement program either via cooperative agreement with USFWS or State Wildlife Agency or develop a service request for support with the Navy Installation Security Office. Obtain from NAVFAC MILDANT EV22 a detailed agricultural program management plan and a detailed forestry program management plan to be inserted into the INRMP and to clarify what support will be provided and how/when it will be provided by the region to the installation in relationship to these programs.
Improve coordination within the various levels of the navy and with agency partners.

6 - INRMP Implementation

Focus Area Score 0.37

Focus Area Purpose: Evaluates the execution of actions, to include projects, taken to meet goals/objectives outlined in the INRMP.

Supplemental Information: The intent of this Focus Area is to assess how well actions are being implemented to execute the goals and objectives of the INRMP. Actions can include projects submitted via EPRWeb, as well as activities executed with alternative funds, not programmed through EPRWeb, or carried out by the use of volunteers or cooperative partnerships with other entities.

For each project or action executed, or partnership forged, or initiative engaged with, during the reporting period for the installation, the following questions are asked to evaluate INRMP action implementation. Note: For EPRWeb projects, the data such as project number, project title, funding source, and total obligated are pre-populated with data from EPRWeb. The user has the ability to edit the percentage applicable to this Reporting Unit (RU) if less than 100%.

Questions followed by an asterisk * are mandatory and must be completed before the datacall can be approved and forwarded to DoD.

FY16 Projects

Focus Area Score **0.37**

Instructions: This section is for projects planned in the installations/site(s) INRMP for award or emergent in **FY16 only**. Select a project from the list below (created in the Action Builder) to begin answering questions. To Add new projects, delete existing projects or modify the percentage allocated (share of the project) to this Reporting Unit (RU), click the Blue 'Add/Manage Projects' button. Select the red '**X**' to delete a project, if a project doesn't apply to the Reporting Unit or is not a project that occurred during the current reporting period. If this is an incomplete list, use the filters to find any missing projects, check the appropriate check boxes, and click the Blue 'Add Projects' to add additional INRMP actions (projects), e.g. emergent projects, unfunded efforts, or actions that do not require funding, and begin answering questions. Users can also create non-EPRWeb projects by clicking the Green 'Create Project' button.

1. 60191NR205 : 4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection

FY16 EPRWeb Total Spent

$29,004.00

FY16 RU Share of Total Spent

$29,004.00

(FY16) 6.0 Does the action have an alternative name?

X Yes
_____ No

(FY16) 6.0.a. Please enter the name(s)

4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection (Tree Planting); 4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection (Acoustic Amphibian Surveys); 4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection (ODU Tick Study); 4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection (CNU Snake Study)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started
_____ Action Underway
X Action Completed
_____ Prior Year Emergent/Executed
_____ Emergent/Accelerated and Executed this FY
_____ Action Considered Accepted Risk/Funding Not Available
_____ Funding Requested but not received
_____ Funding Received but not executable
_____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013
_____ 2014
_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

_____ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
__X__ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

Comment: Alternate Funding Sources not accounted for in EPRWeb, funding not utilized re-aligned to fund other approved projects.

_____ Yes
__X__ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

5900

(FY16) 6.4. Is the INRMP action on schedule? *

X Yes

_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes

_____ Partially

_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
X	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

2. 60191NR203 : CWA MA NASO/NALFF - Mitigation Site Monitoring

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY16) 6.0.a. Please enter the name(s)

CWA MA NASO/NALFF - Mitigation Site Monitoring (Aeropines)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

X Action Completed

_____ Prior Year Emergent/Executed

_____ Emergent/Accelerated and Executed this FY

_____ Action Considered Accepted Risk/Funding Not Available

_____ Funding Requested but not received

_____ Funding Received but not executable

_____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013

_____ 2014

_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

_____ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
__X__ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

Comment: See FY15 Projects for FY16 executed $.

__X__ Yes
_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

$1000

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

X Yes

_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes

_____ Partially

_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
X	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

3. 60191NR209 : CWA MA NASO/NALFF - Soil & Water Conservation - Erosion Control

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

__X__ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

_____ Action Completed

_____ Prior Year Emergent/Executed

_____ Emergent/Accelerated and Executed this FY

__X__ Action Considered Accepted Risk/Funding Not Available

_____ Funding Requested but not received

_____ Funding Received but not executable

_____ On-Hold

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013
_____ 2014
_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

__X__ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
_____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

X Yes

_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

X Yes

_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes

_____ Partially

_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
X	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

Reporting Unit Metrics Q&A Report: NAS OCEANA

4. 60191NR202 : CWA MA NASO/NALFF - Wetland Mapping Inventory

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

_X_ No

(FY16) 6.0.a. Please enter the name(s)

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.1. What is the current status of the INRMP action? *

Comment: Project was not funded with CN O&MN funding. Installation found funding to accomplish the NASO USACE Jurisdictional Determination 5yr renewal. NALFF still needs to be completed in FY17.

	Action Awarded but not started
	Action Underway
X	Action Completed
	Prior Year Emergent/Executed
	Emergent/Accelerated and Executed this FY
	Action Considered Accepted Risk/Funding Not Available
	Funding Requested but not received
	Funding Received but not executable
	On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

	2013
	2014
	2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

	2017
	2018
	2019
	2020

(FY16) 6.2. How much progress has been made in implementing the action?

	0-25%
	26-50%
	51-75%
	76-99%
X	Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

X Yes

_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes

X No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

Comment: CN O&MN Unfunded. Installation found funding to accomplish (source not provided to EV).

_____ Yes

X No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

1750

(FY16) 6.4. Is the INRMP action on schedule? *

X Yes
_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
X	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

5. 60191NR218 : EO 13112 MA NASO/NALFF - Invasive Species

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes
__X__ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started
_____ Action Underway
_____ Action Completed
_____ Prior Year Emergent/Executed
_____ Emergent/Accelerated and Executed this FY
__X__ Action Considered Accepted Risk/Funding Not Available
_____ Funding Requested but not received
_____ Funding Received but not executable
_____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013
_____ 2014
_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

__X__ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
_____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

__X__ Yes
_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

X Yes
_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
X	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

6. 60191NR204 : MBTA MA NASO/NALFF - Migratory & Breeding Bird Surveys

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY16) 6.0.a. Please enter the name(s)

MBTA MA NASO/NALFF - Migratory & Breeding Bird Surveys (Annual BASH - USDA)

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.1. What is the current status of the INRMP action? *

Comment: AirOps Funds this effort thru their BASH Program Agreement with USDA. Data is provided to the INRM.

	Action Awarded but not started
	Action Underway
X	Action Completed
	Prior Year Emergent/Executed
	Emergent/Accelerated and Executed this FY
	Action Considered Accepted Risk/Funding Not Available
	Funding Requested but not received
	Funding Received but not executable
	On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

	2013
	2014
	2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

	2017
	2018
	2019
	2020

(FY16) 6.2. How much progress has been made in implementing the action?

	0-25%
	26-50%
	51-75%
	76-99%
X	Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

X Yes

_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes

X No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

Comment: Funded by AirOps for USDA BASH Biologist

_____ Yes

X No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

20000

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

X Yes
_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
X	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

7. 60191NR231 : MSFCA MA NASO – Nearshore Environment Assessments

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY16) 6.0.a. Please enter the name(s)

MSFCA MA NASO - Nearshore Environment and Climate Change Assessements (Climate Change)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

_____ Action Completed

_____ Prior Year Emergent/Executed

_____ Emergent/Accelerated and Executed this FY

X Action Considered Accepted Risk/Funding Not Available

_____ Funding Requested but not received

_____ Funding Received but not executable

_____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013

_____ 2014

_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

__X__ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
_____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

__X__ Yes
_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes
__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

__X__ Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

Comment: Climate Change

_____	None
_____	Flora
_____	Fauna
_____	Habitat
_____	At Sea
_____	INRMP-Planned Developments, Updates, & Revisions
_____	Listed Species
_____	Wetlands
_____	Invasives
_____	Soil
_____	Forestry
_____	Outdoor Recreation
_____	Training
X	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

8. 60191NR221 : MSFCA MA NASO/NALFF - Fisheries, Ditches & Streams

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

__X__ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

_____ Action Completed

_____ Prior Year Emergent/Executed

_____ Emergent/Accelerated and Executed this FY

__X__ Action Considered Accepted Risk/Funding Not Available

_____ Funding Requested but not received

_____ Funding Received but not executable

_____ On-Hold

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013
_____ 2014
_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

__X__ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
_____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

X Yes

_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes

X No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes

_____ Partially

_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
X	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

Reporting Unit Metrics Q&A Report: NAS OCEANA

9. 60191NR232 : SIKES MA NASO/NALFF - Conservation Law Enforcement

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

_X_ No

(FY16) 6.0.a. Please enter the name(s)

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.1. What is the current status of the INRMP action? *

- ____ Action Awarded but not started
- ____ Action Underway
- ____ Action Completed
- ____ Prior Year Emergent/Executed
- ____ Emergent/Accelerated and Executed this FY
- X Action Considered Accepted Risk/Funding Not Available
- ____ Funding Requested but not received
- ____ Funding Received but not executable
- ____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

- ____ 2013
- ____ 2014
- ____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

- ____ 2017
- ____ 2018
- ____ 2019
- ____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

- X 0-25%
- ____ 26-50%
- ____ 51-75%
- ____ 76-99%
- ____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

- X Yes
- ____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

__X__ Yes
_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes
__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

- [X] Yes
- [ ] Partially
- [ ] No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

Comment: Conservation Law enforcement/Resource Protection

- [ ] None
- [ ] Flora
- [ ] Fauna
- [ ] Habitat
- [ ] At Sea
- [ ] INRMP-Planned Developments, Updates, & Revisions
- [ ] Listed Species
- [ ] Wetlands
- [ ] Invasives
- [ ] Soil
- [ ] Forestry
- [ ] Outdoor Recreation
- [ ] Training
- [X] Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

10. 60191NR224 : SIKES MA NASO/NALFF - Equipment Maintenance & Repair

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

_X_ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

- ____ Action Awarded but not started
- ____ Action Underway
- ____ Action Completed
- ____ Prior Year Emergent/Executed
- ____ Emergent/Accelerated and Executed this FY
- X Action Considered Accepted Risk/Funding Not Available
- ____ Funding Requested but not received
- ____ Funding Received but not executable
- ____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

- ____ 2013
- ____ 2014
- ____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

- ____ 2017
- ____ 2018
- ____ 2019
- ____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

- X 0-25%
- ____ 26-50%
- ____ 51-75%
- ____ 76-99%
- ____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

X Yes

_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes

X No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

X Yes

_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes
__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

__X__ Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
X	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

11. 60191NR223 : SIKES MA NASO/NALFF - Equipment Storage Structures

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes
__X__ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started
_____ Action Underway
_____ Action Completed
_____ Prior Year Emergent/Executed
_____ Emergent/Accelerated and Executed this FY
__X__ Action Considered Accepted Risk/Funding Not Available
_____ Funding Requested but not received
_____ Funding Received but not executable
_____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013
_____ 2014
_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

__X__ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
_____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

__X__ Yes
_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes
__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

__X__ Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
X	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

12. 60191NR226 : SIKES MA NASO/NALFF - INRMP

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY16 EPRWeb Total Spent

$8,465.00

FY16 RU Share of Total Spent

$8,465.00

(FY16) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY16) 6.0.a. Please enter the name(s)

SIKES MA NASO/NALFF - INRMP (GIS Support)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

X Action Completed

_____ Prior Year Emergent/Executed

_____ Emergent/Accelerated and Executed this FY

_____ Action Considered Accepted Risk/Funding Not Available

_____ Funding Requested but not received

_____ Funding Received but not executable

_____ On-Hold

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013
_____ 2014
_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

_____ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
__X__ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

X Yes

_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

X Yes

_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes

_____ Partially

_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
X	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

Reporting Unit Metrics Q&A Report: NAS OCEANA

13. 60191NR228 : SIKES MA NASO/NALFF - Natural Resources Staff Certification Requirements

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

__X__ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

- ____ Action Awarded but not started
- ____ Action Underway
- X Action Completed
- ____ Prior Year Emergent/Executed
- ____ Emergent/Accelerated and Executed this FY
- ____ Action Considered Accepted Risk/Funding Not Available
- ____ Funding Requested but not received
- ____ Funding Received but not executable
- ____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

- ____ 2013
- ____ 2014
- ____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

- ____ 2017
- ____ 2018
- ____ 2019
- ____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

- ____ 0-25%
- ____ 26-50%
- ____ 51-75%
- ____ 76-99%
- X Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

- X Yes
- ____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

Comment: NAVFAC ML Funded the these requirements with another funding EPR/JON, but did not notify INRM of funding source.

_____ Yes
__X__ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

6967

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

6967

(FY16) 6.4. Is the INRMP action on schedule? *

__X__ Yes
_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

- [X] Yes
- [ ] Partially
- [ ] No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

- [ ] None
- [ ] Flora
- [ ] Fauna
- [ ] Habitat
- [ ] At Sea
- [ ] INRMP-Planned Developments, Updates, & Revisions
- [ ] Listed Species
- [ ] Wetlands
- [ ] Invasives
- [ ] Soil
- [ ] Forestry
- [ ] Outdoor Recreation
- [X] Training
- [ ] Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

14. 60191NR220 : SIKES MA NASO/NALFF – Nuisance Wildlife Inventory, Assessment & Removal

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

_X_ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

- ____ Action Awarded but not started
- ____ Action Underway
- ____ Action Completed
- ____ Prior Year Emergent/Executed
- ____ Emergent/Accelerated and Executed this FY
- X Action Considered Accepted Risk/Funding Not Available
- ____ Funding Requested but not received
- ____ Funding Received but not executable
- ____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

- ____ 2013
- ____ 2014
- ____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

- ____ 2017
- ____ 2018
- ____ 2019
- ____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

- X 0-25%
- ____ 26-50%
- ____ 51-75%
- ____ 76-99%
- ____ Complete

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.3. Was the Action Programmed in EPRWeb?

X Yes

_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes

X No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

X Yes

_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes
__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

__X__ Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
X	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

15. 60191NR222 : SIKES MA NASO/NALFF - Outdoor Recreation Program Requirements

FY16 EPRWeb Total Spent

$0.00

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

__X__ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

_____ Action Completed

_____ Prior Year Emergent/Executed

_____ Emergent/Accelerated and Executed this FY

__X__ Action Considered Accepted Risk/Funding Not Available

_____ Funding Requested but not received

_____ Funding Received but not executable

_____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013

_____ 2014

_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

	2017
	2018
	2019
	2020

(FY16) 6.2. How much progress has been made in implementing the action?

	0-25%
	26-50%
X	51-75%
	76-99%
	Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

X	Yes
	No

(FY16) 6.3.a. Is this action an emergent action?

	Yes
X	No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

X	Yes
	No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes
__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

__X__ Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
X	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

16. 60191NR219 : SIKES MA NASO/NALFF - Wildlife Emergency Response

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

__X__ No

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

_____ Action Completed

_____ Prior Year Emergent/Executed

_____ Emergent/Accelerated and Executed this FY

__X__ Action Considered Accepted Risk/Funding Not Available

_____ Funding Requested but not received

_____ Funding Received but not executable

_____ On-Hold

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013
_____ 2014
_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

_____ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
__X__ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

X Yes

_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

X Yes

_____ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

X Yes

_____ Partially

_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
X	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

17. 60191NR206 : SWCA MA NASO/NALFF - Forest Management

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

__X__ No

(FY16) 6.0.a. Please enter the name(s)

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.1. What is the current status of the INRMP action? *

- ____ Action Awarded but not started
- ____ Action Underway
- ____ Action Completed
- ____ Prior Year Emergent/Executed
- ____ Emergent/Accelerated and Executed this FY
- X Action Considered Accepted Risk/Funding Not Available
- ____ Funding Requested but not received
- ____ Funding Received but not executable
- ____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

- ____ 2013
- ____ 2014
- ____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

- ____ 2017
- ____ 2018
- ____ 2019
- ____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

- X 0-25%
- ____ 26-50%
- ____ 51-75%
- ____ 76-99%
- ____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

- X Yes
- ____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

__X__ Yes
_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes
__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

- [X] Yes
- [ ] Partially
- [ ] No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

- [ ] None
- [ ] Flora
- [ ] Fauna
- [ ] Habitat
- [ ] At Sea
- [ ] INRMP-Planned Developments, Updates, & Revisions
- [ ] Listed Species
- [ ] Wetlands
- [ ] Invasives
- [ ] Soil
- [X] Forestry
- [ ] Outdoor Recreation
- [ ] Training
- [ ] Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

18. 60191NR216 : SWCA MA NASO/NALFF - Habitat Management - Prescribed Fire

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

_____ Yes

__X__ No

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.0.a. Please enter the name(s)

(FY16) 6.1. What is the current status of the INRMP action? *

- ____ Action Awarded but not started
- ____ Action Underway
- ____ Action Completed
- ____ Prior Year Emergent/Executed
- ____ Emergent/Accelerated and Executed this FY
- X Action Considered Accepted Risk/Funding Not Available
- ____ Funding Requested but not received
- ____ Funding Received but not executable
- ____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

- ____ 2013
- ____ 2014
- ____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

- ____ 2017
- ____ 2018
- ____ 2019
- ____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

- X 0-25%
- ____ 26-50%
- ____ 51-75%
- ____ 76-99%
- ____ Complete

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY16) 6.3. Was the Action Programmed in EPRWeb?

X Yes

_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes

X No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

X Yes

_____ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes
__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

__X__ Yes
_____ Partially
_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
X	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

19. UC-60191NR213 : Agriculture

FY16 EPRWeb Total Spent

$0.00

FY16 RU Share of Total Spent

$0.00

(FY16) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY16) 6.0.a. Please enter the name(s)

CWA MA NASO/NALFF – Agricultural Monitoring

(FY16) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

X Action Completed

_____ Prior Year Emergent/Executed

_____ Emergent/Accelerated and Executed this FY

_____ Action Considered Accepted Risk/Funding Not Available

_____ Funding Requested but not received

_____ Funding Received but not executable

_____ On-Hold

(FY16) 6.1.a. If awarded in a prior year, select the year in which the action was awarded.

_____ 2013

_____ 2014

_____ 2015

(FY16) 6.1.b. Select the year that this action was originally planned for in your INRMP.

_____ 2017
_____ 2018
_____ 2019
_____ 2020

(FY16) 6.2. How much progress has been made in implementing the action?

_____ 0-25%
__X__ 26-50%
_____ 51-75%
_____ 76-99%
_____ Complete

(FY16) 6.3. Was the Action Programmed in EPRWeb?

__X__ Yes
_____ No

(FY16) 6.3.a. Is this action an emergent action?

_____ Yes
__X__ No

(FY16) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If no, explain why you believe EPRWeb's amount shown is incorrect in the comments box. If EPRWeb shows zero and funding was spent, select No.

Comment: funded via Ag funds

_____ Yes
__X__ No

(FY16) 6.3.b.1. Enter the correct Total Spent Amount here:

25333.33

(FY16) 6.3.b.2. Enter the correct Expended (invoiced) year to date here:

25333.33

(FY16) 6.4. Is the INRMP action on schedule? *

_____ Yes

__X__ No

(FY16) 6.5. Does this action meet the goals and objectives of the INRMP? *

__X__ Yes

_____ Partially

_____ No

(FY16) 6.5.g. Please select the goal(s) that this action supports.

(FY16) 6.5.o. Please select the objective(s) that this action supports.

(FY16) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

Comment: Agriculture, Soils, and Clean Water Act

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
X	Other NR Requirements (Misc)

(FY16) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

FY15 Projects

Instructions: This section is for projects planned in the installations/site(s) INRMP for award or emergent in **FY15 only**. Projects completed in FY15 and reported as complete in FY15 do not need to be entered. Select a project from the list below (created in the Action Builder) to begin answering questions. To Add new projects, delete existing projects or modify the percentage allocated (share of the project) to this Reporting Unit (RU), click the Blue 'Add/Manage Projects' button. Select the red '**X**' to delete a project, if a project doesn't apply to the Reporting Unit or is not a project that occurred during the current reporting period. If this is an incomplete list, change the 'Action Plan Year' to "2015", use the filters to find any missing projects, check the appropriate check boxes, and click the Blue 'Add Projects' to add additional INRMP actions (projects), e.g. emergent projects, unfunded efforts, or actions that do not require funding, and begin answering questions. Users can also create non-EPRWeb projects by clicking the Green 'Create Project' button.

1. 60191NR205 : 4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection

FY15 EPRWeb Total Spent

$2,000.00

FY15 RU Share of Total Spent

$2,000.00

(FY15) 6.0 Does the action have an alternative name?

X Yes
____ No

(FY15) 6.0.a. Please enter the name(s)

4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection (Bald Eagle)

(FY15) 6.1. What is the current status of the INRMP action? *

____ Action Awarded but not started
X Action Underway
____ Action Completed
____ On-Hold

(FY15) 6.2. How much progress has been made in implementing the action?

____ 0-25%
____ 26-50%
X 51-75%
____ 76-99%
____ Complete

(FY15) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: Habitat Mapping, 1 of 2 Aerial Surveys, and 1 of 2 Eagle Banding efforts Completed in FY16, Invoice Information Not Available at time of INRMP Metrics.

____ Yes
X No

(FY15) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY15) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY15) 6.5. Does this action meet the goals and objectives of the INRMP?

X Yes
_____ Partially
_____ No

(FY15) 6.5.g. Please select the goal(s) that this action supports.

(FY15) 6.5.o. Please select the objective(s) that this action supports.

(FY15) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
X	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY15) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

2. 60191NR203 : CWA MA NASO/NALFF - Mitigation Site Monitoring

FY15 EPRWeb Total Spent

$12,267.61

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY15 RU Share of Total Spent

$12,267.61

(FY15) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY15) 6.0.a. Please enter the name(s)

CWA MA NASO/NALFF - Mitigation Site Monitoring (Aeropines)

(FY15) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

X Action Completed

_____ On-Hold

(FY15) 6.2. How much progress has been made in implementing the action?

_____ 0-25%

_____ 26-50%

_____ 51-75%

_____ 76-99%

X Complete

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY15) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: Approximately, $1000 was expended by NAVFAC LANT to finish writing report and submitting it to the regualtory agency.

_____ Yes

_X_ No

(FY15) 6.3.b.1. Enter the correct Total Spent Amount here:

$1000.00

(FY15) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY15) 6.5. Does this action meet the goals and objectives of the INRMP?

_X_ Yes

_____ Partially

_____ No

(FY15) 6.5.g. Please select the goal(s) that this action supports.

(FY15) 6.5.o. Please select the objective(s) that this action supports.

(FY15) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
X	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY15) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

3. 60191NR218 : EO 13112 MA NASO/NALFF - Invasive Species

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY15 EPRWeb Total Spent

$0.00

FY15 RU Share of Total Spent

$0.00

(FY15) 6.0 Does the action have an alternative name?

_____ Yes

__X__ No

(FY15) 6.0.a. Please enter the name(s)

(FY15) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

__X__ Action Underway

_____ Action Completed

_____ On-Hold

(FY15) 6.2. How much progress has been made in implementing the action?

- ____ 0-25%
- ____ 26-50%
- ____ 51-75%
- X 76-99%
- ____ Complete

(FY15) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: See FY14 Project for FY16 Execution info.

- X Yes
- ____ No

(FY15) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY15) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY15) 6.5. Does this action meet the goals and objectives of the INRMP?

- X Yes
- ____ Partially
- ____ No

(FY15) 6.5.g. Please select the goal(s) that this action supports.

(FY15) 6.5.o. Please select the objective(s) that this action supports.

(FY15) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
X	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY15) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

Reporting Unit Metrics Q&A Report: NAS OCEANA

4. 60191NR232 : SIKES MA NASO/NALFF - Conservation Law Enforcement

FY15 EPRWeb Total Spent

$39,927.55

FY15 RU Share of Total Spent

$39,927.55

(FY15) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY15) 6.0.a. Please enter the name(s)

SIKES MA NASO/NALFF - Conservation Law Enforcement (Program Needs Assessment)

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY15) 6.1. What is the current status of the INRMP action? *

	Action Awarded but not started
	Action Underway
X	Action Completed
	On-Hold

(FY15) 6.2. How much progress has been made in implementing the action?

	0-25%
	26-50%
	51-75%
	76-99%
X	Complete

(FY15) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: FY16 executed amount = $13, 041.10

	Yes
X	No

(FY15) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY15) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY15) 6.5. Does this action meet the goals and objectives of the INRMP?

X Yes
_____ Partially
_____ No

(FY15) 6.5.g. Please select the goal(s) that this action supports.

(FY15) 6.5.o. Please select the objective(s) that this action supports.

(FY15) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

Comment: Conservation Law Enforcement/Resource Protection

_____ None
_____ Flora
_____ Fauna
_____ Habitat
_____ At Sea
_____ INRMP-Planned Developments, Updates, & Revisions
_____ Listed Species
_____ Wetlands
_____ Invasives
_____ Soil
_____ Forestry
_____ Outdoor Recreation
_____ Training
X Other NR Requirements (Misc)

(FY15) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

5. 60191NR206 : SWCA MA NASO/NALFF - Forest Management

FY15 EPRWeb Total Spent

$15,000.00

FY15 RU Share of Total Spent

$15,000.00

(FY15) 6.0 Does the action have an alternative name?

X Yes

_____ No

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY15) 6.0.a. Please enter the name(s)

SWCA MA NASO/NALFF - Forest Management (Urban Forest Inventory)

(FY15) 6.1. What is the current status of the INRMP action? *

- ____ Action Awarded but not started
- X Action Underway
- ____ Action Completed
- ____ On-Hold

(FY15) 6.2. How much progress has been made in implementing the action?

- ____ 0-25%
- ____ 26-50%
- ____ 51-75%
- X 76-99%
- ____ Complete

(FY15) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: Project was funded at the same time as 5 other projects and funding was allocated to a single EPR for ease of contract funding managment. FY16 Executed Amount = $24,068.01

- ____ Yes
- X No

(FY15) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY15) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY15) 6.5. Does this action meet the goals and objectives of the INRMP?

X Yes
_____ Partially
_____ No

(FY15) 6.5.g. Please select the goal(s) that this action supports.

(FY15) 6.5.o. Please select the objective(s) that this action supports.

(FY15) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
X	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY15) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

6. 60191NR216 : SWCA MA NASO/NALFF - Habitat Management - Prescribed Fire

FY15 EPRWeb Total Spent

$20,774.81

FY15 RU Share of Total Spent

$20,774.81

(FY15) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY15) 6.0.a. Please enter the name(s)

SWCA MA NASO/NALFF - Habitat Management - Prescribed Fire (Management Plan)

(FY15) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

X Action Underway

_____ Action Completed

_____ On-Hold

(FY15) 6.2. How much progress has been made in implementing the action?

_____ 0-25%

_____ 26-50%

X 51-75%

_____ 76-99%

_____ Complete

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY15) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: Project was funded at the same time as 5 other projects and funding was allocated to a single EPR for ease of contract funding managment. FY16 Executed Amount = $24,068.01

_____ Yes

_X_ No

(FY15) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY15) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY15) 6.5. Does this action meet the goals and objectives of the INRMP?

_X_ Yes

_____ Partially

_____ No

(FY15) 6.5.g. Please select the goal(s) that this action supports.

(FY15) 6.5.o. Please select the objective(s) that this action supports.

(FY15) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
X	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY15) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

7. 60191NR231 : MSFCA MA NASO – Nearshore Environment Assessments

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY15 EPRWeb Total Spent

$0.00

FY15 RU Share of Total Spent

$0.00

(FY15) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY15) 6.0.a. Please enter the name(s)

32442MH103 CHS and EFH MA Owls Creek Nearshore Habitat Assessment

(FY15) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

X Action Underway

_____ Action Completed

_____ On-Hold

(FY15) 6.2. How much progress has been made in implementing the action?

- ____ 0-25%
- X 26-50%
- ____ 51-75%
- ____ 76-99%
- ____ Complete

(FY15) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: Project funding was lumped under a different EPR for ease of contract management. FY16 amount executed = $48,435.10

- ____ Yes
- X No

(FY15) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY15) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY15) 6.5. Does this action meet the goals and objectives of the INRMP?

- X Yes
- ____ Partially
- ____ No

(FY15) 6.5.g. Please select the goal(s) that this action supports.

(FY15) 6.5.o. Please select the objective(s) that this action supports.

(FY15) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

Comment: Nearshore

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
X	Other NR Requirements (Misc)

(FY15) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

FY14 Projects

Instructions: This section is for projects planned in the installations/site(s) INRMP for award or emergent in **FY14 only**. Projects completed in FY14 and reported as complete in FY14 do not need to be entered. Select a project from the list below (created in the Action Builder) to begin answering questions. To Add new projects, delete existing projects or modify the percentage allocated (share of the project) to this Reporting Unit (RU), click the Blue 'Add/Manage Projects' button. Select the red '**X**' to delete a project, if a project doesn't apply to the Reporting Unit or is not a project that occurred during the current reporting period. If this is an incomplete list, change the 'Action Plan Year' to "2014", use the filters to find any missing projects, check the appropriate check boxes, and click the Blue 'Add Projects' to add additional INRMP actions (projects), e.g. emergent projects, unfunded efforts, or actions that do not require funding, and begin answering questions. Users can also create non-EPRWeb projects by clicking the Green 'Create Project' button.

1. 60191NR205 : 4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection

FY14 EPRWeb Total Spent

$106,620.90

FY14 RU Share of Total Spent

$106,620.90

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY14) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY14) 6.0.a. Please enter the name(s)

4 SAR MA NASO/NALFF - Species and Habitat of Concern Protection

(FY14) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

X Action Underway

_____ Action Completed

_____ On-Hold

(FY14) 6.2. How much progress has been made in implementing the action?

_____ 0-25%

_____ 26-50%

_____ 51-75%

X 76-99%

_____ Complete

(FY14) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: Funding Lumped into a single EPR for ease of contract Management. FY16 executed = $ 16,159.13.

_____ Yes

X No

(FY14) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY14) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY14) 6.5. Does this action meet the goals and objectives of the INRMP?

X Yes
_____ Partially
_____ No

(FY14) 6.5.g. Please select the goal(s) that this action supports.

(FY14) 6.5.o. Please select the objective(s) that this action supports.

(FY14) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
X	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY14) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

2. 60191NR218 : EO 13112 MA NASO/NALFF - Invasive Species

FY14 EPRWeb Total Spent

$219,791.53

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY14 RU Share of Total Spent

$219,791.53

(FY14) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY14) 6.0.a. Please enter the name(s)

EO 13112 MA NASO/NALFF - Invasive Species (Phragmites, Kudzu, Alligator weed, Asian spiderwort, Golden bamboo)

(FY14) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

X Action Underway

_____ Action Completed

_____ On-Hold

(FY14) 6.2. How much progress has been made in implementing the action?

_____ 0-25%

_____ 26-50%

_____ 51-75%

X 76-99%

_____ Complete

Reporting Unit Metrics Q&A Report: NAS OCEANA

(FY14) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: EPR lumping for ease of contract management. FY16 executed amount = $47,225.50

_____ Yes

_X_ No

(FY14) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY14) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY14) 6.5. Does this action meet the goals and objectives of the INRMP?

_X_ Yes

_____ Partially

_____ No

(FY14) 6.5.g. Please select the goal(s) that this action supports.

(FY14) 6.5.o. Please select the objective(s) that this action supports.

(FY14) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
X	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY14) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

3. 60191NR221 : MSFCA MA NASO/NALFF - Fisheries, Ditches & Streams

Reporting Unit Metrics Q&A Report: NAS OCEANA

FY14 EPRWeb Total Spent

$24,941.45

FY14 RU Share of Total Spent

$24,941.45

(FY14) 6.0 Does the action have an alternative name?

X Yes

_____ No

(FY14) 6.0.a. Please enter the name(s)

MSFCA MA NASO/NALFF - Fisheries, Ditches & Streams (NALFF Inventory/Assessment)

(FY14) 6.1. What is the current status of the INRMP action? *

_____ Action Awarded but not started

_____ Action Underway

X Action Completed

_____ On-Hold

(FY14) 6.2. How much progress has been made in implementing the action?

_____ 0-25%
_____ 26-50%
_____ 51-75%
_____ 76-99%
__X__ Complete

(FY14) 6.3.b. Is the EPRWeb Total Spent amount shown correct? If EPRWeb shows zero and funding was spent, select No.

Comment: EPR consolidation for ease of contract management. FY16 executed amount = $1,058.97.

_____ Yes
__X__ No

(FY14) 6.3.b.1. Enter the correct Total Spent Amount here:

(FY14) 6.3.b.2. Enter the correct Expended (invoiced) here:

(FY14) 6.5. Does this action meet the goals and objectives of the INRMP?

__X__ Yes
_____ Partially
_____ No

(FY14) 6.5.g. Please select the goal(s) that this action supports.

(FY14) 6.5.o. Please select the objective(s) that this action supports.

(FY14) 6.6. Which Natural Resources Program Area most benefitted from the INRMP action? (If other, please describe in the comments)

	None
	Flora
	Fauna
X	Habitat
	At Sea
	INRMP-Planned Developments, Updates, & Revisions
	Listed Species
	Wetlands
	Invasives
	Soil
	Forestry
	Outdoor Recreation
	Training
	Other NR Requirements (Misc)

(FY14) 6.7. If the INRMP action provided an ecosystem integrity benefit, select the ecosystem benefitted.

FY13 Projects

Instructions: This section is for projects planned in the installations/site(s) INRMP for award or emergent in **FY13 only**. Projects completed in FY13 and reported as complete in FY13 do not need to be entered. Select a project from the list below (created in the Action Builder) to begin answering questions. To Add new projects, delete existing projects or modify the percentage allocated (share of the project) to this Reporting Unit (RU), click the Blue 'Add/Manage Projects' button. Select the red '**X**' to delete a project, if a project doesn't apply to the Reporting Unit or is not a project that occurred during the current reporting period. If this is an incomplete list, change the 'Action Plan Year' to "2013", use the filters to find any missing projects, check the appropriate check boxes, and click the Blue 'Add Projects' to add additional INRMP actions (projects), e.g. emergent projects, unfunded efforts, or actions that do not require funding, and begin answering questions. Users can also create non-EPRWeb projects by clicking the Green 'Create Project' button.

Satisfaction Index

Focus Area Score 0.80

Please answer the following general questions associated with INRMP Actions. Questions followed by an asterisk * are mandatory and must be completed before the datacall can be approved and submitted to DoD.

6.8. Do the goals and objectives of the INRMP/Natural Resources Program support other conservation partnerships/initiatives? *

- [X] Yes
- [ ] No

6.9. Which conservation partnerships/initiatives are supported?

- [ ] American Land Trust
- [X] Chesapeake Bay Initiative
- [ ] Coastal America
- [ ] Environmental Security Technology Certification Program (ESTCP)
- [ ] Flat-tailed Horned Lizard Rangewide (sic) Management Strategy
- [ ] Gulf of Coastal Plain Ecosystem Partnership
- [ ] Gulf of Mexico Initiative
- [X] Joint Ventures
- [X] Land Conservation Cooperatives (LCCs)
- [X] Longleaf Pine Initiative
- [X] Longleaf Alliance
- [ ] Mojave Desert Initiative
- [X] National Military Fish and Wildlife Association (NMFWA)
- [X] National Ocean Council (NOC) Regional Planning Bodies
- [ ] Oahu Conservation Partnership
- [X] Partners in Amphibian and Reptile Conservation (PARC)
- [X] Partners in Flight
- [ ] Other, please list

6.10. To what level does the Natural Resources Program/INRMP meet or exceed USFWS expectations? *

- ____ Dissatisfied
- ____ Minimally satisfied
- ____ Somewhat satisfied
- X Completely satisfied
- ____ More than satisfied

6.11. To what level are Natural Resources Program executions meeting State Fish and Wildlife Agency conservation management expectations? *

- ____ Dissatisfied
- ____ Minimally satisfied
- ____ Somewhat satisfied
- X Completely satisfied
- ____ More than satisfied

6.12. To what level are Natural Resource program executions meeting NOAA/NMFS conservation management expectations, if applicable? *

- ____ N/A Does not apply
- ____ Dissatisfied
- ____ Minimally satisfied
- ____ Somewhat satisfied
- X Completely satisfied
- ____ More than satisfied

6.13. To what extent has the INRMP/Natural Resources program successfully supported other mission areas? *

- ____ Not supported
- ____ Minimally supported
- ____ Satisfactorily supported
- X Well supported
- ____ Very well supported

6.14. Are Cooperative Agreements used to execute natural resources program requirements?

Comment: Old Dominion University Tick Study; Christopher Newport University Snake Study; William & Mary College Center for Conservation Biology Bald Eagle Research and Osprey Banding; etc.

- X Yes
- ____ No

6.15. Describe any obstacles to INRMP implementation.

Inadequate field support staffing levels. Inability to acquire ammunition and other explosive devices associated with animal control activities. Lack of funding. Acceptable Risk determinations to not promote, not fund, re-assign funding, or not pursue funding for installation/activity identified projects (POM/EPRweb submitted funds requests). Government Vehicle Reductions causing: an inability for staff to respond or conduct field work in remote areas of the installations requiring 4x4 vehicles for safe and efficient travel and hauling (staff will now either not be able to accomplish certain tasks as usual or they will have less time to accomplish tasks because people are going to have to be shuttled to and from work sites); and an inability to haul equipment to work sites (CN funding is now required to pay to have PWD transportation haul equipment from one site to another so NR can accomplish INRMP required work).

Please enter Findings and Recommendations. Findings and Recommendations serve as additional clarification to the answers provided for this Focus Area, and they are encouraged in order to provide a better understanding of existing activities, issues to be addressed, and unique circumstances.

6. Findings

Obligated = Total Reported Obligated Funds to support the project in the line item FY.
Spent = Total Reported Spent Funds to support the project in the current FY.
Not all inhouse fees utilized by NAVFAC MIDLANT Core EV2/CNRMA EV staff to support Projects identified in this datacall have been reported.
Per NAVFAC MIDLANT Core EV2/CNRMA they fund the majority of their in-house labor with excess funds throughout the region. Also, CNRMA would not issue project orders which complicated the FY funding reporting process. At this time NAVFAC MIDLANT CORE EV2/CNRMA does not specifically tie in-house cost to a specific EPR #. As such, guidance from NAVFAC MIDLANT EV2/CNRMA regarding reporting in the INRMP Metrics datacall, is that for contracts managed by MIDLANT/CNRMA EV2 staff, only contract award amount is to be reported.

NAVFAC LANT provided inhouse funding spent in FY15 on projects and contracts they managed for the FY15 INRMP Metrics Datacall.

Not all conservation initiatives submitted by the installation into EPRweb in POMs 14, 16 and 18 were promoted past the NAVFAC MIDLANT Core/CNRMA to NAVFAC HQ and CNIC (e.g., Agriculture and Forestry Program EPRs). In some cases project frequencies or budgets were altered from what the installation submitted without further justification and detailed updated budget. Budget reductions for the projects resulted in the inability to implement the programs as originally intended.

6. Recommendations

Need to find other funding sources that can help fund projects that do not receive CNIC funding.
Need to utilize end of year funds to fund unfunded projects, which will require SOWs and other paperwork to be prepared in advance of end of year funding availability.
Need to resolve Ammunition Purchasing issues.
CNRMA should authorize project purchase orders to help with tracking of total project (cradle to grave) costs. Better tracking of project costs will help to ensure accuracy of future planning budgets.
If an EPR submission/exhibit is proposed to be altered from what the installation originally entered, then a detailed budget and project justification should be submitted to the installation to ensure that the proposed changes meet the installation's intended purpose for the exhibit before the exhibit is adjusted.

Provide Government vehicles that allow the Natural Resources (NR) program to conduct full range of services. All vehicles should be 4wheel drive and have a minimum engine size of 8 cylinders. At least one vehicle must be capable of safely hauling a large trailer and tractor (several thousand pounds).

7 - Support of Installation Mission

Focus Area Score 0.87

Focus Area Purpose: Evaluate the level to which existing natural resources requirements support the installation's ability to sustain the current operational mission, ensuring no net loss of mission capability.

NOTE: As always, this focus area is to be completed by the Regional Commander/Commanding Officer (CO) or his/her designee with the responsibility for Title 10 installation assets and resources. Natural Resource Manager(s) are available to facilitate and support this process.

Comment on this Focus Area and associated Questions Select this link below each question if you would like to elaborate on the answer provided. This is also a good way to document the assumptions made by all partners that contributed to the answer.

7.1. To what level do natural resources program support the installation's operational mission? *

- [X] The installation is fully mission-capable because the NR Program fully supports current and future missions.
- [ ] Partially mission-capable
- [ ] Not mission-capable

7.2. The Natural Resource program effectively considers current and potential future mission sustainment. *

- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neutral
- [X] Agree
- [ ] Strongly Agree

7.3. What is the level of coordination between natural resources staff and other site(s) departments and military staff? *

- [ ] No coordination
- [ ] Minimal coordination
- [ ] Satisfactory coordination
- [X] Effective coordination
- [ ] Highly effective and successful coordination

7.4. To what extent has the INRMP successfully supported other mission areas? *

	Mission not supported
	Mission minimally supported
	Mission satisfactorily supported
X	Mission well supported and fully capable
	Mission enhanced, well supported and fully capable

7.5. To what extent does the NR Program and INRMP minimize possible contraints imposed by natural resources regulatory requirements?

X	Effectly minimizes mission constraints
	Partially minimizes
	Has not minimized constraints
	Does not address constraints

7.6. To what extent has there been a net loss of training lands or mission-related operational/training activities? *

	Mission is fully impeded; training activities cannot be conducted due to regulatory requirements
	Mission/Training activities are somewhat impeded with workarounds due to regulatory requirements
	Neutral
	No loss occurred
X	Mission has seen benefits

7.7. Please provide examples of how the INRMP or Natural Resources program has resulted in any mission impacts

Due to NR Survey findings confirming the presence of protected species on the installation projects and mission requirements have been delayed or had to be reschedule for a time that was not as convenient to the military mission schedule to avoid and/or minimize impacts to protected resources. Airfield Height Obstruction Tree Clearing delayed due to Northern long-eared bat confirmed presence and wetland permitting & mitigation requirements. These are more a funding and time issue than a lack of programmatic support.

7.8. Please provide examples of how the INRMP or Natural Resources program actions have resulted in mission benefits.

The INRMP has provided sufficient information to aid the installation planners to make more informed decisions regarding proposed activities on the installation. The Natural Resources Program has provided substantial benefits to the moral and welfare of the military and non-military tenants, staff, and community associated with the installation through the hunting and educational trail programs. The Natural Resources program has increased awareness of threats to human health and safety (venomous snakes, poisonous plants, bear safety, etc.) thru the creation and distribution of wildlife brochures and providing training upon request to staff and tenant commands. The Natural Resources program worked with AirOps and Real-estate to update the Agricultural Lease agreements to help support the BASH program.

Regional Commander / Commanding Officer Signature

In the Regional Commander / Commanding Officer Section, this is a simple form to track who your Regional Commander / Commanding Officer is and that they have seen your results. It is not required that they physically type in their name and rank below.

Enter then name of your Regional Commander / Commanding Officer.

Richard J. Meadows

Enter then rank of your Regional Commander / Commanding Officer.

Captiain

Please enter Findings and Recommendations. Findings and Recommendations serve as additional clarification to the answers provided for this Focus Area, and they are encouraged in order to provide a better understanding of existing activities, issues to be addressed, and unique circumstances.

7. Findings

The Natural Resources (NR) program has benefited the mission by ensuring compliance with appropriate Federal and State Requirements. The NR program has coordinated with the appropriate authorities and commands to identify requirements and has actively pursued and obtained permits such as USFWS Migratory Bird and Eagle Harassment, VDGIF Kill, VDEQ Wetland, and USACE Wetland Permits. They have also coordinated all mitigation requirement oversights to keep the military mission in full operation. They have conducted various other projects such as nuisance wildlife and invasive species control that reduces blockages and damage to our stormwater infrastructure which helps to minimize the installation's flooding issues, which also contributes to human health and safety as well as continued military operations. The NR program has continued to restore Dune Habitat which has promoted conservation initiatives, and has ensured realistic training environments for our military personnel. The NR program has provided recreational opportunities to our military (active and retired), staff, spouses/family, and friends that have

boosted the morale and welfare of our warfighters, families and supporters, while managing wildlife populations for mission safety, disease control and conservation. The NR program has also provided Conservation Law-enforcement support to the installation. The NR team's efforts to educate the tenants on the installation and in the public (outside the installation boundaries) has led to a superior crew of 100+ volunteers supporting the NR program to ensure conservation and mission readiness (dune restoration, hunting and fishing area maintenance, etc.). The NR manager has taken the lead in collecting information from tenants and installation support personnel to submit consolidated NAS Oceana responses to datacalls, permit reporting, and to apply for awards & grants. These datacalls and permit reports are not always NR program datacalls, but NR has a component to the information collection. The NR manager is recognized for her leadership and technical expertise not only on the installation but within the entire Conservation Community. She routinely helps to support regional and other installation NR managers and she supports National DoD programs and NGO programs (DoD Partners in Flight Steering Committee Representative, DoD Partners in Flight BASH Working Group Member, National Military Fish & Wildlife Service BASH Working Group Immediate Past-Chairman, and SE Hampton Roads Invasive Species Management Partnership Coordinator).
The NR team utilizes staff, contractors, volunteers, partnerships, and reach-back support to implement the INRMP. Even though all current Navy NR billets (FTEs) are filled, there appears to be a bona fide need for one additional Natural Resources and one additional Conservation Law Enforcement FTEs to fully implement the INRMP to meet all laws, regulations, and policies (see focus areas 3 and 5 of these INRMP metrics for additional details). One program area associated with the INRMP showing the largest staffing deficiency and lacking clear programmatic
details/instruction is the Conservation Law Enforcement Program. Scores in the team adequacy focus area will not improve until the team is adequately staffed.
The Conservation law-enforcement program needs to be better defined and staffed in accordance with DoD Instruction for the Conservation Law-enforcement Program and the Sikes Act. The installation has documented actual and/or attempted wildlife poaching, wildlife killing, illegal introduction of non-native species, baiting, hunting without proper approvals, and cultural resources damage and/or theft. The installation has an active hunting program and is considering implementing an active fishing program. 1 Conservation Law-enforcement officer is not adequate to cover 11+ installations. Cross trained NR, EC, and CR staff is not law-enforcement and all they can do is identify and notify. Installation security officers are not trained to accomplish conservation law-enforcement; however, they do assist upon request. In FY15, the installation planned and awarded, with contract support from NAVFAC MIDLANT EV22 staff, a Conservation Law enforcement Program Needs Assessment. The assessment was finalized in FY16 and is undergoing installation internal coordination prior to further escalation. The integrated BASH program with USDA, Air Operations, and Natural Resources continues to implement wildlife population and habitat management, which provides for improved operations and safety.
The installation staff works with INRMP partners to identify natural resources programmatic needs for the installation. The installation staff develops project justifications, estimated costs to implement the programmatic needs, and enters this information into the appropriate systems for DoD budgeting purposes. Various installation submitted projects identified during the POM funding planning cycles, which are critical to both Natural Resources and Military Mission requirements, were not approved/funded and should be approved/funded. For Example, the Installation identified funding requirements to install BMPs and monitoring needs associated with agricultural leases to support conservation initiatives to reduce run-off of pesticides and soil erosion/sedimentation into waterways and stormwater systems; however, region project reviewers determined the requirement was not needed/did not have a regulatory requirement and did not promote the projects in previous years (POMs 12-14), and reduced the funding (POM16-18) in current and future years to the point that these initiatives cannot be implemented with the revised CNIC budgeted request. CNRMA Instructions for hunting and fishing programs were dated and cancelled last quarter FY16 and 1st quarter FY17. Installation instructions are now needed.
The Natural Resources program demonstrates good overall sensitivity to and awareness of mission needs and environmental issues and strives to improve communication with the command and associated tenants.

The efforts of the NR team have not gone unrecognized. The installation won the Tree City USA award for the 22nd consecutive year for employing superior Urban Forestry management. InFY16 the installation NR team also won the Team, CNO Environmental Award for Natural Resources Conservation.

7. Recommendations

Natural Resources program staffing levels continue to be a limiting factor to completing/complying with INRMP objectives and requirements. Scores in the team adequacy focus area will not improve until the team is adequately staffed.
CNRMA, Hire a full time Natural Resources Specialist and a full time Biological Science Technician to support the mission of NW Annex and its tenant commands.
CNRMA. Hire a full time GS-11 Natural Resources Specialist to support the PWD Oceana Natural Resources Program. CNRMA, Stand up an official Conservation Law-enforcement Program that provides the requirements (Personnel, equipment, training, etc.) identified in the FY15 funded Conservation Law Enforcement Program Assessment of Need documentation. The Conservation Officers should coordinate directly with the installation Natural and Cultural Resources Managers.
Various projects identified during the POM 14, POM 16 & POM 18 funding planning cycles, which are critical to both Natural Resources and military mission requirements or provide a substantial conservation benefit to the installation and surrounding ecosystems, were not approved and/or funded as the installation requested and should be approved/funded should resources become available.
NAVFAC MIDLANT CORE/CNRMA, approve installation/activity submitted POM Conservation Exhibits that are submitted into the EPR system
(including those that are not a regulatory requirement). If NAVFAC MIDLANT
CORE/CNRMA reviewers do not agree with installation submitted estimated costs, methodologies, or frequencies of occurrence; then NAVFAC MIDLANT CORE should submit a revised detailed estimate of cost, methodologies or frequency of occurrence with justification and explanation for the recommended changes to the installation for consideration and verification that it meets the installation's intended purpose and need.
CNIC & CNRMA, fund approved EPR projects. If CNIC funding is not initially vailable/budgeted for an approved project, provide assistance to the installation in locating funds to implement the projects from other sources (Ag., Forestry, QRP, Legacy, inkind services, range funds, end of year funds, funded projects that can't be executed, other sources, etc.).
Installation/NAVFAC MIDLANT PWD Oceana and CNRMA/NAVFAC MIDLANT CORE, continue to coordinate with the appropriate military and civilian personnel at all levels (installation, MIDLANT, LANT, regulatory, etc.) to accomplish mission goals. Strive to improve coordination and information sharing at all levels (both up and down the chain of command).
Installation, create an installation level instruction to cover the hunting and fishing programs for the installation. Due to current staffing shortages consider creating a single instruction that is jointly signed by the NASO and NSAHR COs, since the programs for both commands are currently managed by the same Installation Natural Resources Manager. Remove reference in the INRMP to the CNRMA Hunting and Fishing Instructions once an installation instruction is finalized, since the CNRMA instruction has been cancelled.

Success Stories

Enter the title of the story in the box to the right, then:

1. Click on the blue "Add Story" button to create a record.
2. Click on the record/row of the story and completely fill-out the success story form.
3. Add any supporting document or image files.
4. Click the green "Save" button in the form.

1. Christopher Newport University Snake Study

Source

Date

Reporting Unit Metrics Q&A Report: NAS OCEANA

Select the appropriate topic(s)

	Awards
	BASH
	Coral Reefs
	Cultural
	Erosion Control
X	Fauna
	Flora
	Forestry
	GIS
X	Invasive Species
	NR Management
	Policy
	Public Outreach
	Recreation
	Restoration
X	T&E Species
	Wetlands
	Other - Please Specify

Background discussion.

The objective of the study is to investigate the color variation of garter snakes at several locations across southern Virginia. Color variation can be utilized to determine species differences that could result in new or sub-class species identifications.

Enter summary of the success.

Project is still on going. Results from the Study are provided to the Navy at no cost to the Navy other than access coordination. Project provides data necessary to maintain INRMP object to maintain species inventory data and INRMP goals for ecosystem management and partnerships.

Select story POC.

Wright, Michael - michael.f.wright@navy.mil

Date that the story was submitted.

Upload any images that depict the story.

2. CNO Environmental Award – Natural Resources Team

Source

Reporting Unit Metrics Q&A Report: NAS OCEANA

Date

Select the appropriate topic(s)

X	Awards
	BASH
	Coral Reefs
	Cultural
	Erosion Control
	Fauna
	Flora
	Forestry
	GIS
	Invasive Species
X	NR Management
	Policy
	Public Outreach
	Recreation
	Restoration
	T&E Species
	Wetlands
	Other - Please Specify

Background discussion.

In FY16, the Installation NR Team won the Chief of Naval Operation FY2015 Environmental Award for significant achievements in the Natural Resources Conservation Team Category.

Enter summary of the success.

In FY16, the Installation NR Team won the Chief of Naval Operation FY2015 Environmental Award for significant achievements in the Natural Resources Conservation Team Category.

Select story POC.

Wright, Michael - michael.f.wright@navy.mil

Date that the story was submitted.

Upload any images that depict the story.

3. Eagle Nesting & Roosting Cooperative Ecosystems Studies Unit Agreement

Reporting Unit Metrics Q&A Report: NAS OCEANA

Source

Date

Select the appropriate topic(s)

	Awards
X	BASH
	Coral Reefs
	Cultural
	Erosion Control
X	Fauna
	Flora
	Forestry
X	GIS
	Invasive Species
X	NR Management
	Policy
X	Public Outreach
	Recreation
	Restoration
X	T&E Species
	Wetlands
	Other - Please Specify

Reporting Unit Metrics Q&A Report: NAS OCEANA

Background discussion.

Bald Eagle has been delisted from the ESA, but is still protected under the BAGEPA and the MBTA. The installation has never had a nesting or roosting eagle survey nor a suitable nesting habitat evaluation completed. In FY15 the installation entered into a CESU Partnership with the College of William & Mary's Center for Conservation Biology to conduct such work. Survey and mapping efforts began in FY16.

Enter summary of the success.

Project is still ongoing but is already contributing to data gaps used for Installation, State, and National data repositories. Data is being utilized for project planning on and off the installation.

Select story POC.

Wright, Michael - michael.f.wright@navy.mil

Date that the story was submitted.

Upload any images that depict the story.

4. Multi-Agency Migratory Bird Treaty Act Training Course

Source

Date

4/12/2016

Reporting Unit Metrics Q&A Report: NAS OCEANA

Select the appropriate topic(s)

	Awards
X	BASH
	Coral Reefs
	Cultural
	Erosion Control
X	Fauna
	Flora
	Forestry
	GIS
	Invasive Species
X	NR Management
X	Policy
X	Public Outreach
	Recreation
	Restoration
X	T&E Species
	Wetlands
	Other - Please Specify

Background discussion.

Installation helped to coordinate and host the Navy Funded USFWS Migratory Bird Conservation Training Course. At NASO a field trip was completed that demonstrated the Aviation and Construction Military Missions in conjunction with Migratory Bird Management Implementation Requirements.

Enter summary of the success.

Event pulled together regulators, natural resources managers, NEPA planners, lawyers, etc. from a variety of agencies and branches of DoD. Event provided a mechanism to clarify requirements, allow open candid discussions and answer questions regarding Migratory Bird management requirements. The most important this was that the course provided real-time opportunities for individuals to observe actual military missions and how migratory bird management in needed and being conducted to all military missions to continue without a net loss in training & operations.

Select story POC.

Wright, Michael - michael.f.wright@navy.mil

Date that the story was submitted.

Upload any images that depict the story.

5. Old Dominion University Tick Study

Source

Reporting Unit Metrics Q&A Report: NAS OCEANA

Date

Select the appropriate topic(s)

	Awards
	BASH
	Coral Reefs
	Cultural
	Erosion Control
X	Fauna
	Flora
	Forestry
	GIS
X	Invasive Species
	NR Management
	Policy
	Public Outreach
	Recreation
	Restoration
X	T&E Species
	Wetlands
X	Other - Please Specify

Background discussion.

Partnership with Old Dominion University to identify tick species in the region and associated zoonotic diseases.

Enter summary of the success.

Project is still ongoing but is already contributing to data gaps used for Installation, State, and National data repositories. Data is being utilized for project planning on and off the installation. Study has already identified at least one previously unknown species to the area, it has confirmed the expansion of a species territory from previously know boundaries, it has also confirmed the likely miss identification of one zoonotic disease for another in the local medical facilities.

Select story POC.

Wright, Michael - michael.f.wright@navy.mil

Date that the story was submitted.

Upload any images that depict the story.

6. Tree City USA Award

Reporting Unit Metrics Q&A Report: NAS OCEANA

Source

Date

4/28/2016

Select the appropriate topic(s)

- [X] Awards
- [ ] BASH
- [ ] Coral Reefs
- [ ] Cultural
- [ ] Erosion Control
- [ ] Fauna
- [ ] Flora
- [X] Forestry
- [ ] GIS
- [ ] Invasive Species
- [ ] NR Management
- [ ] Policy
- [ ] Public Outreach
- [ ] Recreation
- [ ] Restoration
- [ ] T&E Species
- [ ] Wetlands
- [ ] Other - Please Specify

Reporting Unit Metrics Q&A Report: NAS OCEANA

Background discussion.

Installation received the Tree City USA Award for the 22nd consecutive year due to their Urban Forest Management efforts.

Enter summary of the success.

Installation received the Tree City USA Award for the 22nd consecutive year due to their Urban Forest Management efforts.

Select story POC.

Wright, Michael - michael.f.wright@navy.mil

Date that the story was submitted.

Upload any images that depict the story.

Summary

List the top three accomplishments for the Natural Resources Program during this reporting period. Please include a statement regarding how these accomplishments support the mission of the installation or other activities. This information may be used to brief program successes up to leadership. See detailed examples provided, here.

1. As a result of this year's annual review, have any additional actions, such as management recommendations related to regulatory drivers (ACOE permits, EFH Issues, etc.), been identified that should be considered for incorporation into the INRMP? *

X Yes

_____ No

1.a. Please explain in detail.

Northern Long Eared Bat Vegetation Management. No Tree Removal During Pupping Season (Jun-Jul).

2. In addition to any findings submitted in the previous 7 Focus Areas, please provide any additional or general findings.

3. In addition to any recommendations submitted in the previous 7 Focus Areas, please provide any additional or general recommendations.

Reporting Unit Metrics Q&A Report: NAS OCEANA

4. List the top accomplishment for the Natural Resources Program during this reporting period. *

Providing real-time/life military mission and migratory bird management requirements experiences for students and instructors attending the multi-agency migratory bird conservation training course. (Via a collaboration with the installation and HQ NR programs, installation Air Ops program, USDA-WS, USACE and USFWS.

5. List the second accomplishment for the Natural Resources Program during this reporting period. *

Completing the 1st Nesting Eagle Survey of the installations and associated buffer via a partnership with the College of William and Mary's Center for Conservation Biology.

6. List the third accomplishment for the Natural Resources Program during this reporting period. *

Supporting disease vector research via partnerships with Old Dominion University and City of Virginia Beach.

Agriculture

Agriculture Program Status

Objective: This purpose of this section of the Natural Resources Conservation Metrics data call is to gather required information associated with the status of the Agriculture Program. Responses to the questions in this section are not scored as a part of the Natural Resources Conservation Metrics data call. These questions have been added here to collect information that will support the Defense Environmental Program Annual Report to Congress (DEPARC) and Office of the Secretary of Defense Environmental Management Review (EMR). By combining these questions with responses to the Metric's seven (7) focus areas, Natural Resources Managers are faced with fewer annual data calls.

Is there an active agriculture out-lease program on this site? *

X Yes

_____ No

What are the driving factors for having an Ag Lease on this site?

Airfield Vegetation Height Management. Bird/Animal Aircraft Strike Hazard Minimization. Conservation Funding Revenue. Local Community Economic Benefits.

1. How many active leases are currently associated with this site?

Comment: NASO = 2; NALFF = 3. The NR program manages 5 Ag leased properties. There are technically 7 ag-leases with the additional 2 sites being located in NC. These 2 sites are managed strictly by Real-estate and have not been coordinated with Natural Resources for managment. One property was purchased with the desire to create a new OLF several years ago. The other lease was associated with a tower communication site's land maintenance. Both sites are going through the property disposal process.

5

Reporting Unit Metrics Q&A Report: NAS OCEANA

2. What is the total number # of leased acres?

Comment: Acres were reduced partially thru the year by approximately 93 acres. Removed from 1 NASO lease for a Solar PV Array Renewable Energy Project.

1409

3. What is the Annual lease income?

Comment: Reduced by $6,841.25 for the lease reduction for the PV Array Project at NASO. NRM was not notified of any additional lease reductions that may have occured.

156350

4. What are the Annual expenses?

Comment: NAVFAC MIDLANT Support for minimum requirements.

38,000

5. Do any leases involve in-kind payments?

X Yes

_____ No

5.a What are the number of in-kind leases?

Comment: Leases include maintaining major ditches and security perimeters which reduces the installation's ground-maintenance costs.

5

6. What are the leases for?

- [X] Crop Production
- [ ] Hay
- [ ] Grazing
- [ ] Other
- [ ] Honey Production
- [ ] Honey Bee Rearing

7. What is the primary land use where agriculture out-leasing occurs? Select all that apply.

- [X] Airfield clear/buffer zone
- [ ] Antenna area
- [ ] ESQD Arc
- [ ] Outlying landing field
- [ ] Weapons storage
- [ ] Other, please list

8. Are additional lands available for AG out-leasing?

- [X] Yes
- [ ] No

8.a What is the number of additional acres available?

Comment: Final Acreage is pending implementation of Airfield Obstruction Management Plan Vegetation Conversions and Permitting. Estimated from 5 to 100+.

100

9. Is there an apiary program?

Comment: Our farmer do and are authorized to utilize beens to pollinate their crops; however, we do not specifically have an apiary for bee, wax, or honey production. We are interested in learning more about this process and if it would be feasible on our lands.

- [ ] Yes
- [X] No

9.a Is the apiary activity part of the AG out-lease program?

_____ Yes
_____ No

10. How many personnel are funded through agriculture out-lease funds?

1

11. Primary installation agriculture program POC.

Markham, Jack - jack.markham@navy.mil

Forestry

Forestry Program Status

Objective: This purpose of this section of the Natural Resources Conservation Metrics data call is to gather required information associated with the status of the Forestry Program. Responses to the questions in this section are not scored as a part of the Natural Resources Conservation Metrics data call. These questions have been added here to collect information that will support the Defense Environmental Program Annual Report to Congress (DEPARC) and Office of the Secretary of Defense Environmental Management Review (EMR). By combining these questions with responses to the Metric's seven (7) focus areas, Natural Resources Managers are faced with fewer annual data calls.

1. Does the site have forest cover? *

X Yes

_____ No

1.a What is the total number of forested acres on this site?

3575

2. Is there an active forestry program on this site?

Comment: Currently, no actively managed commercial forest program, but the program was managed decades earlier in such a manner. We conduct select timber harvests and allow the timber to regenerate naturally. There is a proposal to reinitiate a more traditional commercial forest program in support of the Airfield Obstruction Management Plan; however, given the listing of the NLEB and potential Wetland Conversion requirements we are pending an Updated EA and Regulatory Consultations with USFWS and USACE. The Commercial Forestry Program currently consists of Commercial Value and Urban Forest Inventories, Disease Inspections, After Storm Inspections, and Firewood Program. OC = ~2275; FN = ~1300. This will decrease and increase given the status of implementing the Airfield Obstruction Management Plan.

_____ Yes
__X__ No

3. What is the total number of acres currently under active forest management?

4. Is there a commercial forest program?

_____ Yes
_____ No

5. What was the annual program revenue over the past fiscal year?

6. Where any trees harvested during the past fiscal year?

_____ Yes
_____ No

6.a How many acres of forest were harvested during the past fiscal year?

6.b What was the method of harvest?

_____ Clearcut
_____ Seed Tree Cut
_____ Shelterwood Cut
_____ Select Cutting
_____ Group Selection
_____ Single Tree Selection
_____ Commercial Thinning

7. What were the annual program expenses during the past fiscal year?

8. Was there a planting during the past fiscal year?

_____ Yes
_____ No

8.a What were the number of acres regenerated through planting over the past fiscal year?

8.b What species were planted?

9. Did natural regeneration occur last fiscal year?

X Yes

_____ No

9.a How many acres are naturally regenerated?

Comment: 99%. We are assuming this question means cleared areas not currently considered forest but is naturally being allowed to become forest? If not 99% of our forest is currently managed for natural regeneration (not active planting). Decades earlier when the program was managed as a commercial forestry program a mix of planting and natural regeneration. Currently, natural regeneration is the primary method utilized; however, the program does conduct regeneration via planting in several mitigation sites (~150 acres), and also trees are planted in association with our urban forest management program. The installation used to maintain it's own tree nursery; however that program was shut down (apparently due to fare market concerns).

400

10. Does the site have longleaf pine (Pinus palustris)?

X Yes

_____ No

10.a What is the number of acres of longleaf pine (Pinus palustris)?

Comment: Our Stands of Long-leaf Pine are not monocultures, so providing an exact estimate of acreage is a little difficult. NAS Oceana: Non-Urban/Commercial Forest Inventory = ~17.15 Acres mixed species stands (1117-1451 longleaf pine trees, saw-timber) reported; Metrics Originally = Reported 2 acres; and Urban Forest Inventory = TBD. In the past two FYs we have only spent funding on: identifying the presence of this species of concern on the installations via our Natural Heritage and Non-Urban Forest Inventories; and controlling invasive plant species (kudzu and phragmites) on or adjacent to the sites. We have not taken any specific management actions to manage specifically for longleaf pine, except to avoid clearing of such sites. In FY15, we awarded a project to update our prescribed and wildland fire management plan and our urban forest inventory. The fire plan will include some options to specifically benefit the regeneration of Longleaf pine, if we can obtain fire prescriptions that will allow us to burn, then we will implement management action in future years (not anticipated to occur until FY17 or later). Until we are in a position to apply prescribed fire our management of these sites will continue to be natural regeneration, control Invasive Species, control disease outbreaks, and advise planning to avoid conducting longleaf pine tree clearing activities . We have obligated between 2012 and 2015 over $746K on the following contracts: Non-Urban/Commercial Forest Inventories, Invasive Plant Species Inventory, Invasive Plant Control, Natural Heritage Inventories, Prescribed/Wildland Fire Plan Updates, and Urban Forest Inventories? Each of these contracts were associated with ~10,302 acres of Navy Property (Oceana, Dam Neck Annex, and Fentress), of which it appears only 20-30 acres (Oceana and Dam Neck Annex) included long-leaf pine.

17

11. What are the primary commercial species managed?

12. Is prescribed burning used?

_____ Yes

_____ No

12.a What is the number of acres burned in the past year?

13. How many personnel are funded through forestry funds?

14. Primary site forestry program POC.

Summary Score

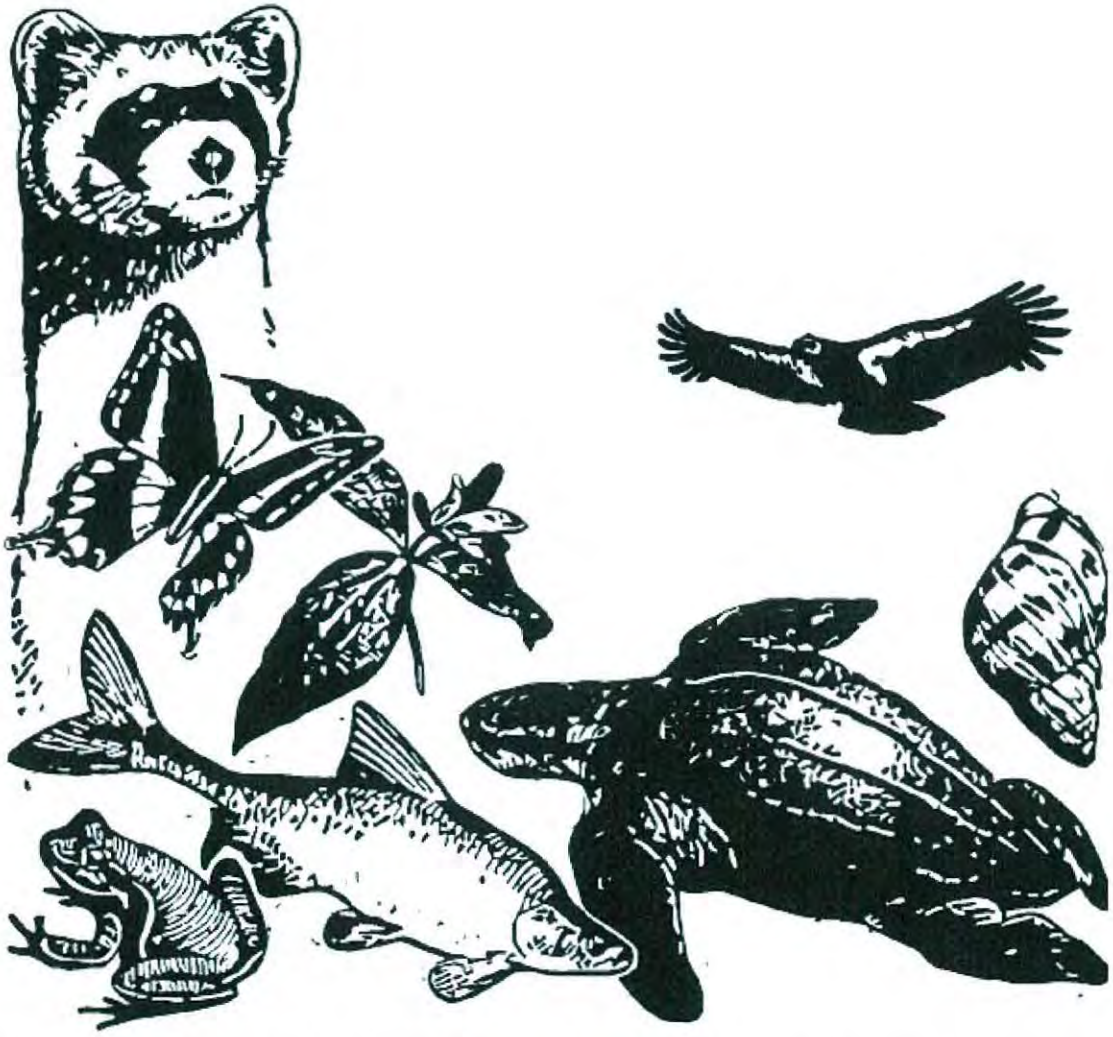
1 - Ecosystem Integrity	0.88
Ecosystems	0.76
Encroachment	1.00
2 - Listed Species Critical Habitat	0.82
Threatened and Endangered Species	0.63
Unoccupied Critical Habitat	1.00
3 - Recreation Use and Access	0.88
4 - Sikes Act Cooperation	0.81
5 - Team Adequacy	0.82
6 - INRMP Implementation	0.37
FY16 Projects	0.37
Satisfaction Index	0.80
7 - Support of Installation Mission	0.87

U.S. Fish & Wildlife Service

IPaC Trust Resources Report

Generated April 27, 2016 11:37 AM MDT, IPaC v3.0.2

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.



IPaC - Information for Planning and Conservation (https://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

U.S. Fish & Wildlife Service

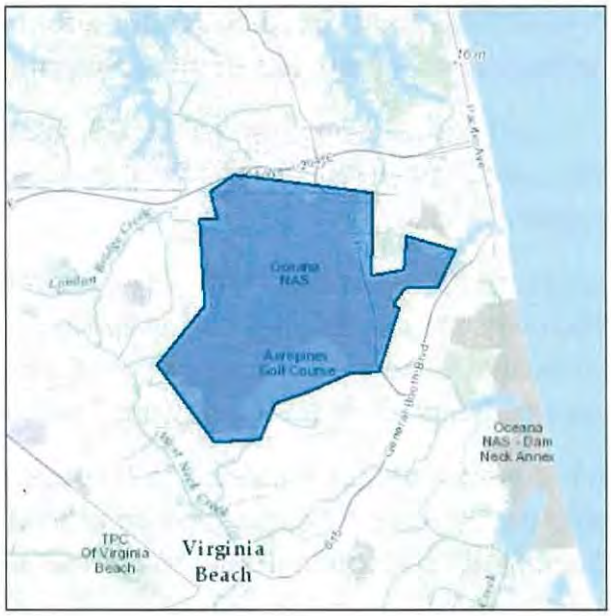
IPaC Trust Resources Report

LOCATION

Virginia Beach County, Virginia

IPAC LINK

https://ecos.fws.gov/ipac/project/PXTR3-2C5YN-GVXPC-HSIYM-FMRG74



U.S. Fish & Wildlife Service Contact Information

Trust resources in this location are managed by:

Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410
(804) 693-6694

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish & Wildlife Service.[1] There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

---

1. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/akn-histogram-tools.php

The following species of migratory birds could potentially be affected by activities in this location:

American Kestrel Falco sparverius paulus — Bird of conservation concern
Year-round

American Oystercatcher Haematopus palliatus — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0G8

American Bittern Botaurus lentiginosus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0F3

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B008

Prothonotary Warbler Protonotaria citrea — Bird of conservation concern
Season: Breeding

Purple Sandpiper Calidris maritima — Bird of conservation concern
Season: Wintering

Red Knot Calidris canutus rufa — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0DM

Red-headed Woodpecker Melanerpes erythrocephalus — Bird of conservation concern
Year-round

Rusty Blackbird Euphagus carolinus — Bird of conservation concern
Season: Wintering

Saltmarsh Sparrow Ammodramus caudacutus — Bird of conservation concern
Year-round

Seaside Sparrow Ammodramus maritimus — Bird of conservation concern
Year-round

Sedge Wren Cistothorus platensis — Bird of conservation concern
Season: Wintering

Short-billed Dowitcher Limnodromus griseus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JK

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Snowy Egret Egretta thula — Bird of conservation concern
Season: Breeding

Swainson's Warbler Limnothlypis swainsonii — Bird of conservation concern
Season: Breeding

Whimbrel Numenius phaeopus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JN

Wood Thrush Hylocichla mustelina — Bird of conservation concern
Season: Breeding

Worm Eating Warbler Helmitheros vermivorum — Bird of conservation concern
Season: Breeding

Yellow Rail Coturnicops noveboracensis — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JG

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

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Wetland data is unavailable at this time.

U.S. Fish & Wildlife Service

IPaC Trust Resources Report

Generated April 27, 2016 11:47 AM MDT, IPaC v3.0.2

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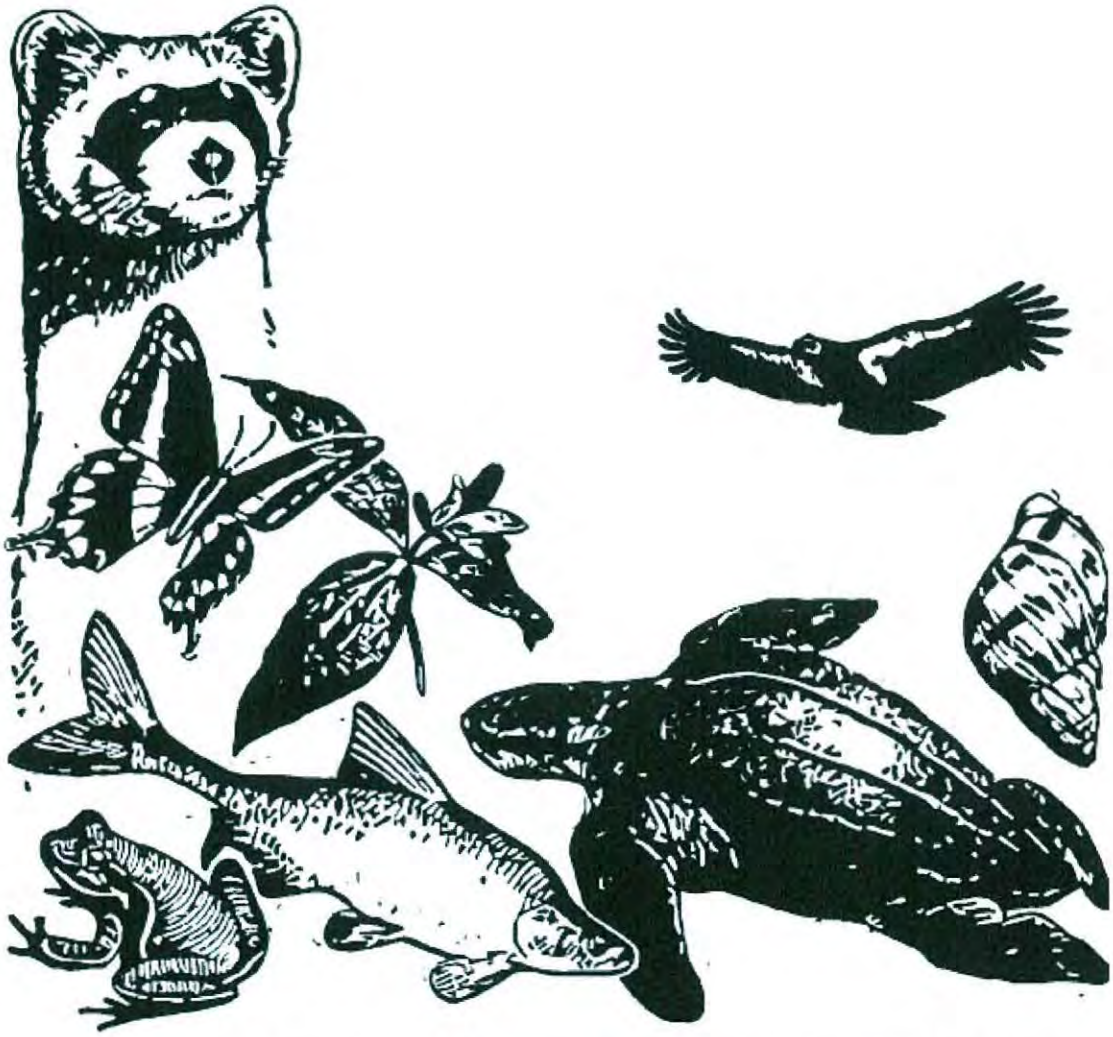

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U.S. Fish & Wildlife Service

IPaC Trust Resources Report

LOCATION

Chesapeake County, Virginia

IPAC LINK

https://ecos.fws.gov/ipac/project/62DWR-VUIGB-CUZNZ-NKWYQ-65NTUY

U.S. Fish & Wildlife Service Contact Information

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Season: Breeding

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Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JN

Wood Thrush Hylocichla mustelina — Bird of conservation concern
Season: Breeding

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Wetland data is unavailable at this time.


Virginia Department of Game and Inland Fisheries

4/9/2015 2:15:43 PM

Fish and Wildlife Information Service

VaFWIS Search Report Compiled on 4/9/2015, 2:15:43 PM

Help

Known or likely to occur within a **5 mile radius around point Naval Air Station Oceanna Military Virginia Beach city**
(at 36,48,57.9 -76,01,22.9)
in **810 Virginia Beach City, VA**

View Map of Site Location

627 Known or Likely Species ordered by Status Concern for Conservation
(displaying first 51) (51 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name
010031	FESE	I	Sturgeon, shortnose	Acipenser brevirostrum
010032	FESE	II	Sturgeon, Atlantic	Acipenser oxyrinchus
040183	FESE	IV	Tern, roseate	Sterna dougallii dougallii
030073	FESE		Turtle, hawksbill sea	Eretmochelys imbricata
030074	FESE		Turtle, Kemp's ridley sea	Lepidochelys kempii
030075	FESE		Turtle, leatherback sea	Dermochelys coriacea
120030	FESE		Manatee, West Indian	Trichechus manatus
030071	FTST	I	Turtle, loggerhead sea	Caretta caretta
040120	FTST	I	Plover, piping	Charadrius melodus
030072	FTST		Turtle, green sea	Chelonia mydas
030064	SE	I	Turtle, eastern chicken	Deirochelys reticularia reticularia
040118	SE	I	Plover, Wilson's	Charadrius wilsonia
040110	SE	I	Rail, black	Laterallus jamaicensis
050034	SE	I	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis
030013	SE	II	Rattlesnake, canebrake	Crotalus horridus
040096	ST	I	Falcon, peregrine	Falco peregrinus
040129	ST	I	Sandpiper, upland	Bartramia longicauda
040293	ST	I	Shrike, loggerhead	Lanius ludovicianus
040379	ST	I	Sparrow, Henslow's	Ammodramus henslowii
040179	ST	I	Tern, gull-billed	Sterna nilotica
020002	ST	II	Treefrog, barking	Hyla gratiosa
030010	ST	II	Lizard, eastern glass	Ophisaurus ventralis
050008	ST	IV	Shrew, Dismal Swamp southeastern	Sorex longirostris fisheri

040403	ST		Falcon, Arctic peregrine	Falco peregrinus tundrius
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans
040144	FP	IV	Knot, red	Calidris canutus rufa
050022	FP		Bat, northern long-eared	Myotis septentrionalis
010038	FC	IV	Alewife	Alosa pseudoharengus
040093	FS	II	Eagle, bald	Haliaeetus leucocephalus
110353	FS	II	SPIDER, FUNNEL-WEB	Barronopsis jeffersi
100002	FS	III	Skipper, Duke's (or scarce swamp)	Euphyes dukesi
030067	CC	II	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin
030063	CC	III	Turtle, spotted	Clemmys guttata
040225		I	Sapsucker, yellow-bellied	Sphyrapicus varius
040319		I	Warbler, black-throated green	Dendroica virens
040422		I	Warbler, Wayne's	Dendroica virens waynei
020063		II	Toad, oak	Anaxyrus quercicus
040038		II	Bittern, American	Botaurus lentiginosus
040052		II	Duck, American black	Anas rubripes
040029		II	Heron, little blue	Egretta caerulea caerulea
040036		II	Night-heron, yellow-crowned	Nyctanassa violacea violacea
040213		II	Owl, northern saw-whet	Aegolius acadicus
040114		II	Oystercatcher, American	Haematopus palliatus
040105		II	Rail, king	Rallus elegans
040192		II	Skimmer, black	Rynchops niger
040381		II	Sparrow, saltmarsh sharp-tailed	Ammodramus caudacutus
040186		II	Tern, least	Sterna antillarum
040187		II	Tern, royal	Sterna maxima maximus
040320		II	Warbler, cerulean	Dendroica cerulea
040304		II	Warbler, Swainson's	Limnothlypis swainsonii
040266		II	Wren, winter	Troglodytes troglodytes

To view **All 627 species** View 627

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; FS=Federal Species of Concern; CC=Collection Concern

** I=VA Wildlife Action Plan - Tier I - Critical Conservation Need;
II=VA Wildlife Action Plan - Tier II - Very High Conservation Need;
III=VA Wildlife Action Plan - Tier III - High Conservation Need;
IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need

Anadromous Fish Use Streams

N/A

Impediments to Fish Passage (1 records) View Map of All Fish Impediments

ID	Name	River	View Map
156	GREAT NECK DAM	TR-EASTERN BR LYNNHAVEN RIVER	Yes

Threatened and Endangered Waters

N/A

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

N/A

Bald Eagle Nests (4 records)

View Map of All Query Results
Bald Eagle Nests

Nest	N Obs	Latest Date	DGIF Nest Status	View Map
VB0401	13	Apr 27 2010	HISTORIC	Yes
VB0601	13	May 18 2011	RECENTLY ACTIVE	Yes
VB0702	10	May 18 2011	RECENTLY ACTIVE	Yes
VB0901	7	May 18 2011	UNKNOWN	Yes

Displayed 4 Bald Eagle Nests

Habitat Predicted for Aquatic WAP Tier I & II Species

N/A

Habitat Predicted for Terrestrial WAP Tier I & II Species (7 Species)

View Map of Combined Terrestrial Habitat Predicted for 7 WAP Tier I & II Species Listed Below

ordered by Status Concern for Conservation

BOVA Code	Status*	Tier**	Common Name	Scientific Name	View Map
040183	FESE	IV	Tern, roseate	Sterna dougallii dougallii	Yes
030071	FTST	I	Turtle, loggerhead sea	Caretta caretta	Yes
030013	SE	II	Rattlesnake, canebrake	Crotalus horridus	Yes
050008	ST	IV	Shrew, Dismal Swamp southeastern	Sorex longirostris fisheri	Yes
030067	CC	II	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin	Yes
040422		I	Warbler, Wayne's	Dendroica virens waynei	Yes

040105		II	Rail, king	Rallus elegans	Yes

Virginia Breeding Bird Atlas Blocks (7 records)

View Map of All Query Results
Virginia Breeding Bird Atlas Blocks

BBA ID	Atlas Quadrangle Block Name	Breeding Bird Atlas Species			View Map
		Different Species	Highest TE*	Highest Tier**	
62046	Cape Henry, SE	72		II	Yes
62045	Cape Henry, SW	1		II	Yes
62022	Pleasant Ridge, NE	2			Yes
62032	Princess Anne, NE	56		IV	Yes
62036	Princess Anne, SE	59		IV	Yes
63033	Virginia Beach, CW	61		II	Yes
63035	Virginia Beach, SW	75		II	Yes

Public Holdings: (6 names)

Name	Agency	Level
Oceana Naval Air Station	Department of the Navy	Federal
Dam Neck Combat Training Center	Dept. of the Army	Federal
Camp Pendleton State Military Reservation	U.S. Dept. of Army	Federal
NAB Camp Pendleton	U.S. Dept. of Navy	Federal
Oceana Naval Air Station	U.S. Dept. of Navy	Federal
Back Bay National Wildlife Refuge	U.S. Fish and Wildlife Service	Federal

Summary of BOVA Species Associated with Cities and Counties of the Commonwealth of Virginia:

FIPS Code	City and County Name	Different Species	Highest TE	Highest Tier
810	Virginia Beach City	556	FESE	I

USGS 7.5' Quadrangles:
Pleasant Ridge
Princess Anne
Cape Henry
North Bay
Virginia Beach
North Virginia Beach

USGS NRCS Watersheds in Virginia:

N/A

USGS National 6th Order Watersheds Summary of Wildlife Action Plan Tier I, II, III, and IV Species:

HU6 Code	USGS 6th Order Hydrologic Unit	Different Species	Highest TE	Highest Tier
AO23	Atlantic Ocean-Rudee Inlet	86	FESE	I
AO25	Atlantic Ocean-Sand Ridge	82	FESE	I
AS13	Upper North Landing River	86	FPSE	I
AS14	West Neck Creek	81	FPSE	I
AS18	Ashville Bridge Creek	83	FESE	I
CB25	Lynnhaven River	90	FESE	I

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audit no. 645307 4/9/2015 2:15:43 PM Virginia Fish and Wildlife Information Service


Virginia Department of Game and Inland Fisheries

4/9/2015 2:23:26 PM

Fish and Wildlife Information Service

VaFWIS Search Report Compiled on 4/9/2015, 2:23:26 PM

Help

Known or likely to occur within a **5 mile radius around point Naval Auxiliary Landing Field Fentress Military Chesapeake city (at 36.7000556 -76.1309444)** in **550 Chesapeake City, 810 Virginia Beach City, VA**

View Map of Site Location

659 Known or Likely Species ordered by Status Concern for Conservation (displaying first 51) (51 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name
010031	FESE	I	Sturgeon, shortnose	Acipenser brevirostrum
010032	FESE	II	Sturgeon, Atlantic	Acipenser oxyrinchus
040183	FESE	IV	Tern, roseate	Sterna dougallii dougallii
030073	FESE		Turtle, hawksbill sea	Eretmochelys imbricata
030074	FESE		Turtle, Kemp's ridley sea	Lepidochelys kempii
030075	FESE		Turtle, leatherback sea	Dermochelys coriacea
120030	FESE		Manatee, West Indian	Trichechus manatus
030071	FTST	I	Turtle, loggerhead sea	Caretta caretta
040120	FTST	I	Plover, piping	Charadrius melodus
030072	FTST		Turtle, green sea	Chelonia mydas
030064	SE	I	Turtle, eastern chicken	Deirochelys reticularia reticularia
040118	SE	I	Plover, Wilson's	Charadrius wilsonia
040110	SE	I	Rail, black	Laterallus jamaicensis
050034	SE	I	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis
030013	SE	II	Rattlesnake, canebrake	Crotalus horridus
040096	ST	I	Falcon, peregrine	Falco peregrinus
040129	ST	I	Sandpiper, upland	Bartramia longicauda
040293	ST	I	Shrike, loggerhead	Lanius ludovicianus
040379	ST	I	Sparrow, Henslow's	Ammodramus henslowii
040179	ST	I	Tern, gull-billed	Sterna nilotica
020002	ST	II	Treefrog, barking	Hyla gratiosa
030010	ST	II	Lizard, eastern glass	Ophisaurus ventralis
050008	ST	IV	Shrew, Dismal Swamp southeastern	Sorex longirostris fisheri

040403	ST		Falcon, Arctic peregrine	Falco peregrinus tundrius
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans
040144	FP	IV	Knot, red	Calidris canutus rufa
050022	FP		Bat, northern long-eared	Myotis septentrionalis
010038	FC	IV	Alewife	Alosa pseudoharengus
010045	FC		Herring, blueback	Alosa aestivalis
040093	FS	II	Eagle, bald	Haliaeetus leucocephalus
100002	FS	III	Skipper, Duke's (or scarce swamp)	Euphyes dukesi
030067	CC	II	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin
030063	CC	III	Turtle, spotted	Clemmys guttata
040225		I	Sapsucker, yellow-bellied	Sphyrapicus varius
040319		I	Warbler, black-throated green	Dendroica virens
040422		I	Warbler, Wayne's	Dendroica virens waynei
020063		II	Toad, oak	Anaxyrus quercicus
040038		II	Bittern, American	Botaurus lentiginosus
040052		II	Duck, American black	Anas rubripes
040029		II	Heron, little blue	Egretta caerulea caerulea
040036		II	Night-heron, yellow-crowned	Nyctanassa violacea violacea
040213		II	Owl, northern saw-whet	Aegolius acadicus
040114		II	Oystercatcher, American	Haematopus palliatus
040105		II	Rail, king	Rallus elegans
040192		II	Skimmer, black	Rynchops niger
040381		II	Sparrow, saltmarsh sharp-tailed	Ammodramus caudacutus
040186		II	Tern, least	Sterna antillarum
040187		II	Tern, royal	Sterna maxima maximus
040320		II	Warbler, cerulean	Dendroica cerulea
040304		II	Warbler, Swainson's	Limnothlypis swainsonii
040266		II	Wren, winter	Troglodytes troglodytes

To view **All 659 species** View 659

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; FS=Federal Species of Concern; CC=Collection Concern

** I=VA Wildlife Action Plan - Tier I - Critical Conservation Need;
II=VA Wildlife Action Plan - Tier II - Very High Conservation Need;
III=VA Wildlife Action Plan - Tier III - High Conservation Need;
IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need

Anadromous Fish Use Streams

N/A

Impediments to Fish Passage (1 records) View Map of All Fish Impediments

ID	Name	River	View Map
297	STUMPY LAKE DAM	NORTH LANDING RIVER	Yes

Threatened and Endangered Waters

N/A

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

N/A

Bald Eagle Nests (6 records)

View Map of All Query Results Bald Eagle Nests

Nest	N Obs	Latest Date	DGIF Nest Status	View Map
CP0303	16	May 18 2011	UNKNOWN	Yes
CP1001	3	May 18 2011	RECENTLY ACTIVE	Yes
VB0701	10	May 18 2011	RECENTLY ACTIVE	Yes
VB1103	2	May 18 2011	RECENTLY ACTIVE	Yes
VB9501	4	Jun 10 1996	HISTORIC	Yes
VB9701	26	May 18 2011	RECENTLY ACTIVE	Yes

Displayed 6 Bald Eagle Nests

Habitat Predicted for Aquatic WAP Tier I & II Species

N/A

Habitat Predicted for Terrestrial WAP Tier I & II Species (5 Species)

View Map of Combined Terrestrial Habitat Predicted for 5 WAP Tier I & II Species Listed Below

ordered by Status Concern for Conservation

BOVA Code	Status*	Tier**	Common Name	Scientific Name	View Map
030013	SE	II	Rattlesnake, canebrake	Crotalus horridus	Yes
050008	ST	IV	Shrew, Dismal Swamp southeastern	Sorex longirostris fisheri	Yes
030067	CC	II	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin	Yes
040422		I	Warbler, Wayne's	Dendroica virens waynei	Yes

040105		II	Rail, king	Rallus elegans	Yes

Virginia Breeding Bird Atlas Blocks (7 records)

View Map of All Query Results
Virginia Breeding Bird Atlas Blocks

BBA ID	Atlas Quadrangle Block Name	Breeding Bird Atlas Species			View Map
		Different Species	Highest TE*	Highest Tier**	
61026	Fentress, SE	78		IV	Yes
61025	Fentress, SW	2		III	Yes
61036	Kempsville, SE	53		II	Yes
62023	Pleasant Ridge, CW	2			Yes
62022	Pleasant Ridge, NE	2			Yes
62021	Pleasant Ridge, NW	2			Yes
62026	Pleasant Ridge, SE	64		IV	Yes

Public Holdings: (2 names)

Name	Agency	Level
Fentress Landing field	Dept. of the Navy	Federal
North Landing River State Natural Area Preserve	VA Dept. of Conservation and Recreation	State

Summary of BOVA Species Associated with Cities and Counties of the Commonwealth of Virginia:

FIPS Code	City and County Name	Different Species	Highest TE	Highest Tier
550	Chesapeake City	491	FESE	I
810	Virginia Beach City	556	FESE	I

USGS 7.5' Quadrangles:
Fentress
Kempsville
Pleasant Ridge
Princess Anne

USGS NRCS Watersheds in Virginia:

N/A

USGS National 6th Order Watersheds Summary of Wildlife Action Plan Tier I, II, III, and IV Species:

HU6 Code	USGS 6th Order Hydrologic Unit	Different Species	Highest TE	Highest Tier

AS12	Chesapeake Canal	84	FPSE	I
AS13	Upper North Landing River	86	FPSE	I
AS14	West Neck Creek	81	FPSE	I
AS15	Pocaty River	86	FPSE	I
AS16	North Landing River-Blackwater Creek	86	FPSE	I
JL51	Southern Branch Elizabeth River-New Mill Creek	74	FPSE	I

Compiled on 4/9/2015, 2:23:26 PM V645309.0 report=V searchType= R dist= 8046.72 poi= 36.7000556 -76.1309444

audit no. 645309 4/9/2015 2:23:26 PM Virginia Fish and Wildlife Information Service

Virginia Natural Heritage Database Search

Results

Natural Heritage Resources

Your Criteria
County: Chesapeake (City)
Watershed (8 digit HUC): 03010205 - Albemarle
Subwatershed (12 digit HUC): AS12 - Chesapeake Canal-Stumpy Lake
Search Run: 4/9/2015 14:48:34 PM
Click scientific names below to go to NatureServe report.
Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Chesapeake (City)						
Albemarle						
Chesapeake Canal-Stumpy Lake						
DIPLOPODA (MILLIPEDES)						
A Millipede	*Pseudopolydesmus paludicolus*	G2G4	S2?	None	None	2
LEPIDOPTERA (BUTTERFLIES & MOTHS)						
Little Metalmark	*Calephelis virginiensis*	G4	S1	None	None	11
Dukes' Skipper	*Euphyes dukesi*	G3	S2	None	None	12
MAMMALS						
Dismal Swamp Southeastern Shrew	*Sorex longirostris fisheri*	G5T4	S2	None	LT	8
REPTILES						
Canebrake Rattlesnake	*Crotalus horridus [Coastal Plain population]*	G4T4	S1	None	LE	19
TERRESTRIAL NATURAL COMMUNITY						
Non-Riverine Swamp Forest (Tupelo - Bald Cypress Type)	*Nyssa biflora - Taxodium distichum - Acer rubrum / (Persea palustris) / Clethra alnifolia / Woodwardia virginica Forest*	G2G3	S1S2	None	None	2
Non-Riverine Wet Hardwood Forest (Southern Coastal Plain Type)	*Quercus (michauxii, pagoda, laurifolia) / Carpinus caroliniana / (Leucothoe axillaris) - Arundinaria tecta Forest*	G2	S1	None	None	6
Bald Cypress - Mixed Tupelo Intermediate	*Taxodium distichum - Nyssa (biflora, aquatica) / Itea virginica / Saururus*	G3G4	S3S4	None	None	4

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Swamp	*cernuus Forest*					
VASCULAR PLANTS						
Spanish-moss	*Tillandsia usneoides*	G5	S1S2	None	None	19
Virginia Least Trillium	*Trillium pusillum var. virginianum*	G3T2	S2	SOC	None	33
Iris-leaf yellow-eyed grass	*Xyris iridifolia*	G4G5T4T5	S1	None	None	5

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.
For Additional Information on locations of Natural Heritage Resources please submit an **information request**.
To Contribute information on locations of natural heritage resources, please fill out and submit a **rare species sighting form**.

Natural Heritage Resources

Your Criteria
County: Chesapeake (City)
Watershed (8 digit HUC): 03010205 - Albemarle
Subwatershed (12 digit HUC): AS13 - (Upper) North Landing River
Search Run: 4/9/2015 15:08:10 PM
Click scientific names below to go to NatureServe report.
Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Chesapeake (City)						
Albemarle						
(Upper) North Landing River						
DIPLOPODA (MILLIPEDES)						
A Millipede	*Pseudopolydesmus paludicolus*	G2G4	S2?	None	None	2
LEPIDOPTERA (BUTTERFLIES & MOTHS)						
Dukes' Skipper	*Euphyes dukesi*	G3	S2	None	None	12
Palatka Skipper	*Euphyes pilatka*	G3G4	S1	None	None	2
REPTILES						
Canebrake Rattlesnake	*Crotalus horridus [Coastal Plain population]*	G4T4	S1	None	LE	19
TERRESTRIAL NATURAL COMMUNITY						
Bald Cypress - Mixed Tupelo Intermediate Swamp	*Taxodium distichum - Nyssa (biflora, aquatica) / Itea virginica / Saururus cernuus Forest*	G3G4	S3S4	None	None	4
VASCULAR PLANTS						
Sawgrass	*Cladium jamaicense*	G5T5	S2	None	None	4
Long-leaf lobelia	*Lobelia elongata*	G4G5	S1	None	None	7
Winged Seedbox	*Ludwigia alata*	G3G5	S1	None	None	7

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.
For Additional Information on locations of Natural Heritage Resources please submit an **information request**.
To Contribute information on locations of natural heritage resources, please fill out and submit a **rare species sighting form**.

Natural Heritage Resources

Your Criteria
County: Chesapeake (City)
Watershed (8 digit HUC): 03010205 - Albemarle
Subwatershed (12 digit HUC): AS15 - Pocaty River
Search Run: 4/9/2015 15:09:08 PM
Click scientific names below to go to NatureServe report.
Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Chesapeake (City)						
Albemarle						
Pocaty River						
LEPIDOPTERA (BUTTERFLIES & MOTHS)						
Little Metalmark	*Calephelis virginiensis*	G4	S1	None	None	11
Dukes' Skipper	*Euphyes dukesi*	G3	S2	None	None	12
Palatka Skipper	*Euphyes pilatka*	G3G4	S1	None	None	2
REPTILES						
Canebrake Rattlesnake	*Crotalus horridus [Coastal Plain population]*	G4T4	S1	None	LE	19
VASCULAR PLANTS						
Sawgrass	*Cladium jamaicense*	G5T5	S2	None	None	4
Long-leaf lobelia	*Lobelia elongata*	G4G5	S1	None	None	7
Winged Seedbox	*Ludwigia alata*	G3G5	S1	None	None	7

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.
For Additional Information on locations of Natural Heritage Resources please submit an **information request**.
To Contribute information on locations of natural heritage resources, please fill out and submit a **rare species sighting form**.

Virginia Natural Heritage Database Search

Results

Natural Heritage Resources

Your Criteria
County: Virginia Beach (City)
Watershed (8 digit HUC): 02080108 - Lynnhaven-Poquoson
Subwatershed (12 digit HUC): CB25 - Lynnhaven River-Broad Bay
Search Run: 4/9/2015 15:15:18 PM
Click scientific names below to go to NatureServe report.
Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Virginia Beach (City)						
Lynnhaven-Poquoson						
Lynnhaven River-Broad Bay						
AMPHIBIANS						
Barking Treefrog	*Hyla gratiosa*	G5	S1	None	LT	23
ARACHNIDA (SPIDERS & PSEUDOSCORPIONS)						
A Funnel-web Spider	*Barronopsis jeffersi*	G3	S1S3	None	None	1
A Two-clawed Hunting Spider	*Castianeira trilineata*	G4?	S1S3	None	None	1
A Nursery-web Spider	*Pisaurina dubia*	G4	S1S3	None	None	1
COLEOPTERA (BEETLES)						
A Tiger Beetle	*Cicindela trifasciata*	G5	S1	None	None	6
HETEROPTERA (TRUE BUGS)						
A Mirid Bug	*Bothynotus johnstoni*	G3	S1S3	None	None	1
Combneck Assassin Bug	*Ctenotrachelus shermani*	G3	S1S3	None	None	1
A Burrower Bug	*Melanaethus cavicollis*	G4	S1S3	None	None	1
Carolina Thread-legged Bug	*Ploiaria carolina*	G4?	S1S3	None	None	1
An Assassin Bug	*Ploiaria hirticornis*	G3?	S1S3	None	None	2
Brimley's Assassin Bug	*Pnirontis brimleyi*	G2	S1S3	SOC	None	1
Seashore Mirid Bug	*Pycnoderiella virginiana*	GU	SU	None	None	1
LEPIDOPTERA (BUTTERFLIES & MOTHS)						
Little Metalmark	*Calephelis virginiensis*	G4	S1	None	None	11
A Geometrid Moth	*Cymatophora approximaria*	G4G5	S1S3	None	None	1

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Dukes' Skipper	*Euphyes dukesi*	G3	S2	None	None	12
A Cane Moth	*Franclemontia interrogans*	G3G4	S1S3	None	None	1
Southeastern Cane Borer Moth	*Papaipema sp. 3*	G4	S2S3	None	None	4
King's Hairstreak	*Satyrium kingi*	G3G4	S2	None	None	8
MAMMALS						
Eastern Big-eared Bat	*Corynorhinus rafinesquii macrotis*	G3G4T3	S2	None	LE	36
NON-VASCULAR PLANTS						
Soft Peatmoss	*Sphagnum molle*	G4	S2	None	None	4
ODONATA (DRAGONFLIES & DAMSELFLIES)						
Fine-lined Emerald	*Somatochlora filosa*	G5	S2	None	None	13
REPTILES						
Chicken Turtle	*Deirochelys reticularia*	G5	S1	None	LE	2
TERRESTRIAL NATURAL COMMUNITY						
Interdune Pond	*Interdune Pond*	G2	S2	None	None	3
Non-Riverine Swamp Forest (Tupelo - Bald Cypress Type)	*Nyssa biflora - Taxodium distichum - Acer rubrum / (Persea palustris) / Clethra alnifolia / Woodwardia virginica Forest*	G2G3	S1S2	None	None	2
Loblolly Pine / Sand Heather Dune Woodland	*Pinus taeda / Hudsonia tomentosa Woodland*	G1G2	S1S2	None	None	6
Maritime Mixed Deciduous Forest	*Quercus nigra - Pinus taeda - Carya pallida - (Fagus grandifolia) / Symplocos tinctoria / Gelsemium sempervirens Forest*	G1	S1	None	None	2
Maritime Live Oak Forest	*Quercus virginiana - Pinus taeda Forest*	G2	S1	None	None	2
Live Oak - Bluejack Oak Dune Woodland	*Quercus virginiana - Quercus incana Woodland*	G1	S1	None	None	2
Maritime Swamp Forest (Bald Cypress Type)	*Taxodium distichum / Cephalanthus occidentalis / Boehmeria cylindrica - Ceratophyllum echinatum Forest*	G1	S1	None	None	1
VASCULAR PLANTS						
A Sandwort	*Arenaria lanuginosa ssp. lanuginosa*	G5T5	SH	None	None	1

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Sandhill thistle	*Cirsium repandum*	G5	SH	None	None	2
Plukenet's flatsedge	*Cyperus plukenetii*	G5	S2	None	None	10
Pineland Tick-trefoil	*Desmodium strictum*	G4	S2	None	None	15
Baldwin's spikerush	*Eleocharis baldwinii*	G4G5	S2	None	None	8
Viviparous Spikerush	*Eleocharis vivipara*	G5	S1	None	None	5
Southern seaside spurge	*Euphorbia bombensis*	G4G5	S2	None	None	18
Sea-beach Sandwort	*Honckenya peploides ssp. robusta*	G5T4	SH	None	None	1
Coastal water-pennywort	*Hydrocotyle bonariensis*	G5	S2	None	None	5
Dune marsh-elder	*Iva imbricata*	G5?	S1S2	None	None	8
American halfchaff sedge	*Lipocarpha maculata*	G5	S1	None	None	9
Long Beach Seedbox	*Ludwigia brevipes*	G2G3	S2	SOC	None	15
Wild Olive	*Osmanthus americanus*	G5	S1	None	None	4
Longleaf pine	*Pinus palustris*	G5	S1	None	None	9
Sand laurel oak	*Quercus hemisphaerica*	G5	S1	None	None	6
Bluejack oak	*Quercus incana*	G5	S2	None	None	16
Fasciculate Beakrush	*Rhynchospora fascicularis*	G5	S1	None	None	8
Long-beaked beaksedge	*Rhynchospora scirpoides*	G4	S1	None	None	5
Freshwater Cordgrass	*Spartina pectinata*	G5	S2	None	None	20
Eaton's Ladies'-tresses	*Spiranthes eatonii*	G2G4	SH	None	None	1
Pineland Scaly-pink	*Stipulicida setacea var. setacea*	G4G5T4T5	S1	None	None	4
Spanish-moss	*Tillandsia usneoides*	G5	S1S2	None	None	19
Purple Bladderwort	*Utricularia purpurea*	G5	S2	None	None	12
American Wisteria	*Wisteria frutescens*	G5	S2	None	None	7

Natural Heritage Resources

Your Criteria
County: Virginia Beach (City)
Watershed (8 digit HUC): 03010205 - Albemarle
Subwatershed (12 digit HUC): AS14 - West Neck Creek
Search Run: 4/9/2015 15:16:47 PM
Click scientific names below to go to NatureServe report.
Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Virginia Beach (City)						
Albemarle						
West Neck Creek						
LEPIDOPTERA (BUTTERFLIES & MOTHS)						
Little Metalmark	*Calephelis virginiensis*	G4	S1	None	None	11
Dukes' Skipper	*Euphyes dukesi*	G3	S2	None	None	12
Palatka Skipper	*Euphyes pilatka*	G3G4	S1	None	None	2
Southeastern Cane Borer Moth	*Papaipema sp. 3*	G4	S2S3	None	None	4
Rare Skipper	*Problema bulenta*	G2G3	S1S2	SOC	None	6
MAMMALS						
Dismal Swamp Southeastern Shrew	*Sorex longirostris fisheri*	G5T4	S2	None	LT	8
REPTILES						
Canebrake Rattlesnake	*Crotalus horridus [Coastal Plain population]*	G4T4	S1	None	LE	19
TERRESTRIAL NATURAL COMMUNITY						
Southern Coastal Plain Mesic Mixed Hardwood Forest	*Fagus grandifolia - Quercus (alba, nigra, michauxii) / Symplocos tinctoria - (Stewartia malacodendron) Forest*	G3	S2S3	None	None	9
VASCULAR PLANTS						
Cypress-knee sedge	*Carex decomposita*	G3G4	S2	None	None	12
Sawgrass	*Cladium jamaicense*	G5T5	S2	None	None	4
Buttonbush dodder	*Cuscuta cephalanthi*	G5	SH	None	None	7
Smartweed Dodder	*Cuscuta polygonorum*	G5	S2?	None	None	8
Long-leaf lobelia	*Lobelia elongata*	G4G5	S1	None	None	7
Winged Seedbox	*Ludwigia alata*	G3G5	S1	None	None	7
Joint Paspalum	*Paspalum distichum*	G5	S2	None	None	6
Spanish-moss	*Tillandsia usneoides*	G5	S1S2	None	None	19
Virginia Least Trillium	*Trillium pusillum var. virginianum*	G3T2	S2	SOC	None	33

Natural Heritage Resources

Your Criteria
County: Virginia Beach (City)
Watershed (8 digit HUC): 03010205 - Albemarle
Subwatershed (12 digit HUC): AS18 - Ashville Bridge Creek-Lake Tecumseh-Redwing Lake-Muddy Creek
Search Run: 4/9/2015 15:17:52 PM
Click scientific names below to go to NatureServe report.
Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Virginia Beach (City)						
Albemarle						
Ashville Bridge Creek-Lake Tecumseh-Redwing Lake-Muddy Creek						
BIRDS						
King Rail	*Rallus elegans*	G4	S2B,S3N	None	None	10
COLEOPTERA (BEETLES)						
A Tiger Beetle	*Cicindela trifasciata*	G5	S1	None	None	6
DIPLOPODA (MILLIPEDES)						
A Millipede	*Pseudopolydesmus paludicolus*	G2G4	S2?	None	None	2
HETEROPTERA (TRUE BUGS)						
An Assassin Bug	*Ploiaria hirticornis*	G3?	S1S3	None	None	2
LEPIDOPTERA (BUTTERFLIES & MOTHS)						
Little Metalmark	*Calephelis virginiensis*	G4	S1	None	None	11
Yucca Giant Skipper	*Megathymus yuccae*	G5	SH	None	None	2
NON-VASCULAR PLANTS						
Trinidad Peatmoss	*Sphagnum trinitense*	G4	S2S3	None	None	5
TERRESTRIAL NATURAL COMMUNITY						
Wind-Tidal Oligohaline Marsh (Creeping Spikerush - Bull-Tongue Arrowhead Type)	*Eleocharis fallax - Sagittaria lancifolia - Persicaria punctata Tidal Herbaceous Vegetation*	G1G2	S1	None	None	3
Wind-Tidal Oligohaline Marsh (Black Needlerush Type)	*Juncus roemerianus - Eleocharis fallax Tidal Herbaceous Vegetation*	G2G3	S2S3	None	None	2
Tidal Bald Cypress Forest / Woodland	*Tidal Bald Cypress Forest / Woodland*	G3	SNR	None	None	1
Interdune Pond (Narrow-leaf Cattail - Swamp Rose-Mallow Type)	*Typha angustifolia - Hibiscus moscheutos Herbaceous Vegetation*	G3	SU	None	None	2
VASCULAR PLANTS						
Pale Grass-pink	*Calopogon pallidus*	G4G5	S1	None	None	4
Buttonbush dodder	*Cuscuta cephalanthi*	G5	SH	None	None	7
Smartweed Dodder	*Cuscuta polygonorum*	G5	S2?	None	None	8

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Viviparous Spikerush	*Eleocharis vivipara*	G5	S1	None	None	5
White-top Fleabane	*Erigeron vernus*	G5	S2	None	None	15
Coastal water-pennywort	*Hydrocotyle bonariensis*	G5	S2	None	None	5
Glossy-seed yellow stargrass	*Hypoxis sessilis*	G4	SH	None	None	1
Carolina Lilaeopsis	*Lilaeopsis carolinensis*	G3G5	S1	None	None	13
American halfchaff sedge	*Lipocarpha maculata*	G5	S1	None	None	9
Winged Seedbox	*Ludwigia alata*	G3G5	S1	None	None	7
Long Beach Seedbox	*Ludwigia brevipes*	G2G3	S2	SOC	None	15
Long-stem adder's-tongue	*Ophioglossum petiolatum*	G5	S1	None	None	3
Bluejack oak	*Quercus incana*	G5	S2	None	None	16
Savannah beaksedge	*Rhynchospora debilis*	G4?	S1	None	None	11
Fasciculate Beakrush	*Rhynchospora fascicularis*	G5	S1	None	None	8
Spanish-moss	*Tillandsia usneoides*	G5	S1S2	None	None	19
Carolina yellow-eyed grass	*Xyris caroliniana*	G4G5	S1	None	None	7

Natural Heritage Resources

Your Criteria
County: Virginia Beach (City)
Watershed (8 digit HUC): 02040304 - Eastern Lower Delmarva
Subwatershed (12 digit HUC): AO23 - Atlantic Ocean-Rudee Inlet
Search Run: 4/9/2015 15:19:21 PM
Click scientific names below to go to NatureServe report.
Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Virginia Beach (City)						
Eastern Lower Delmarva						
Atlantic Ocean-Rudee Inlet						
COLEOPTERA (BEETLES)						
A Tiger Beetle	*Cicindela trifasciata*	G5	S1	None	None	6
LEPIDOPTERA (BUTTERFLIES & MOTHS)						
Little Metalmark	*Calephelis virginiensis*	G4	S1	None	None	11
Southeastern Cane Borer Moth	*Papaipema sp. 3*	G4	S2S3	None	None	4
NON-VASCULAR PLANTS						
Soft Peatmoss	*Sphagnum molle*	G4	S2	None	None	4
TERRESTRIAL NATURAL COMMUNITY						
Interdune Pond	*Interdune Pond*	G2	S2	None	None	3
Loblolly Pine / Sand Heather Dune Woodland	*Pinus taeda / Hudsonia tomentosa Woodland*	G1G2	S1S2	None	None	6
Maritime Mixed Deciduous Forest	*Quercus nigra - Pinus taeda - Carya pallida - (Fagus grandifolia) / Symplocos tinctoria / Gelsemium sempervirens Forest*	G1	S1	None	None	2
Live Oak Dune Scrub	*Quercus virginiana - (Morella pensylvanica) Shrubland*	G3	S1	None	None	2
VASCULAR PLANTS						
Sandhill thistle	*Cirsium repandum*	G5	SH	None	None	2
Baldwin's spikerush	*Eleocharis baldwinii*	G4G5	S2	None	None	8
Viviparous Spikerush	*Eleocharis vivipara*	G5	S1	None	None	5
White-top Fleabane	*Erigeron vernus*	G5	S2	None	None	15
Southern seaside spurge	*Euphorbia bombensis*	G4G5	S2	None	None	18
Sea-beach Sandwort	*Honckenya peploides ssp. robusta*	G5T4	SH	None	None	1
Glossy-seed yellow stargrass	*Hypoxis sessilis*	G4	SH	None	None	1

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences
Dune marsh-elder	*Iva imbricata*	G5?	S1S2	None	None	8
Bog Rush	*Juncus elliottii*	G4G5	S1S2	None	None	7
American halfchaff sedge	*Lipocarpha maculata*	G5	S1	None	None	9
Long Beach Seedbox	*Ludwigia brevipes*	G2G3	S2	SOC	None	15
Wild Olive	*Osmanthus americanus*	G5	S1	None	None	4
Longleaf pine	*Pinus palustris*	G5	S1	None	None	9
Sand laurel oak	*Quercus hemisphaerica*	G5	S1	None	None	6
Bluejack oak	*Quercus incana*	G5	S2	None	None	16
Fasciculate Beakrush	*Rhynchospora fascicularis*	G5	S1	None	None	8
Freshwater Cordgrass	*Spartina pectinata*	G5	S2	None	None	20
Eaton's Ladies'-tresses	*Spiranthes eatonii*	G2G4	SH	None	None	1
Spanish-moss	*Tillandsia usneoides*	G5	S1S2	None	None	19
American Wisteria	*Wisteria frutescens*	G5	S2	None	None	7
Carolina yellow-eyed grass	*Xyris caroliniana*	G4G5	S1	None	None	7

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.
For Additional Information on locations of Natural Heritage Resources please submit an **information request**.
To Contribute information on locations of natural heritage resources, please fill out and submit a **rare species sighting form**.

~1.25km from NALFF boundary

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MAPPING PORTAL

Layers

Bald Eagle
> Eagle Nests
Most recent data CCB has on bald eagle nest locations in Virginia. Data is largely from two annual aerial flights conducted in winter and spring of all tributaries of the lower Chesapeake Bay and other prominent bodies of water. Reported ground survey data is also included.
More info
Eagle Nest Buffers 330'/660'
Eagle Roost Centroids
Eagle Roost Polygons
Eagle Roost Buffers 330'/660'
Eagle Roosts by Topoquad

Waterbirds
Colonial Waterbirds 2013
Chesapeake Bay Herons 2013
Colonial Waterbirds 2008
Colonial Waterbirds 2003

Osprey
OspreyWatch Nests
Chesapeake Bay Osprey Nests 1995-1996

Other Species
Nightjar Survey Network Routes

Map | Satellite
SEARCH

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HELP / FAQ

MAPPING PORTAL

Layers

Bald Eagle

> Eagle Nests

Most recent data CCB has on bald eagle nest locations in Virginia. Data is largely from two annual aerial flights conducted in winter and spring of all tributaries of the lower Chesapeake Bay and other prominent bodies of water. Reported ground survey data is also included.

More info

- Eagle Nest Buffers 330'/660'
- Eagle Roost Centroids
- Eagle Roost Polygons
- Eagle Roost Buffers 330'/660'
- Eagle Roosts by Topoquad

Waterbirds

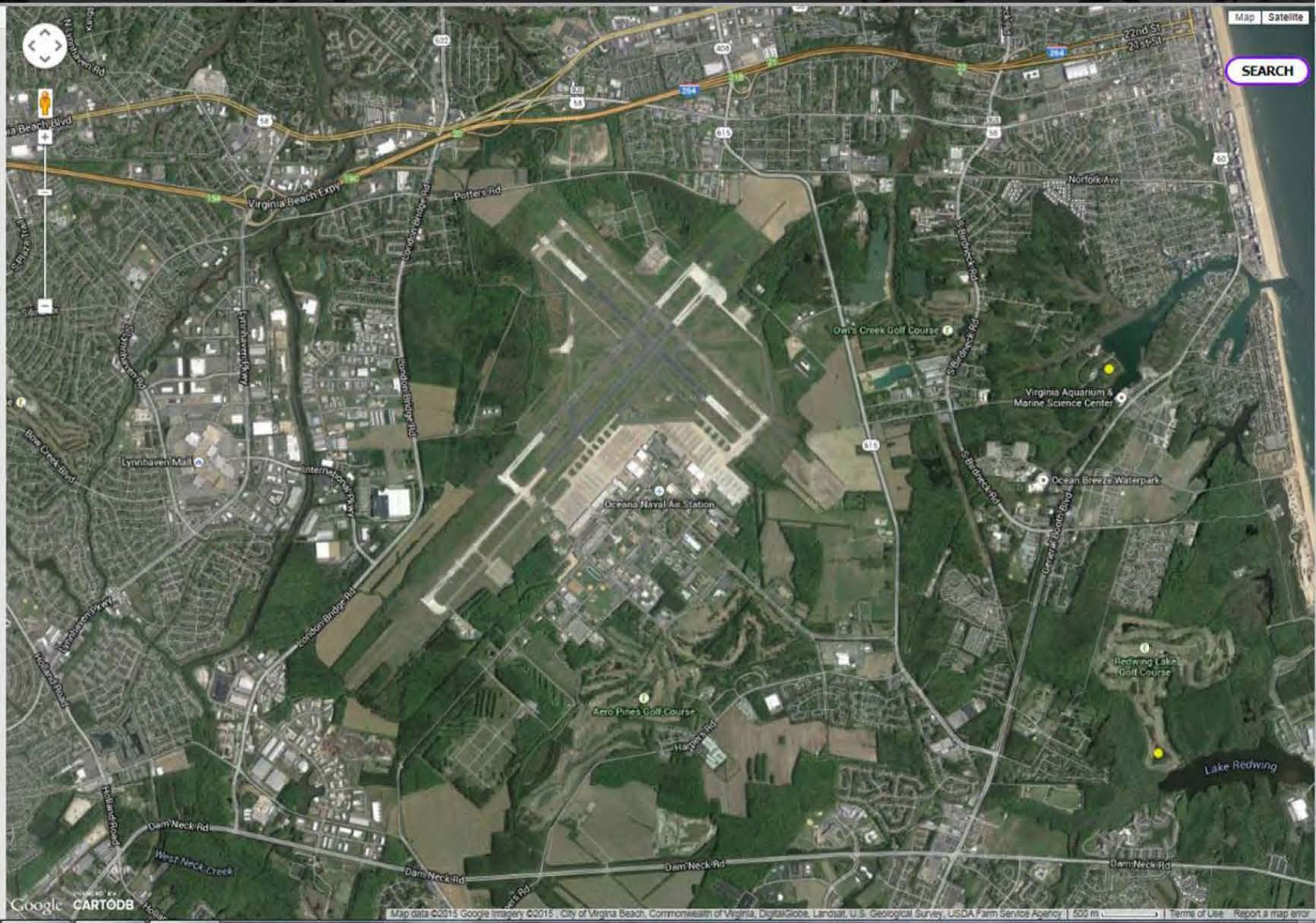
- Colonial Waterbirds 2013
- Chesapeake Bay Herons 2013
- Colonial Waterbirds 2008
- Colonial Waterbirds 2003

Osprey

- OspreyWatch Nests
- Chesapeake Bay Osprey Nests 1995-1996

Other Species

- Nightjar Survey Network Routes



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Appendix N

NAS Oceana–NALF Fentress INRMP Large-Sized Figures (11” x 17”)

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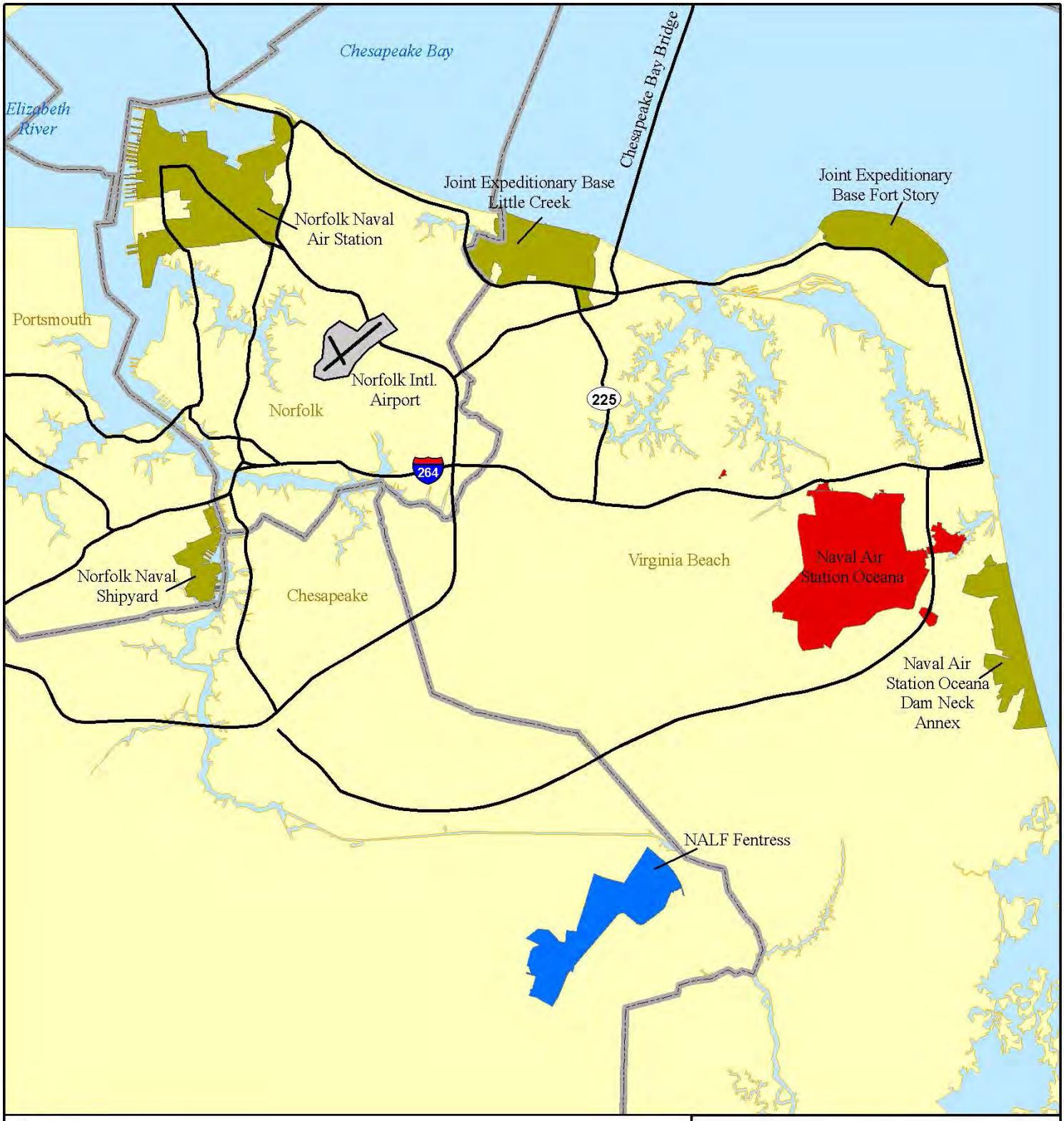
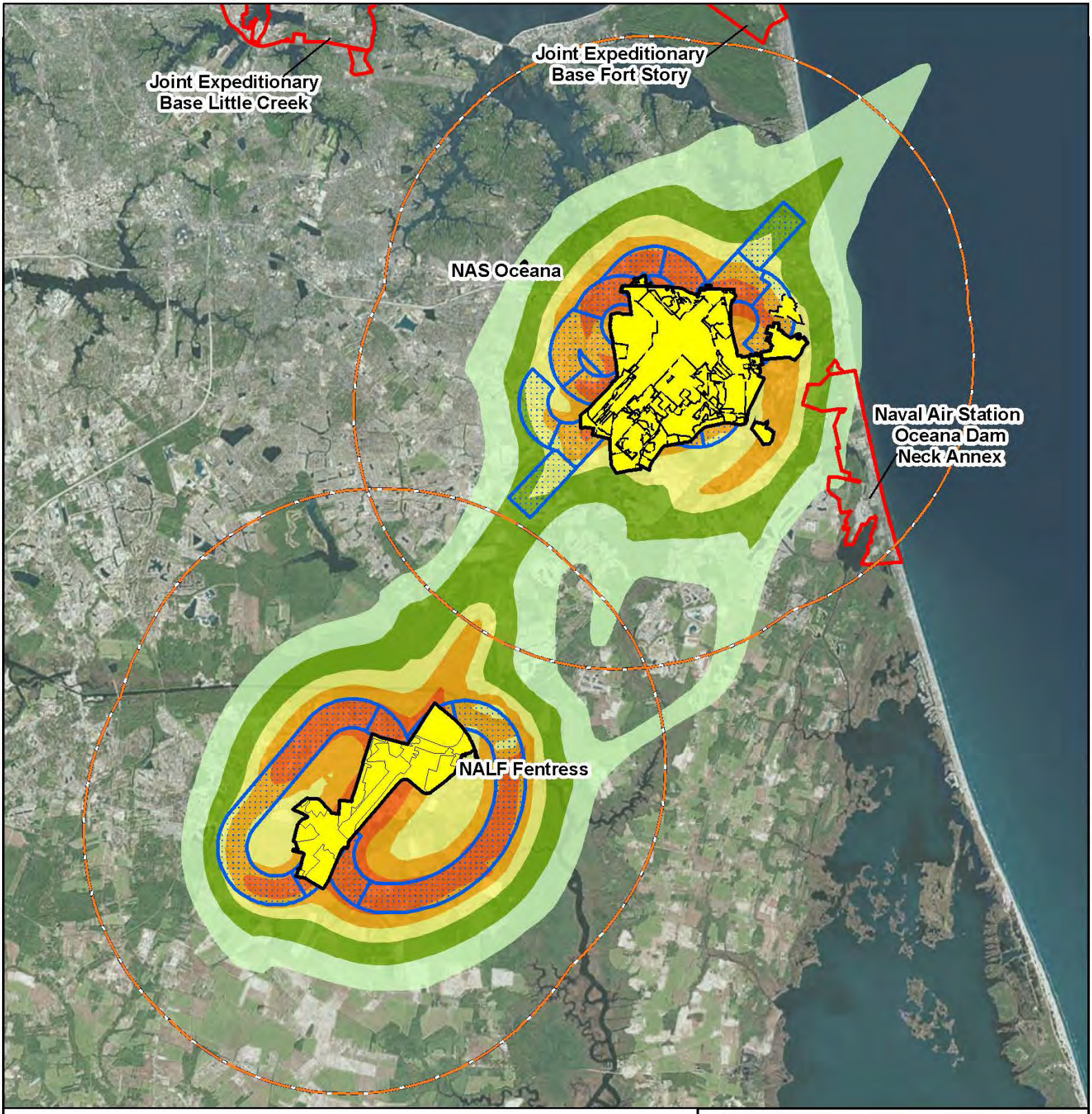

Chesapeake Bay
Elizabeth River
Chesapeake Bay Bridge
Joint Expeditionary Base Little Creek
Joint Expeditionary Base Fort Story
Norfolk Naval Air Station
Portsmouth
Norfolk Intl. Airport
Norfolk
225
264
Virginia Beach
Naval Air Station Oceana
Norfolk Naval Shipyard
Chesapeake
Naval Air Station Oceana Dam Neck Annex
NALF Fentress
Legend
NAS Oceana
NALF Fentress
Regional Installation
City Boundary
Interstate
N
0 1.25 2.5 5
Miles
0 1.5 3 6
Kilometers
Sources: Navy 2014a and ESRI 2012.
Date: Oct. 2014



Legend

- NAS Oceana and NALF Fentress Installation Areas
- Regional Installations
- Accident Zone Potential
- 5-Mile BASH Risk Area

Noise Contours

- 65 dB
- 70 dB
- 75 dB
- 80 dB
- 85+ dB

N

0 1 2 4 Miles

0 1.5 3 6 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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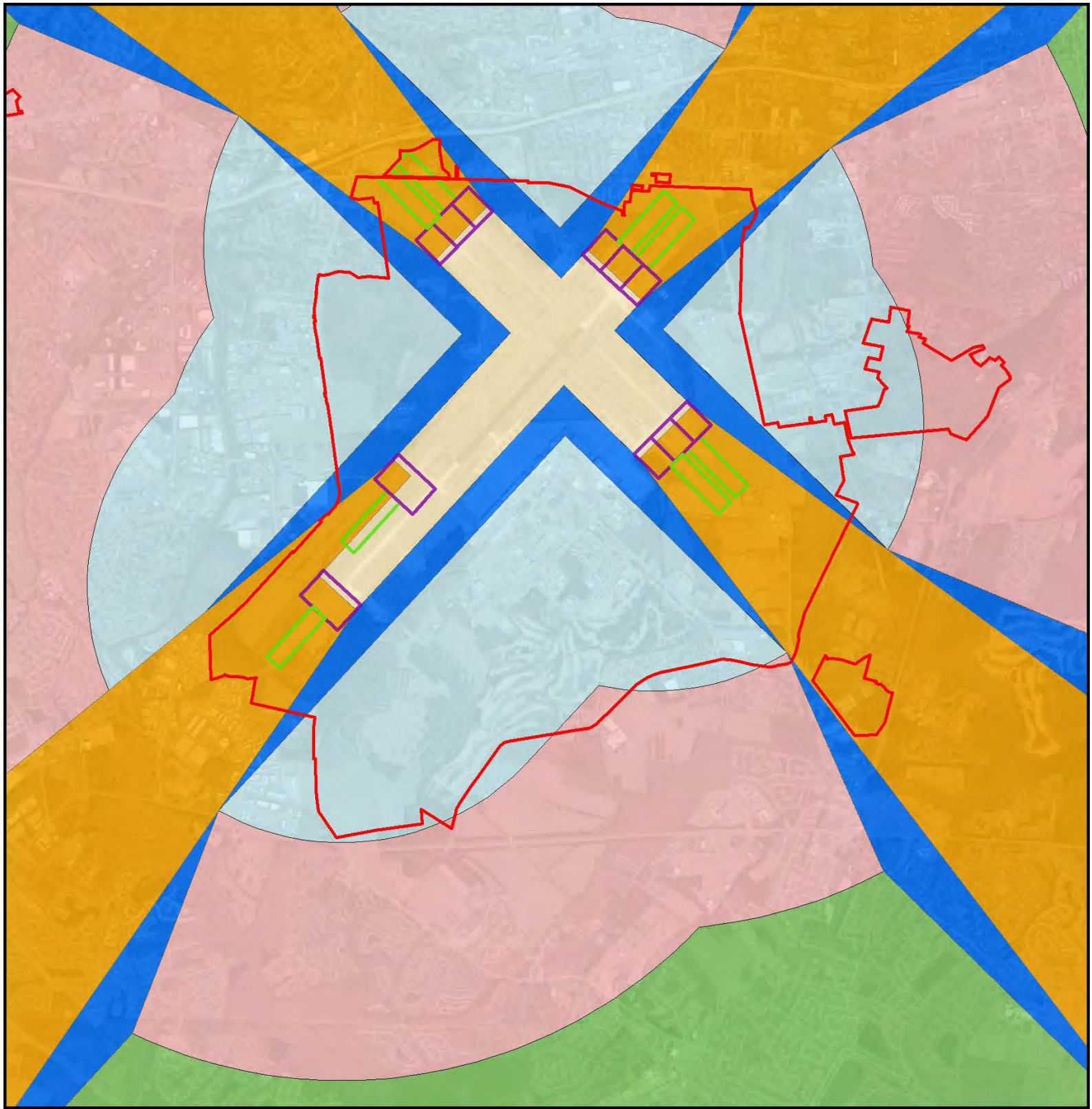

Legend

- NAS Oceana Installation Area
- Clear Zone I
- Clear Zone II
- Primary Surface
- Approach/Departure Transitional
- Outer Horizontal (500 feet above airfield elevation)
- Inner Horizontal Surface (150 feet above airfield elevation)
- Conical Surface (20:1 Slope Ratio)
- Approach-Departure Surface (50:1 Slope Ratio to 500 feet)

N

0 0.25 0.5 1 Miles

0 0.5 1 2 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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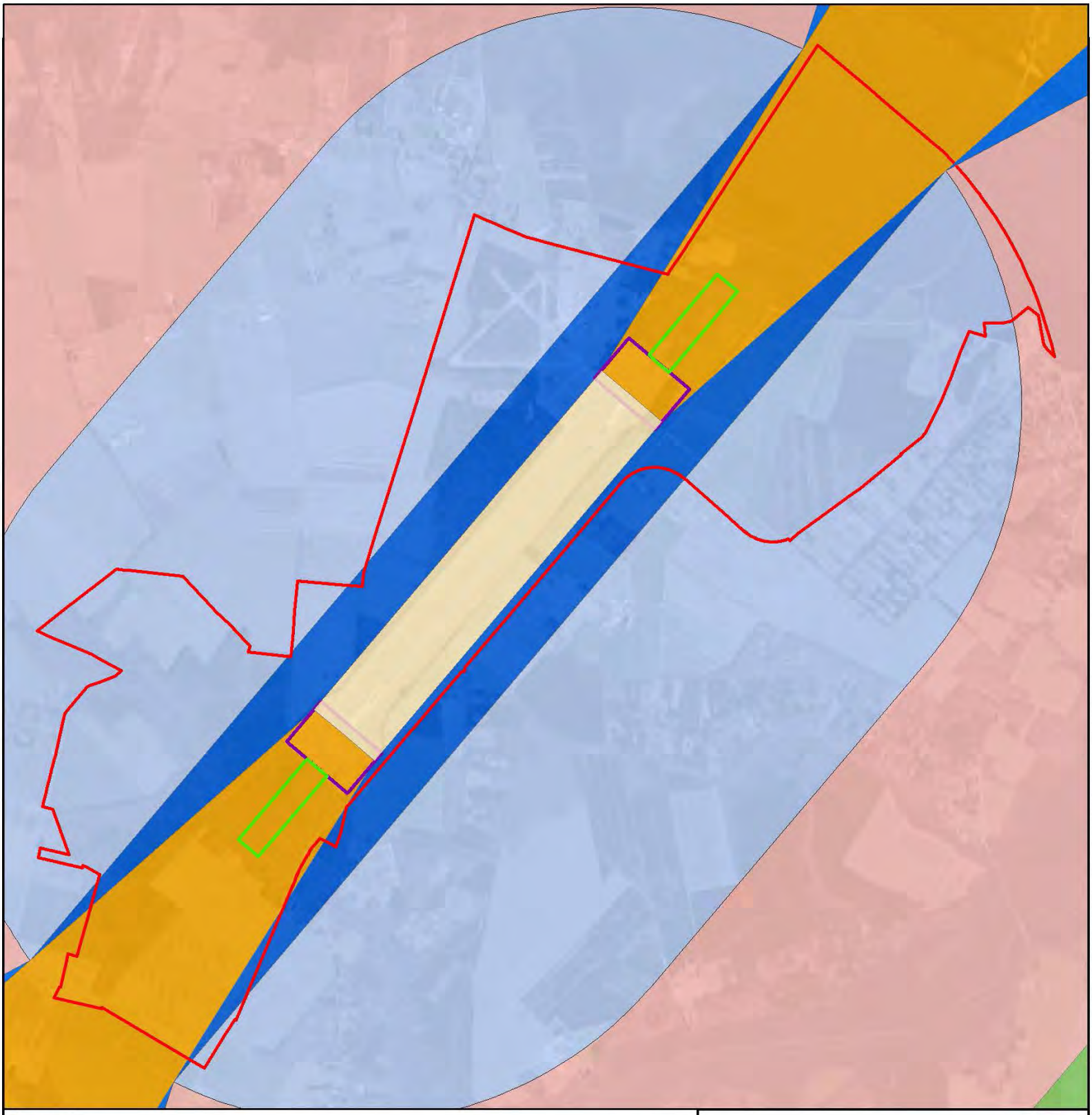


Legend

- NALF Fentress Installation Area
- Clear Zone I
- Clear Zone II
- Outer Horizontal (500 feet above airfield elevation)
- Inner Horizontal (150 feet above airfield elevation)
- Conical (20:1 Slope Ratio)
- Approach/Departure (50:1 Slope Ratio to 500 feet)
- Primary Surface
- Approach/Departure Transitional

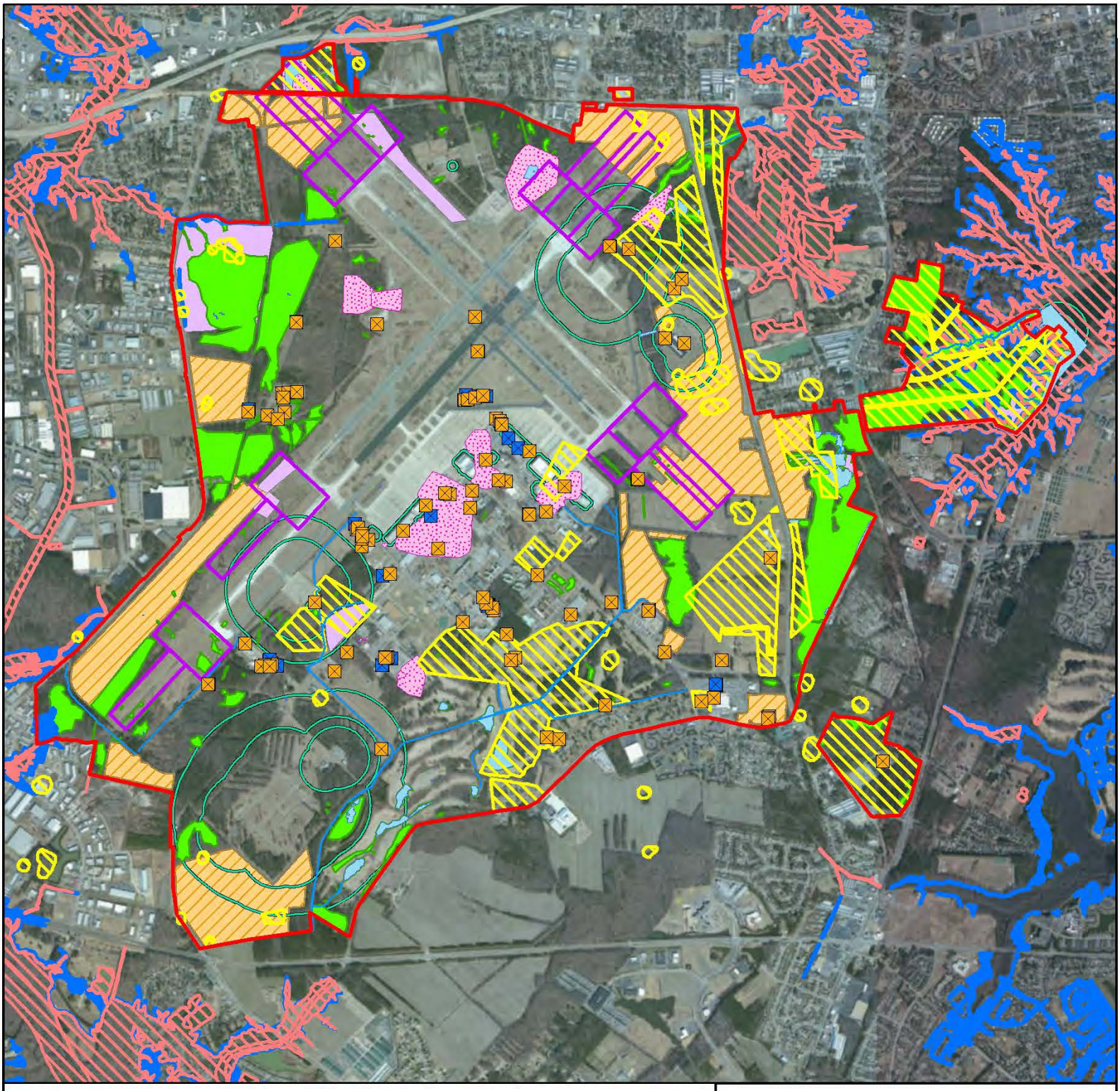
N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014



Legend

- NAS Oceana Installation Area
- Agricultural Outlease Parcel

Constraints

- Clear Zone
- Cultural Probable Sensitive Area
- Explosive Safety Quantity Distance Arc
- Environmental Restoration Program
- Special Interest Area
- Wetland (Jurisdictional)
- Waterbody
- 100-Year Floodplain
- 500-Year Floodplain
- Stream
- Above-ground Storage Tank
- Underground Storage Tank

N

0 0.25 0.5 1 Miles

0 0.5 1 2 Kilometers

Sources: Navy 2014a, ESRI 2012, and FEMA 2014

Date: Oct. 2014

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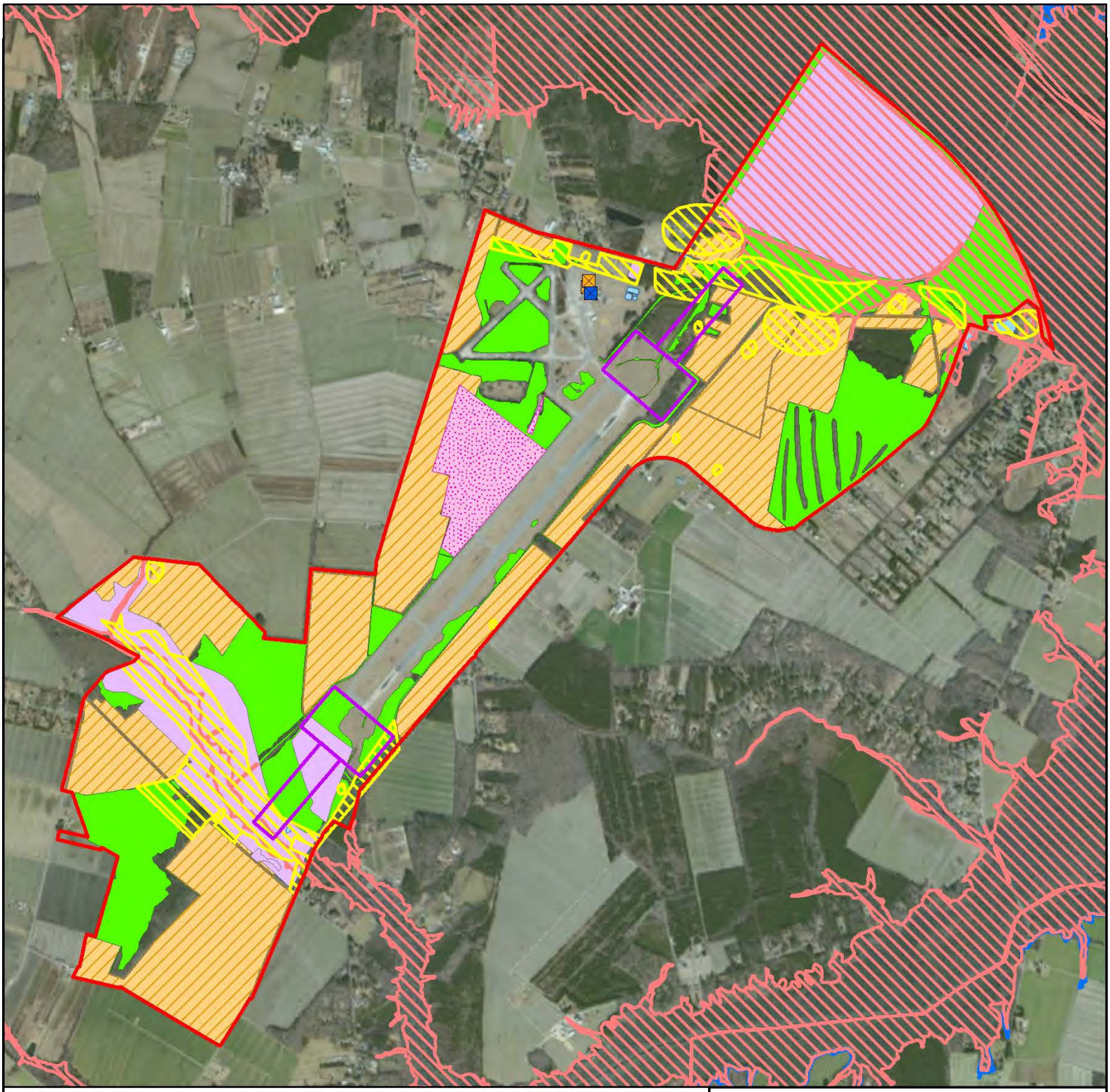


Legend

- NALF Fentress Installation Area
- Agricultural Outlease Parcel

Constraints

- Clear Zone
- Cultural Probable Sentive Area
- Environmental Restoration Program
- Special Interest Area
- Wetland (Jurisdictional)
- Waterbody
- 100-Year Floodplain
- 500-Year Floodplain
- Underground Storage Tank
- Above-ground Storage Tank

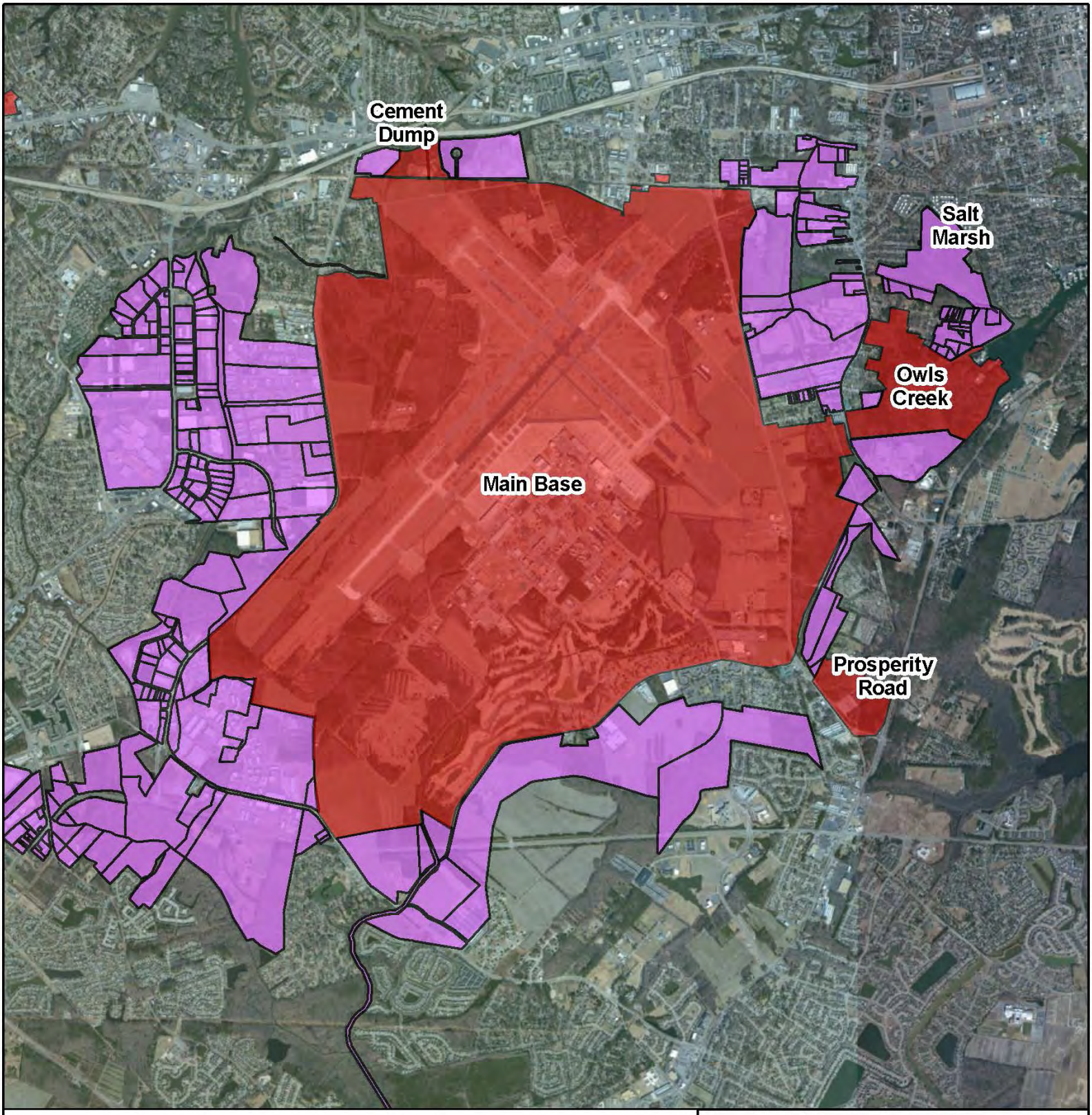
N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a, ESRI 2012, and FEMA 2014.

Date: Oct. 2014



Legend

- NAS Oceana Installation Area
- Restrictive Easement

N

0 0.25 0.5 1 Miles

0 0.5 1 2 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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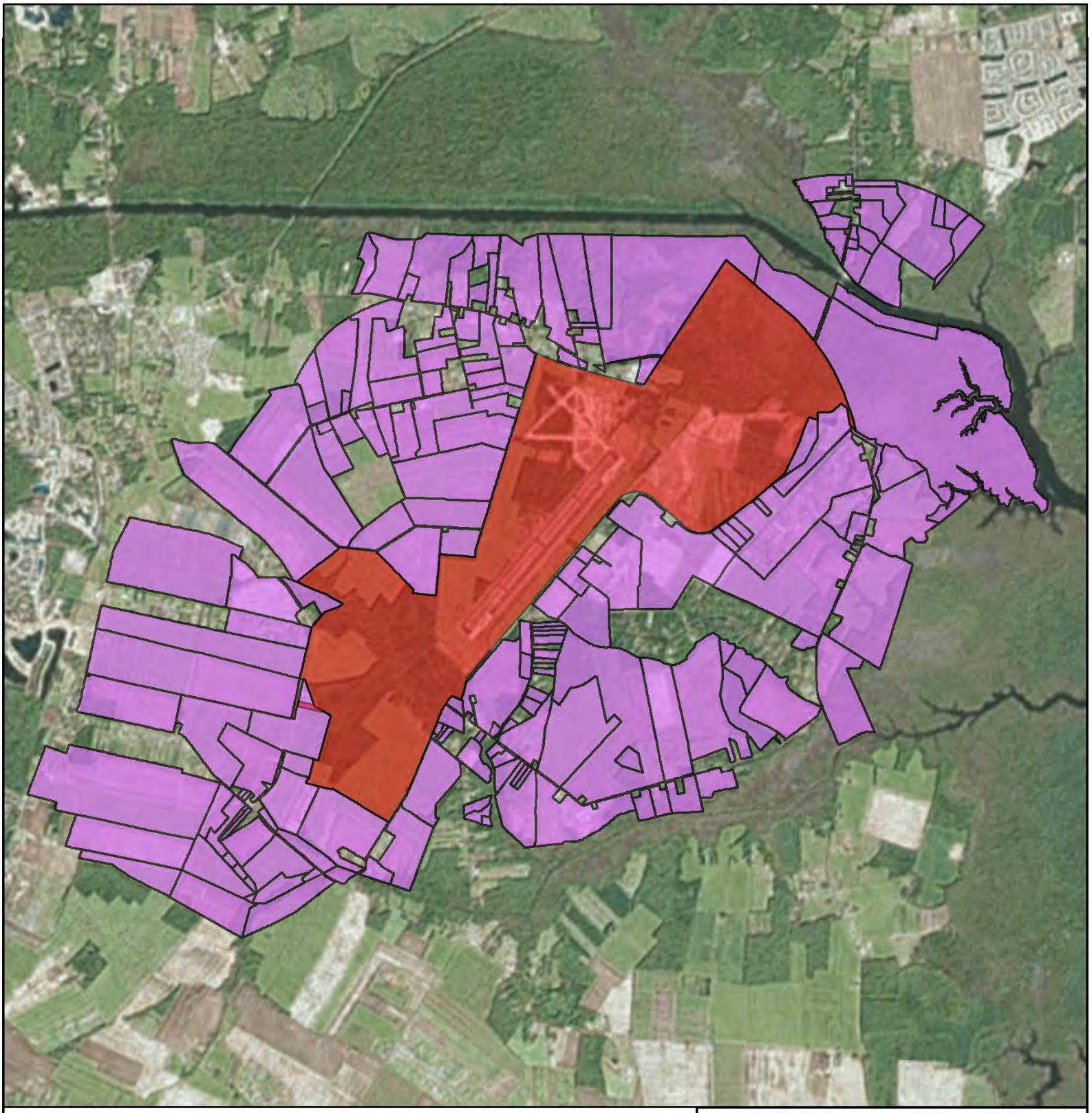

Legend

- NALF Fentress Installation Area
- Restrictive Easement

N

0 0.25 0.5 1
Miles

0 0.5 1 2
Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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Legend

NAS Oceana Installation Area

Elevation Contour (2-foot)

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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Legend

NALF Fentress Installation Area

Elevation Contour (2-foot)

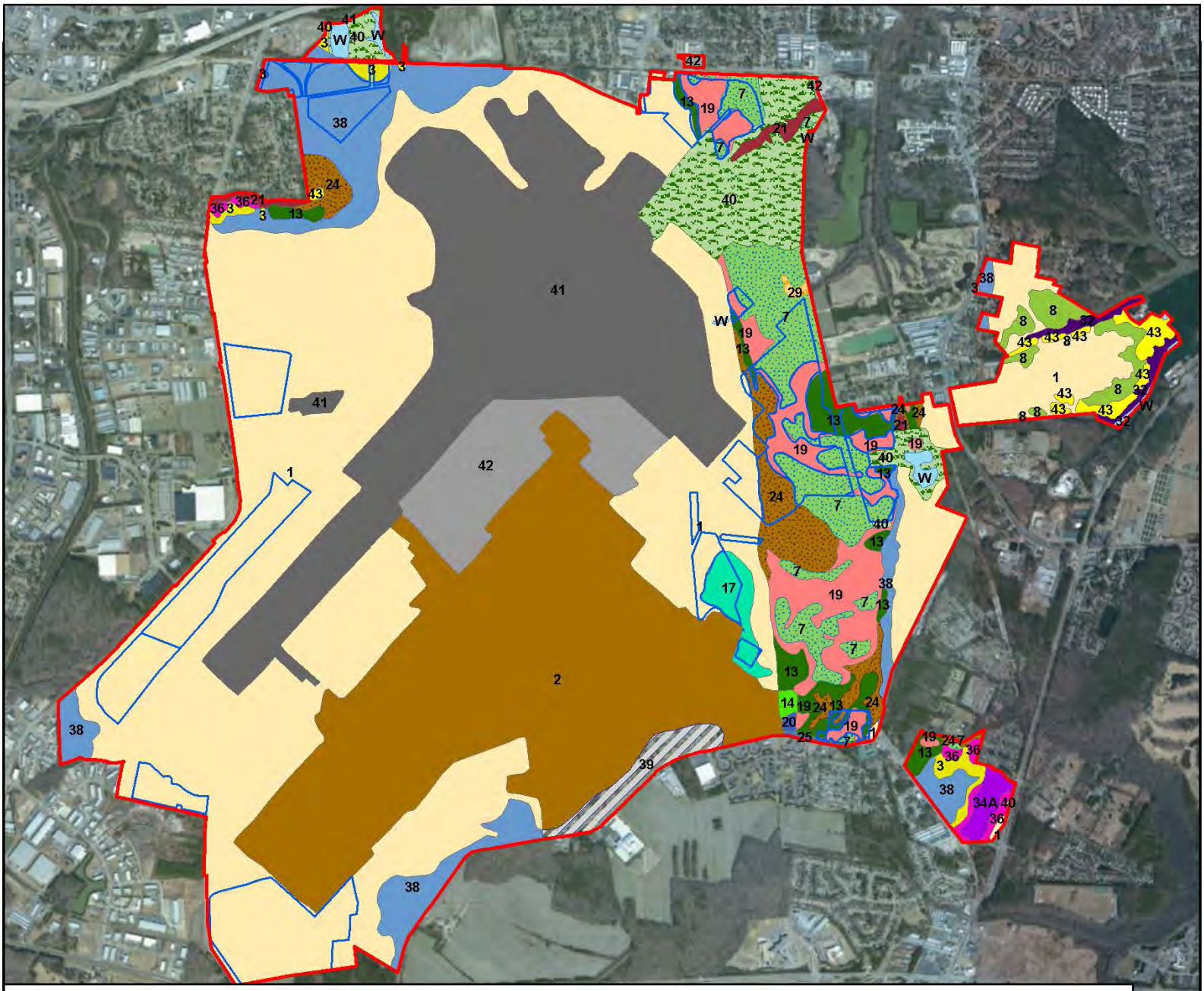
N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014



Legend

- NAS Oceana Installation Area
- Prime and Unique Farmland

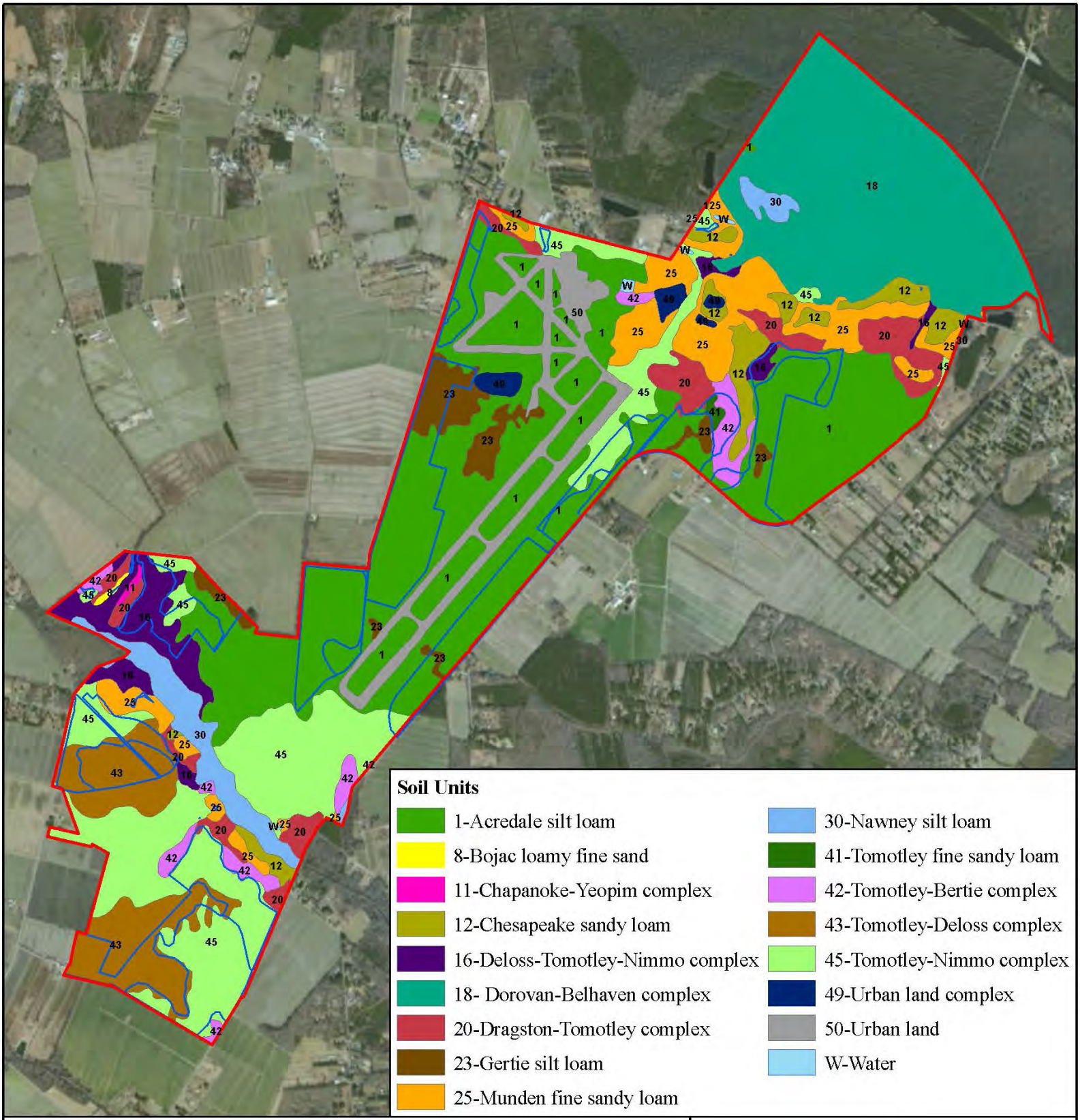
N

0 0.25 0.5 1 Miles

0 0.5 1 2 Kilometers

Sources: Navy 2014a, NRCS 2013, and ESRI 2012.

Date: Oct. 2014



Legend

- NALF Fentress Installation Area
- Prime and Unique Farmland

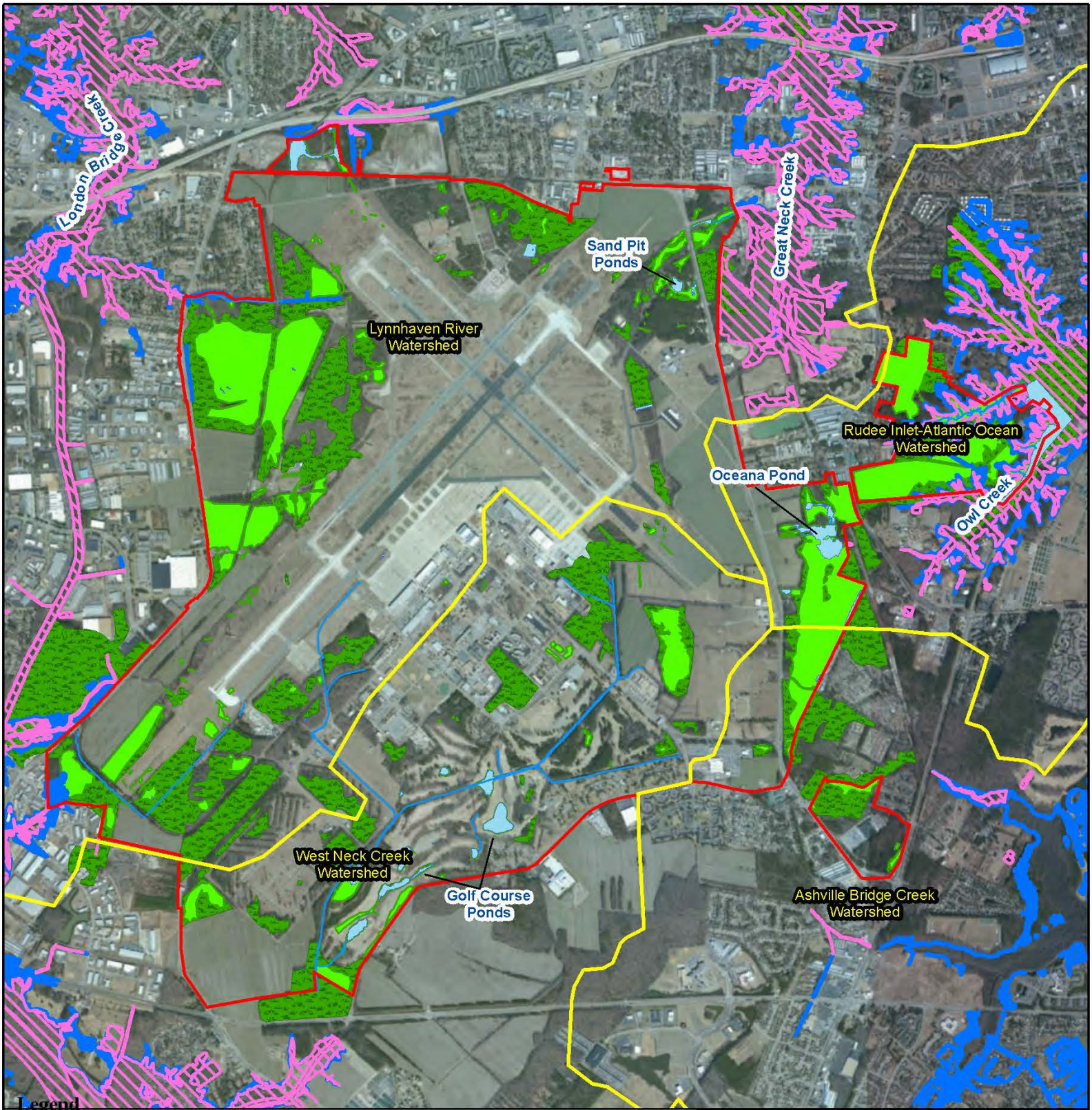
N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a, NRCS 2013, and ESRI 2012.

Date: Oct. 2014



Legend

- NAS Oceana Installation Area
- Stream
- Waterbody
- 100-Year Floodplain
- 500-Year Floodplain
- Watershed Boundary
- Wetland (Jurisdictional)
- Wetland (NWI)

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2012, ESRI 2012, USDA/NRCS 2013, and USFWS NWI 2013, FEMA 2014

Date: Oct. 2014

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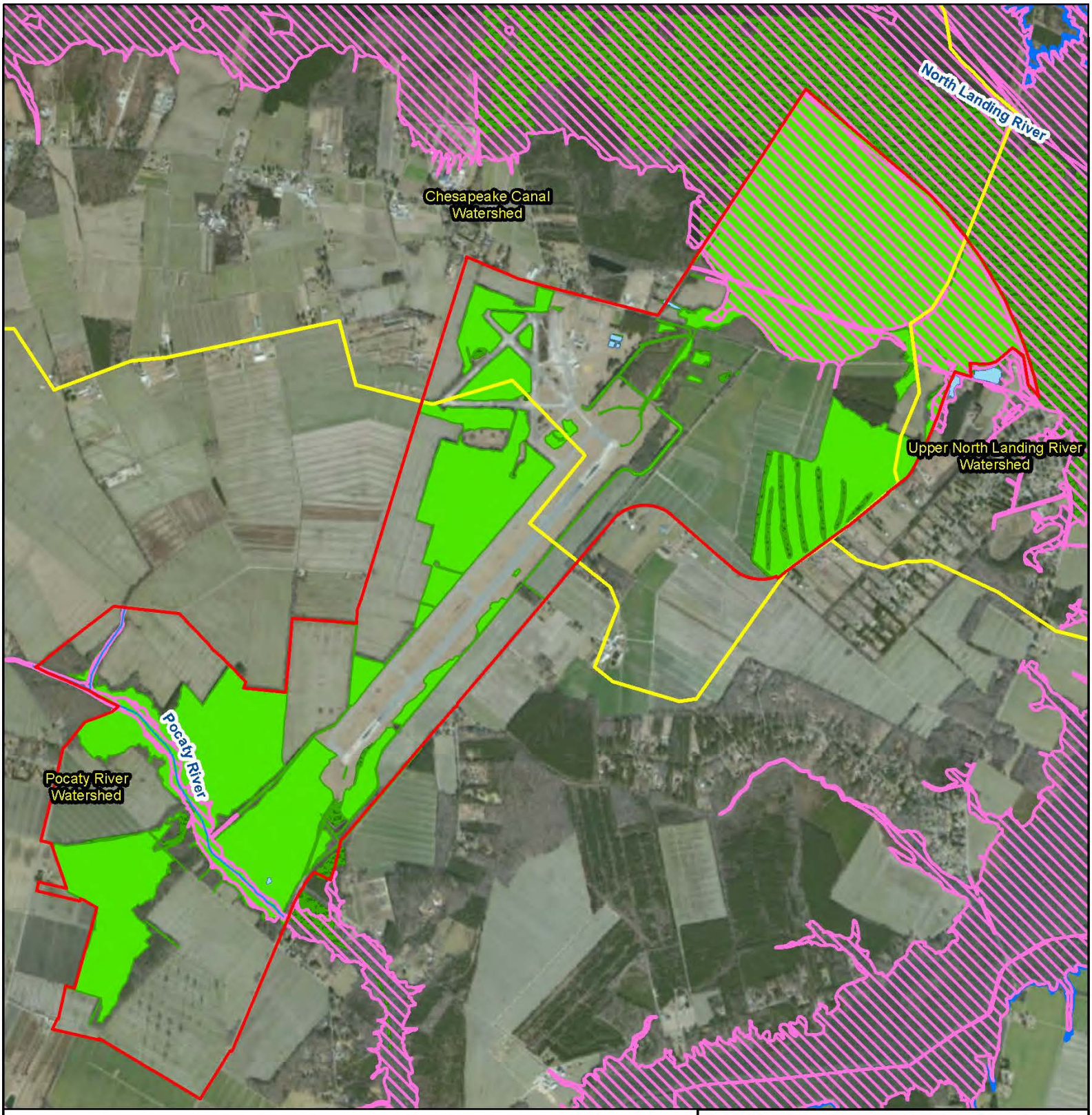

Legend

- NALF Fentress Installation Area
- Stream
- 100-Year Floodplain
- 500-Year Floodplain
- Watershed Boundary
- Waterbody
- Wetland (Jurisdictional)
- Wetland (NWI)

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a, ESRI 2012, USDA/NRCS 2013, USFWS 2013, FEMA 2014

Date: Oct. 2014

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Legend

- NAS Oceana Installation Area
- Airfield

Vegetative Community

- Agriculture
- Forest
- Maintained Open
- Recreation
- Urban
- Water

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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Legend

- NALF Fentress Installation Area
- Airfield

Vegetative Community

- Agriculture
- Forest
- Urban

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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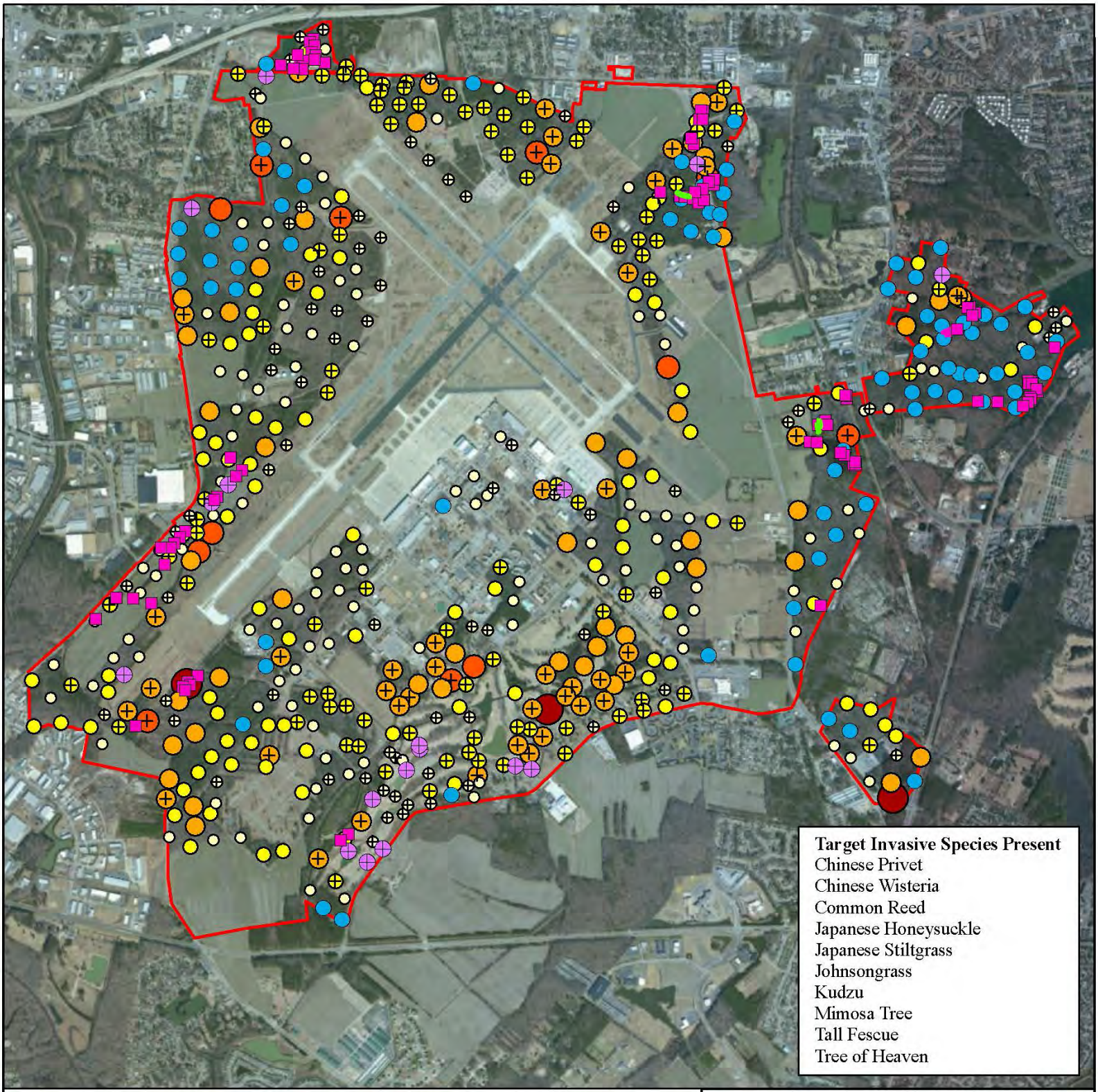


Legend

NAS Oceana Installation Area

Plot Locations

Number of Target Species Present

1
2
3
4
5

No Invasive Species

Non-target Invasive Species Only

\+ Non-target Invasive Species Also Present

Common Reed Stand

2011 Common Reed Treatment Locations

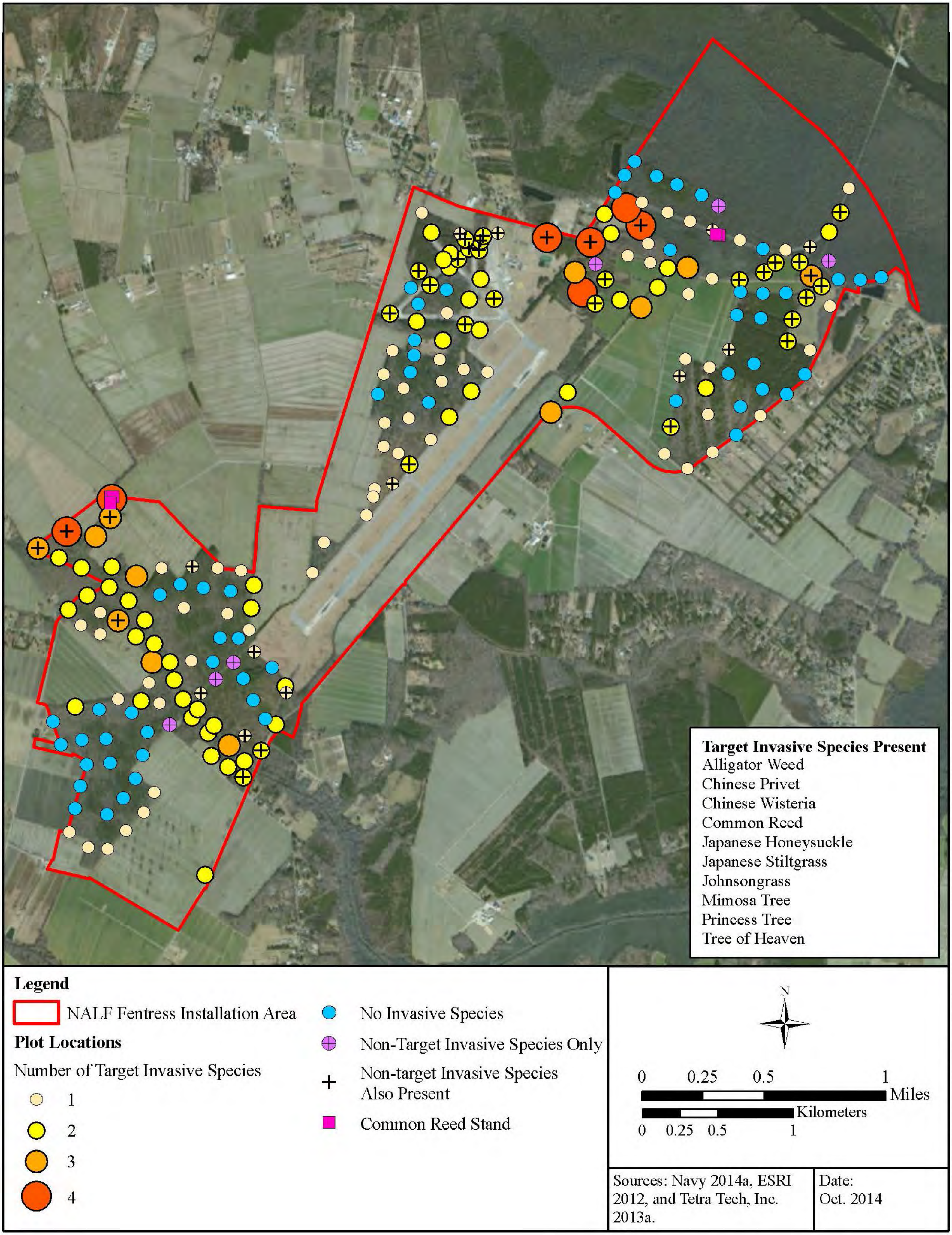
N

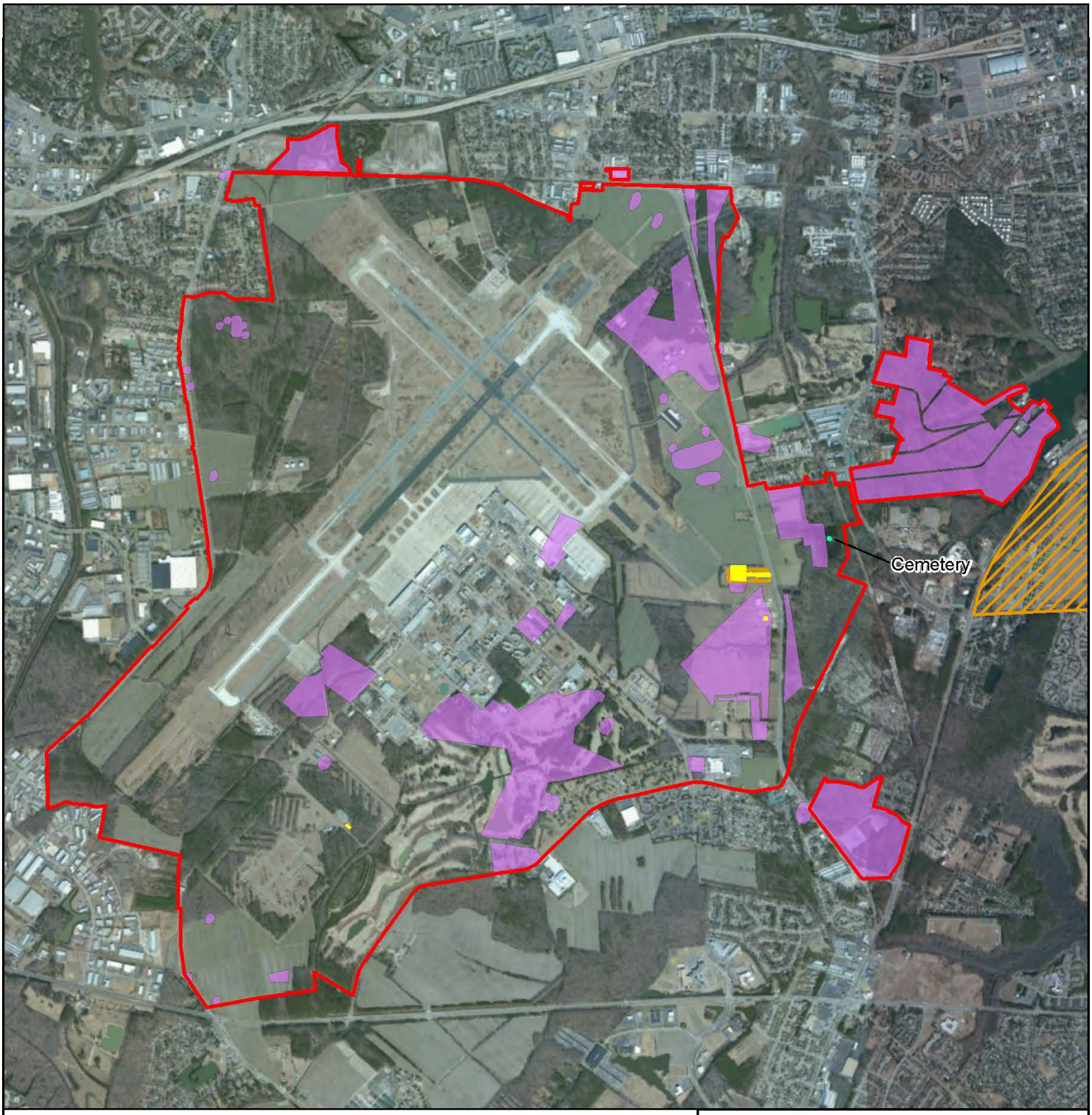
0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a, ESRI 2012, and Tetra Tech, Inc. 2013a.

Date: Oct. 2014


Target Invasive Species Present
Alligator Weed
Chinese Privet
Chinese Wisteria
Common Reed
Japanese Honeysuckle
Japanese Stiltgrass
Johnsongrass
Mimosa Tree
Princess Tree
Tree of Heaven
Legend
NALF Fentress Installation Area
Plot Locations
Number of Target Invasive Species
1
2
3
4
No Invasive Species
Non-Target Invasive Species Only
Non-target Invasive Species Also Present
Common Reed Stand
N
0 0.25 0.5 1 Miles
Kilometers
0 0.25 0.5 1
Sources: Navy 2014a, ESRI 2012, and Tetra Tech, Inc. 2013a.
Date: Oct. 2014



Legend

- NAS Oceana Installation Area
- Historic Structure
- Cemetery
- Cultural Probable Sensitive Area
- Historic Distric

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 20124a and ESRI 2012.

Date: Oct. 2014

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Legend

- NALF Fentress Installation Area
- Cemetery
- Cultural Probable Senstive Area

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a, Navy 2013, and ESRI 2012.

Date: Oct. 2014

Legend

NAS Oceana Installation Area

Environmental Restoration Program

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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Legend

- NALF Fentress Installation Area
- Environmental Restoration Program

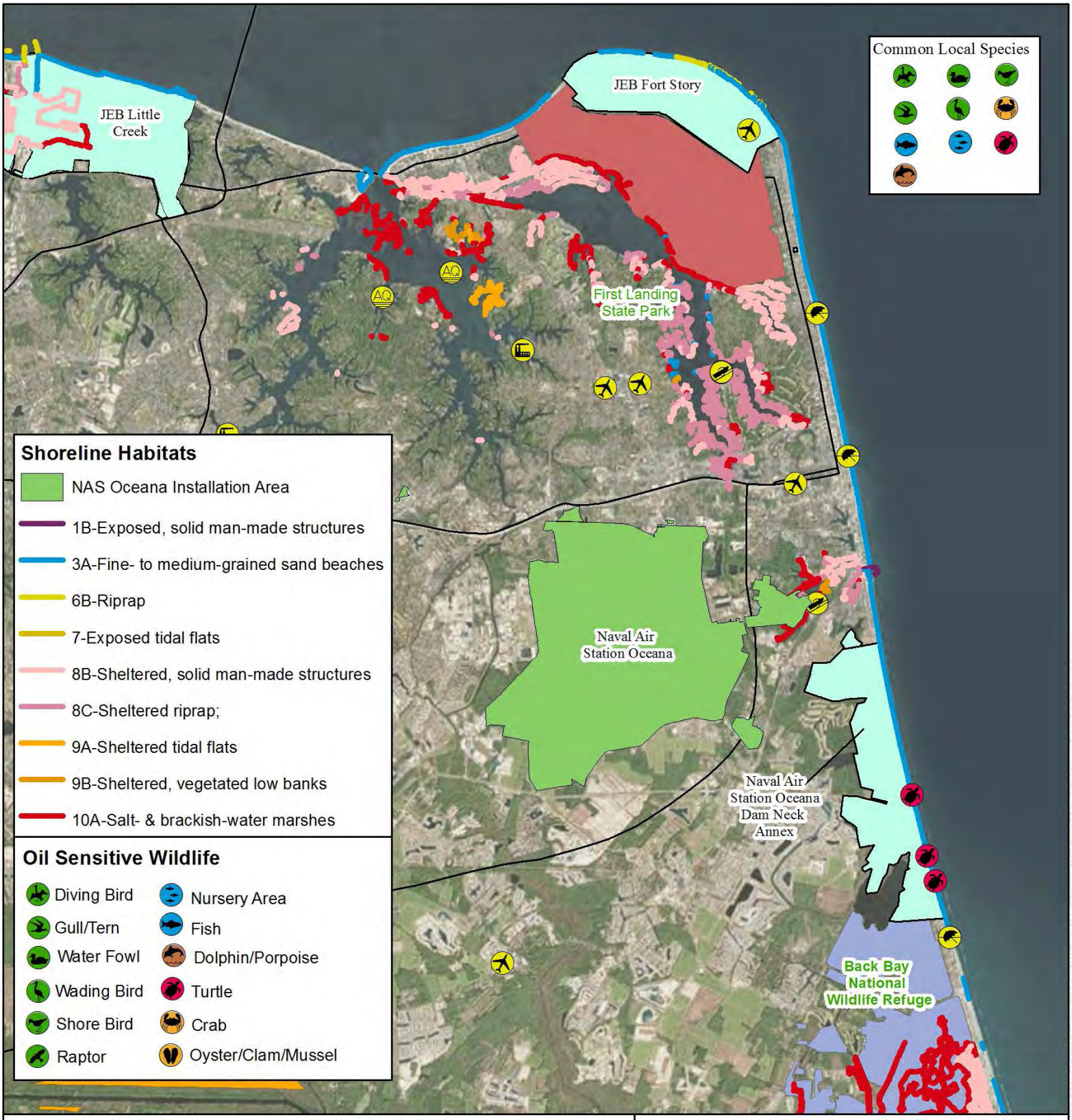
N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014



Legend

- NAS Oceana Installation Area
- Regional Military Installation
- Private Conservation Land
- State Conservation Land
- USFWS National Wildlife Refuge
- Road
- Airport/Heliport
- Aquaculture
- Beach
- Boat Ramp
- Coast Guard
- Lock/Dam
- Marina
- Water Intake

N

0 1 2 Miles

0 2 4 Kilometers

Source: Navy 2014a, ESRI 2012, and NOAA Environmental Sensitivity Index 2005.

Date
Oct. 2014

Legend

- NAS Oceana Installation Area
- 1990 Special Interest Areas
- 2002 Conservation Sites
- 2008 INRMP SIAs
- Water

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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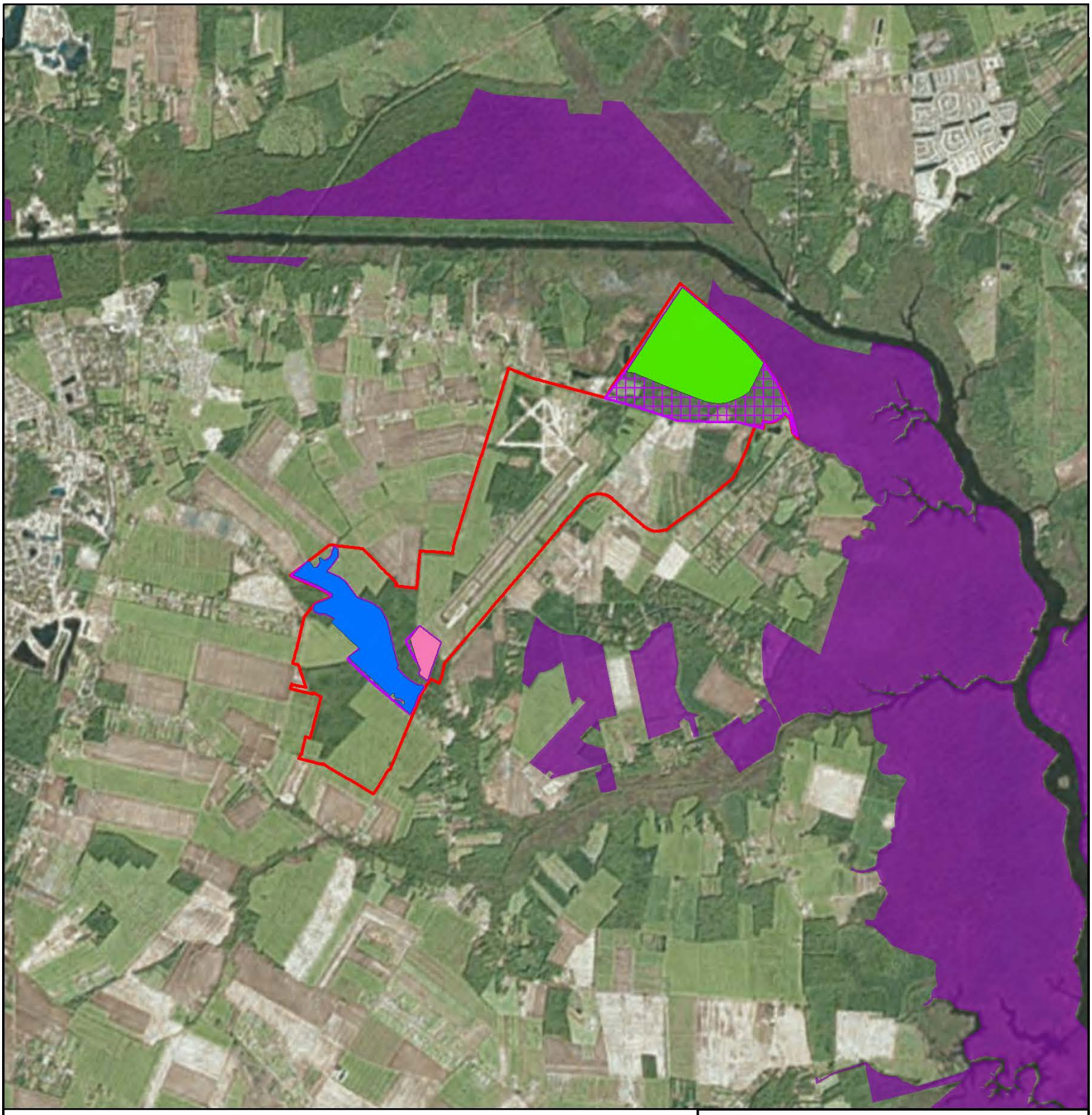

Legend

NALF Fentress Installation Area

Special Interest Area

North Landing River Ecological Reserve

Pocaty Creek

Tip-of-Runway

North Landing River Preserve

North Landing Swamp (1990)

N

0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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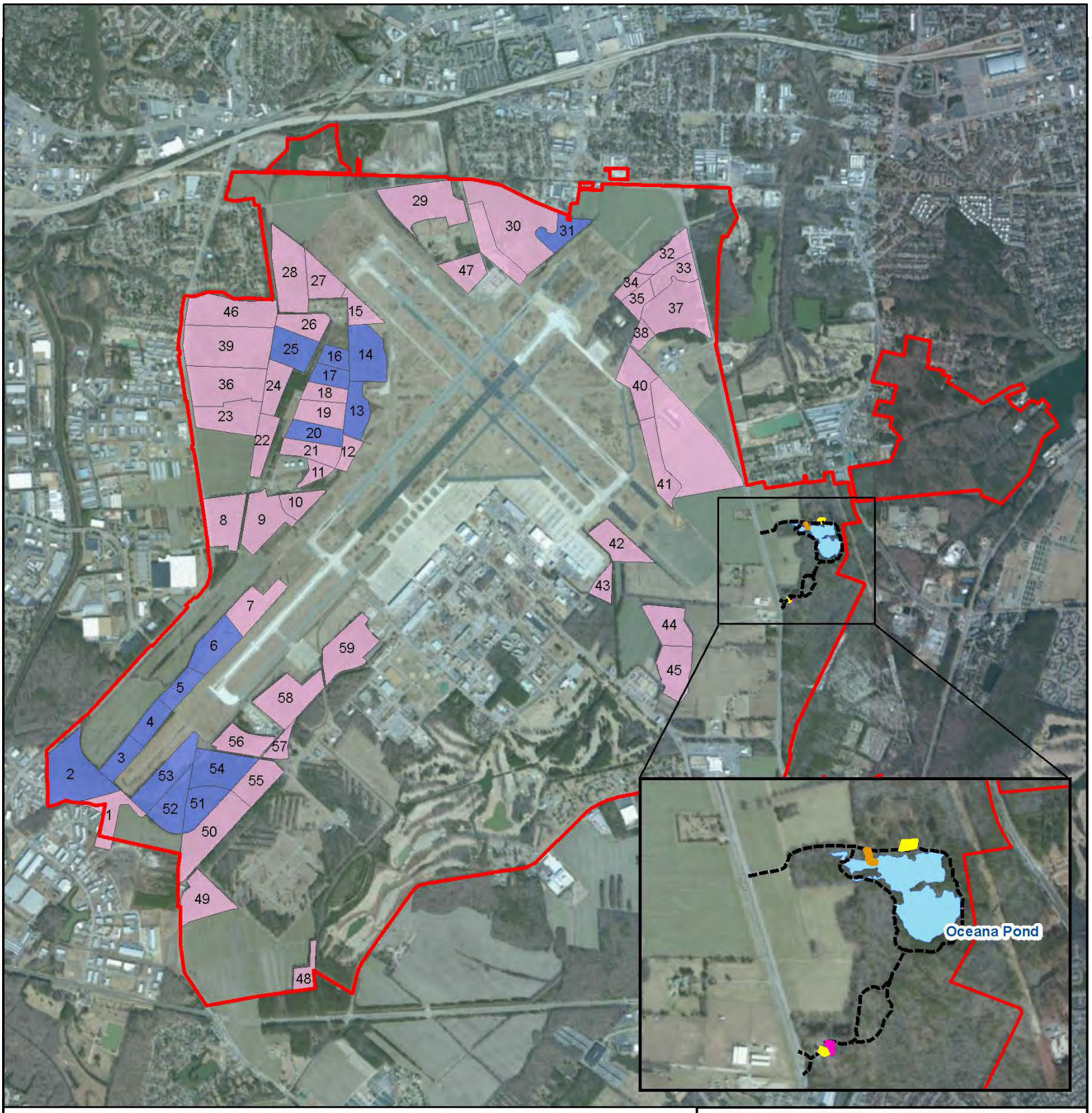

Legend

- NAS Oceana Installation Area
- Boat Ramp
- Fishing Pond
- Parking Area
- Natural Resources Center
- Trail

Hunting Area

- Archery Only
- Muzzleloader, Archery

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

Legend

- NALF Fentress Installation Area
- Parking Area

Hunting Area

- Archery Only
- Shotgun, Muzzleloader, Archery

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

Legend

NAS Oceana Installation Area

Controlled Burn Unit

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2012 and ESRI 2012.

Date: March 2014

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Legend

NALF Fentress Installation Area

Controlled Burn Unit

N

0 0.25 0.5 1 Miles

Kilometers

0 0.25 0.5 1

Sources: Navy 2012 and ESRI 2012.

Date: March 2014

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Legend

NAS Oceana Installation Area

Mitigation Site

- Aeropines Golf Course
- Concrete Removal Site
- Oceana Pond
- Pungo Ridge
- Wherry Housing Area

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014a and ESRI 2012.

Date: Oct. 2014

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Legend

- NAS Oceana Installation Area
- Agricultural Outlease Parcel
- Prime and Unique Farmland

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014 and ESRI 2012.

Date: March 2014

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Legend

- NALF Fentress Installation Area
- Agricultural Outlease Area
- Prime and Unique Farmland

N

0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

Sources: Navy 2014 and ESRI 2012.

Date: March 2014

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