

**FINAL
INTEGRATED NATURAL RESOURCES
MANAGEMENT PLAN**

**NAVAL STATION NORFOLK & CRANEY ISLAND
FUEL TERMINAL**

**CITIES OF NORFOLK AND PORTSMOUTH,
VIRGINIA**



**Prepared for:
Navy Region Mid-Atlantic
Naval Facilities Engineering Command Mid-Atlantic
Naval Station Norfolk and Craney Island Fuel Terminal**

**Prepared by:
Tetra Tech, Inc.**

March 2017

**FINAL
INTEGRATED NATURAL RESOURCES
MANAGEMENT PLAN**

for

**NAVAL STATION NORFOLK AND
CRANEY ISLAND
FUEL TERMINAL
CITIES OF NORFOLK AND PORTSMOUTH, VIRGINIA**

Prepared by:

Tetra Tech, Inc.

For:

Navy Region Mid-Atlantic

Naval Facilities Engineering Command Mid-Atlantic

Naval Station Norfolk and Craney Island Fuel Terminal

March 2017

This page intentionally left blank

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
NAVAL STATION NORFOLK & CRANEY ISLAND FUEL TERMINAL

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (16 U.S.C. 670a et seq.) as amended and Department of Defense Instruction 4715.03 and Chief of Naval Operations Instruction 5090.1D. This document was prepared and reviewed in coordination with United States (U.S.) Department of Interior, Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, and Virginia Department of Game and Inland Fisheries (VDGIF).

Approving Official's Signature:



R.C. McDaniel
Captain, U.S. Navy
Commanding Officer
Naval Station Norfolk

5 June 2017

Date

This page intentionally left blank

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
NAVAL STATION NORFOLK & CRANEY ISLAND FUEL TERMINAL

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (16 U.S.C. 670a et seq.) as amended and Department of Defense Instruction 4715.03 and Chief of Naval Operations Instruction 5090.1D. This document was prepared and reviewed in coordination with United States (U.S.) Department of Interior, Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, and Virginia Department of Game and Inland Fisheries (VDGIF).

Approving Official's Signature:



Emmett Carawan
Natural Resources Program Manager
Commander Navy Region Mid-Atlantic
Naval Facilities Engineering Command
Mid-Atlantic

5-22-17
Date

This page intentionally left blank

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
NAVAL STATION NORFOLK & CRANEY ISLAND FUEL TERMINAL

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (16 U.S.C. 670a et seq.) as amended and Department of Defense Instruction 4715.03 and Chief of Naval Operations Instruction 5090.1D. This document was prepared and reviewed in coordination with United States (U.S.) Department of Interior, Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, and Virginia Department of Game and Inland Fisheries (VDGIF).

Approving Official's Signature:



Thomas Olexa
Natural Resources Manager
Naval Station Norfolk and Craney Island

22 May 2017

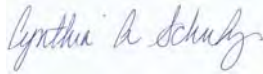
Date

This page intentionally left blank

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
NAVAL STATION NORFOLK & CRANEY ISLAND FUEL TERMINAL

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (16 U.S.C. 670a et seq.) as amended and Department of Defense Instruction 4715.03 and Chief of Naval Operations Instruction 5090.1D. This document was prepared and reviewed in coordination with United States (U.S.) Department of Interior, Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, and Virginia Department of Game and Inland Fisheries (VDGIF).

Approving Official's Signature:



5/9/2017

Cindy Schulz
Field Supervisor
Virginia Ecological Services
United States Fish and Wildlife Service
Virginia Field Office


Date

This page intentionally left blank

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
NAVAL STATION NORFOLK & CRANEY ISLAND FUEL TERMINAL

This Integrated Natural Resources Management Plan (INRMP) fulfills the requirements for the INRMP in accordance with the Sikes Act (16 U.S.C. 670a et seq.) as amended and Department of Defense Instruction 4715.03 and Chief of Naval Operations Instruction 5090.1D. This document was prepared and reviewed in coordination with United States (U.S.) Department of Interior, Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, and Virginia Department of Game and Inland Fisheries (VDGIF).

Approving Official's Signature:


Robert Duncan 5/12/17
Robert Duncan **Date**
Executive Director
Virginia Department of Game and Inland Fisheries

This page intentionally left blank

**INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
NAVAL STATION NORFOLK & CRANEY ISLAND FUEL TERMINAL**

Annual Reviews

Date of Review/Update	Name, Title, and Organization of Reviewer
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Date	Section/Page	Comment	Reviewer

PLAN UPDATES

This Integrated Natural Resources Management Plan (INRMP) is a long-term planning document designed to guide the installation Natural Resources Manager (NRM) in the management of natural resources to support the installation mission while protecting and enhancing installation resources for multiple use, sustainable yield, and biological integrity. INRMPs should contain the most up-to-date natural resources information, and updates and revisions may be necessary to maintain a proactive management plan. Natural resources managers are encouraged to use geographic information systems (GIS) to supplement their INRMP, and to incorporate the guidance and recommendations contained in the Department of Defense (DOD) Manual 4715.03: *Integrated Natural Resources Management Plan (INRMP) Implementation Manual* (25 November 2013); and Chief of Naval Operations Operating Instruction [OPNAVINST] 5090.1D (10 January 2014); as well as *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* (Benton et al. 2008).

In accordance with the Integrated Natural Resources Management Program (32 CFR Appendix to Part 190), the Sikes Act (16 U.S.C. 670a et seq.) as amended; DOD Manual 4715.03; DOD Instruction (DODI) 4715.03 (*Natural Resources Conservation Program*, 18 March 2011); and the United States (U.S.) Department of the Navy (DON) *Environmental Readiness Program Manual* (OPNAV M-5090.1, Chapter 12); installation natural resources managers are required to review their natural resources conservation (NRC) program and INRMP annually, using the Navy Conservation Web site.

The Installation Commanding Officer must participate in the annual NRC program and INRMP metrics review because INRMPs are prepared to assist the installation commander with his or her natural resources responsibilities, and to ensure adequate and appropriate conservation support for operational requirements (OPNAV M-5090.1). The annual INRMP review must be completed with the cooperation of the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the appropriate state fish and wildlife agency. Measurement of the success of the INRMP and identification of any issues associated with implementation of the INRMP will result from collaboration with cooperating partners (OPNAVINST 5090.1D and Navy 2006).

The annual review also provides an opportunity to incorporate changes in accepted environmental conservation practices and scientific advances associated with evaluation and implementation of natural resources management. If necessary, the annual review will include an update to the INRMP that includes an updated project list, documentation of significant changes to natural ecosystems, and updates to information contained in the INRMP appendices. Forms to document annual reviews are included in this document, and should be used to document changes to the INRMP that will improve natural resources management. Each entry in the update form should reference the plan section and page number that is being updated to facilitate quick cross-referencing.

Installation natural resources managers are not required to revise their INRMP within a specified time interval; however, a formal review for operation and effect is required at least once every five years, in coordination with USFWS and the appropriate state partners fish

and wildlife agency when possible (OPNAVINST 5090.1D, OPNAV M-5090.1, and Navy 2006). With agreement from USFWS and state partners, thorough written documentation of the annual informal reviews may be used to substitute for the five-year formal review, thereby reducing demands on installation commanders. Minor updates to the INRMP should be completed annually to reduce the need for a more costly and time consuming revision following the review for operation and effect. Annual reviews should be fully documented each year to provide each installation the option to utilize the annual review documentation to fulfill the formal review requirement whenever possible. If results of the formal review determine that the existing INRMP is current and operational, the INRMP need not be revised. Any revisions to the authorities and guidance documents driving INRMP update requirements would be implemented as appropriate during the annual or formal review periods.

A review for operation and effect of this INRMP will occur every five years with the cooperation of the USFWS, NMFS, and the Virginia Department of Game and Inland Fisheries (VDGIF). The review for operation and effect shall verify that all environmental compliance projects have been budgeted for and implemented on schedule; that all required natural resource positions are filled with trained staff or are in the process of being filled; that projects and activities identified for the coming year are included in the INRMP; that all required coordination has been conducted; and that all significant changes to the Installation's mission requirements or its natural resources have been identified. It is recommended that the review for operation and effect be conducted during an annual INRMP metrics review. Mutual agreement on operation and effect must be documented in writing from the parties in the form of a new signature page for the INRMP.

INRMP updates are usually covered by the original National Environmental Policy Act (NEPA) documentation (usually an Environmental Assessment [EA]) prepared for the INRMP. A new NEPA analysis may be necessary if a revision of the plan is required, such as if there are significant changes in land ownership, land uses, installation mission, or status of natural resources (OPNAV M-5090.1).

During the review process, the DOD Components, USFWS, and appropriate state fish and wildlife agencies should determine whether an existing INRMP needs formal revision. Circumstances that may suggest that a revision is necessary include: (a) the current INRMP no longer provides adequately for the conservation and rehabilitation of the natural resources on the base; (b) the installation mission or physical features have changed significantly; or (c) there are substantial natural resources effects anticipated from base realignment and closure, such as: a new species listing, new construction, new training, changes to training type or tempo, or other factors that were not addressed in the existing INRMP (DOD Manual 4715.03). Any of these activities should be brought to the attention of the USFWS and VDGIF during the formal review process. All such revisions require approval by all parties to the INRMP, and will usually call for a new or supplemental NEPA analysis.

EXECUTIVE SUMMARY

This Integrated Natural Resources Management Plan (INRMP) has been prepared and will be implemented in accordance with the Sikes Act (16 United States Code [U.S.C.] 670a *et seq.*) as amended; Defense (DOD) Manual 4715.03: *Integrated Natural Resources Management Plan (INRMP) Implementation Manual*; DOD Instruction (DODI) 4715.03: *Natural Resources Conservation Program*; and the U.S. Navy (Navy) Environmental Readiness Program (Chief of Naval Operations [OPNAV] Instruction [OPNAVINST] 5090.1D). The Sikes Act (16 U.S.C. 670a *et seq.*) as amended requires the secretary of all military departments to “prepare and implement an INRMP for each military installation in the United States” that contains habitat that is suitable for conservation and management of natural ecosystems. This INRMP was prepared for Naval Station Norfolk (NSN), City of Norfolk, Virginia; and includes Craney Island Fuel Terminal (CI), City of Portsmouth, Virginia; in accordance with the following authorities, which were current at the time the INRMP was developed. Revisions to the following authorities and guidance documents would replace the older version, and any necessary changes to the INRMP would be documented during the annual review, or incorporated into the INRMP at the time it is updated:

- DODI 4715.03: *Natural Resources Conservation Program* (18 March 2011)
- DOD Manual 4715.03: *Integrated Natural Resources Management Plan (INRMP) Implementation Manual* (25 November 2013);
- U.S. Department of the Navy (DON) Instruction OPNAVINST 5090.1D (*Environmental Readiness Program*, 10 January 2014 [U.S. Navy 2014a])
- Sikes Act (16 U.S.C. § 670a *et seq.*) as amended
- Naval Facilities Engineering Command (NAVFAC) Natural Resources Management Procedural Manual (P-73, Chapter 2: Integrated Natural Resources Management Plans, 07 December 2005)
- Navy INRMP Guidance dated 10 April 2006
- Endangered Species Act (ESA)

In addition to these authorities, natural resources managers are encouraged to use geographic information systems (GIS) as the basis for their INRMPs (OPNAV M-5090.1 [U.S. Navy 2014b]), and to incorporate the guidance and recommendations provided in *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers* (Benton et al. 2008).

The overall goal of this INRMP is to implement an ecosystem-based program that provides for conservation and rehabilitation of natural resources in a manner that is consistent with the military mission, integrates and coordinates management activities, provides for sustainable multipurpose use of natural resources, and provides public access for use of natural resources subject to safety and military security considerations. The overall management objectives are to integrate management of natural resources as practicable and consistent with the military mission and established land uses.

ORGANIZATION OF DOCUMENT

This INRMP is organized into the following sections:

Section 1 – Introduction. This section provides a discussion of the purpose of the INRMP and the policies that drive it; the goals and objectives of the INRMP; details regarding the location and regional setting; a brief overview of the history and mission of NSN and CI; an overview of natural resources management, including existing natural resources partnerships and training of natural resources personnel; data management including GIS; and environmental planning.

Section 2 – Existing Conditions. This section describes the existing physical and natural conditions at NSN and CI. Included are climate, physiography and soils, hydrology, ecological communities, fauna, and rare, threatened, and endangered species and significant ecological communities.

Section 3 – Natural Resources Program Overview. The 11 natural resources management areas that are relevant to NSN and CI are discussed in this section to help identify regulatory requirements, conservation opportunities, and potential conflicts in natural resources management. Ongoing management actions and planned projects for the implementation of the natural resources management program are described.

Section 4 – Natural Resources Management Units. This section provides discussion of natural resources management issues and recommendations for the seven natural resources management units that have been identified—including four at NSN and three at CI. For each management unit, natural resources management actions and projects are identified and organized according to the applicable issue areas, which pertain to the five overarching INRMP goals defined in Section 1.

Section 5 – INRMP Implementation. This section identifies the requirements for INRMP implementation. In particular, this section describes achieving no net loss, NEPA compliance, project development and classification, funding sources, commitments, use of cooperative agreements, and a detailed project implementation schedule.

Section 6 – References. References and Internet resources that were used in the development of this document are listed in this section.

Appendix A – Naval Station Norfolk and Craney Island INRMP Projects Table. Appendix A comprises the INRMP Projects Table, which lays out the implementation schedule, prime legal driver and initiative, Navy assessment level, cost estimate, and funding source for each of the projects proposed in this INRMP.

Appendix B – Agency Correspondence and Mutual Agreement Letters. Appendix B includes copies of the cooperative agreements and mutual agreement letters that exist between the Installation and the USFWS and VDGIF.

Appendix C – Project Planning Environmental Checklist. Appendix C includes the Project Planning Environmental Checklist that will be used by the NRM for implementing the natural resources management program.

Appendix D – Tables. Appendix D includes all document tables, with the exception of the project implementation schedule, which is in Appendix A. Rather than include the tables within the body of the document, hyperlinks have been inserted in-text to bring the reader directly to the table’s location in this appendix.

Appendix E – Fish and Wildlife Species of NSN and CI. Appendix E includes the list of avian species detected during surveys in 2015; the full fauna lists from the previous pre-final INRMPs for NSN and CI; and the lists of endangered, threatened, and special concern species with potential to occur at NSN and CI.

Appendix F – Flora Species Checklist for NSN and CI. Appendix F includes the plant species checklist for the Installation, with occurrences that were noted during the 2015 vegetation surveys.

Appendix G – Regional Native Landscaping Species Checklist for NSN and CI. Appendix G includes the regional native landscape plant species checklist.

Appendix H – NSN Chambers Field Bird/Animal Aircraft Strike Hazard (BASH) Safety Program. Appendix H includes an intact copy of the full BASH Plan.

Appendix I – Environmental Assessment on Implementation of the INRMP. Appendix I includes a hard copy of the EA, which has been developed in coordination with this INRMP to ensure compliance with the National Environmental Policy Act.

Appendix J – Maps/Figures. Appendix K contains all of the document figures, including full-sized, 11” x 17” maps of the installation locations, natural resources managed under this INRMP, the surveys that were conducted for the development of this INRMP, and the natural resources management units that have been defined. Cross-reference hyperlinks have been inserted in-text to bring the reader directly to each figure’s location in this appendix.

This INRMP has been prepared to comply with the Office of the Under Secretary of Defense INRMP format (Office of the Under Secretary of Defense [OSD] 2006). Table ES-1, at the end of the Executive Summary, provides a cross-reference of the recommended format and the corresponding sections of this INRMP update.

Map Figures

The Commander, Navy Region Mid-Atlantic’s (CNRMA) GeoReadiness Center is the single, authoritative source and distribution point for all geospatial information within the area of responsibility of the Navy Mid-Atlantic Region and is managed by the Mid-Atlantic Facility Engineering Command GIS Division. The GeoReadiness Center houses the most current geospatial information (including aerial photography) for the entire Navy Mid-Atlantic Region and provides access to the comprehensive data set and analysis tools to Regional and

DOD decision makers/managers, sponsored contractors, and other sponsored individuals via a secure government Internet site. GIS data for the NSN and CI, including those environmental layers used for the development of this INRMP, can be accessed through this portal. Environmental planners, project managers, engineers, and sponsored contractors are encouraged to use the portal to access GIS data for analysis, development of maps and project planning. In addition, the portal provides guidance documentation for the collection of new geospatial data.

Management Actions and Major Initiatives

The management actions identified for the NSN and CI natural resources management program are intended to help the Commanding Officer manage natural resources effectively to ensure that Installation lands remain available and in good condition to support the military mission and to ensure compliance with relevant environmental regulations. These actions incorporate the principles of ecosystem management and are consistent with Navy policy on sustainable, multiple use of natural resources on Navy property. A total of 26 projects and management actions have been identified for implementation during the plan period. In some cases, these management actions and major initiatives may or may not be applicable to both NSN and CI. The following are some of the plan's major initiatives:

- Increase living shorelines in the nearshore area via oyster reef restoration, living shoreline buffer areas, and planting emergent and aquatic vegetation;
- Complete a jurisdictional wetland delineation survey;
- Sustain or enhance urban tree canopy via the planting and care of native trees and the completion of an urban tree assessment, mapping, and preservation plan;
- Conduct surveys for various types of fauna, including migratory and breeding birds, herpetofauna, and other vertebrate species;
- Support habitat management efforts, wildlife harassment, and permitted lethal take of hazardous wildlife species that are considered a threat to flight safety;
- Inventory threatened and endangered species;
- Control invasive species by mapping them, developing a control plan, and applying control treatments;
- Complete a climate change vulnerability assessment and adaptation plan; and
- Conduct a nearshore habitat assessment and species inventory of CI.

Table ES-1. Cross-Reference from the Office of the Under Secretary of Defense *Integrated Natural Resources Management Plan (INRMP) Template* to Naval Station Norfolk (NSN) & Craney Island Fuel Terminal (CI) INRMP.

DOD <i>Integrated Natural Resources Management Plan</i> Template	Cross-Reference to NSN & CI INRMP 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 1.8 Overview of Natural Resources Management Program
a. Purpose	Section 1.1 Purpose and Authority
b. Scope	Section 1.2 Scope
c. Goals and Objectives	Section 1.3 Goals and 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 Natural Resources Management Program
2. Current Conditions and Use	Section 2.0 Existing Conditions
a. Installation Information	Section 1.6 Location and Regional Setting, Section 1.7.1 Historical Overview and Military Mission

DOD <i>Integrated Natural Resources Management Plan</i> Template	Cross-Reference to NSN & CI INRMP Table of Contents
(1) General Description	Section 1.6 Location and Regional Setting, Section 1.7.1 Historical Overview and Military Mission
(2) Regional Land Uses	Section 1.6 Location and Regional Setting and Section 1.10 Encroachment and Adjacent Land Use
(3) Abbreviated History and Pre-Military Land Use	Section 1.7.1 Historical Overview and Military Mission
(4) Military Mission	Section 1.7 Military Mission
(5) Operations and Activities	Section 1.7.1 Historical Overview and Military Mission, Section 1.7.2 Mission Impacts on the Environment, and Section 1.8 Constraints and Opportunities
(6) Constraints Map	No separate map but constraints are discussed in Section 1.8 Constraints and Opportunities, and are shown on other figures as described in-text.
(7) Opportunities	Section 1.8 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 2.3.1 Surface Water, Section 2.3.2 Ground Water, Section 2.3.3 Floodplains, Section 2.3.4 Wetlands

DOD <i>Integrated Natural Resources Management Plan</i> Template	Cross-Reference to NSN & CI INRMP Table of Contents
(6) N/A	Section 2.3.5 Nearshore Environment
(7) Fauna	Section 2.5 Fauna
(8) Flora	Section 2.4 Flora and Section 2.4.1 Ecological Communities
3. Environmental Management Strategy and Mission Sustainability	Executive Summary and Section 1.7.3 Integration of Military Mission and Sustainable Use
a. Supporting Sustainability of the Military Mission and the Natural Environment	Executive Summary and Section 1.7.3 Integration of Military Mission and Sustainable Use
(1) Integrate Military Mission and Sustainable Land Use	Section 1.7.3 Integration of Military Mission and Sustainable Use
(2) Define Impact to the Military Mission	Section 1.7.4 Impact to the Military Mission
(3) Describe Relationship to Range Complex Management Plan or other operation area plan	Section 1.9 INRMP Integration with Other Installation Plans
b. Natural Resources Consultation Requirements	Section 5.2 Natural Resources Consultation Requirements
c. NEPA Compliance	Section 5.4 NEPA Compliance
d. Beneficial Partnerships and Collaborative Resource Planning	Section 1.11 Partnerships and Outreach
e. Public Access and Outreach	Section 3.10 Outdoor Recreation and Environmental Awareness
(1) Public Access and Outdoor Recreation	Section 3.10.1 Outdoor Recreation
(2) Public Outreach	Section 3.10.2 Environmental Awareness
f. Encroachment Partnering	Section 1.10 Encroachment and Adjacent Land Use
g. State Comprehensive Wildlife Plans	Section 3.6.4 General Fish Wildlife Management

DOD <i>Integrated Natural Resources Management Plan</i> Template	Cross-Reference to NSN & CI INRMP Table of Contents
4. Program Elements	Section 3.0 Natural Resources Management Issues
a. T & E Species Management and Species benefit, Critical Habitat, and Species of Concern Management	Section 3.7 Threatened and Endangered Species Protection
b. Wetlands and Deep Water Habitats Management	Section 3.3 Wetlands and Water Quality Protection
c. Law Enforcement of Natural Resources Laws and Regulations	Section 3.11 Conservation Law Enforcement
d. Fish and Wildlife Management	Section 3.6 Fish and Wildlife Management
e. Forestry Management	Section 3.5 Urban Forestry Management
f. Vegetation Management	Section 3.6.2 Bird/Animal Aircraft Strike Hazard, Section 3.8 Habitat Conservation and Restoration, Section 3.8.1 Beneficial Landscaping,
g. N/A	Section 3.8.2 Pollinators
h. Migratory Birds Management	Section 3.6.1 Migratory Bird Management
i. Invasive Species Management	Section 3.9.2 Invasive Plant Species
j. Pest Management	Section 3.9 Invasive Species and Pest Management
k. Land Management	Section 3.4 Land Management, Section 3.4.1 Installation Restoration Program Sites, Section 3.4.2 Oil and Hazardous Substances
l. Agricultural Outleasing	N/A
m. Geographical Information Systems (GIS) Management, Data Integration, Access, and Reporting	Section 1.13 Geographic Information Systems (GIS) Management, Data Integration, Access, and Reporting
n. Outdoor Recreation	Section 3.10.1 Outdoor Recreation
o. Bird Aircraft Strike Hazard	Section 3.6.2 Bird/Animal Aircraft Strike Hazard

DOD <i>Integrated Natural Resources Management Plan</i> Template	Cross-Reference to NSN & CI INRMP Table of Contents
p. Wildland Fire Management	N/A
q. Training of Natural Resource Personnel	Section 1.12 Training of Natural Resources Personnel
r. Coastal/Marine Management	Section 3.1 Marine Resources Protection, and Section 3.2 Coastal Zone Protection
s. Floodplains Management	Section 3.3.2 Floodplain Protection
t. Other Leases	N/A
5. Implementation	Section 5.0 INRMP Implementation
a. Summarize Process of Preparing Prescriptions that Drive the Projects	Section 5.5 Project Development and Classification
b. Achieving No-Net-Loss	Section 5.3 Achieving No Net Loss
c. Use of Cooperative Agreements	Section 5.8 Use of Cooperative Agreements
d. Funding	Section 5.6 Funding Sources

N/A = Not Applicable

This page intentionally left blank.

TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION.....	1
1.1 Purpose and Authority	1
1.2 Scope.....	2
1.3 Goals and Objectives	2
1.4 Responsibilities	5
1.4.1 Installation Stakeholders.....	6
1.4.2 External Stakeholders	6
1.4.3 Technical Assistance	7
1.5 Compliance and Stewardship.....	7
1.6 Location and Regional Setting.....	8
1.7 Military Mission.....	9
1.7.1 Historical Overview and Military Mission	9
1.7.2 Mission Impacts on the Environment	11
1.7.3 Integration of Military Mission and Sustainable Use	12
1.7.4 Impact to the Military Mission	12
1.8 Constraints and Opportunities.....	13
1.9 INRMP Integration with Other Installation Plans	14
1.10 Encroachment and Adjacent Land Use.....	15
1.11 Partnerships and Outreach	16
1.12 Training of Natural Resources Personnel	17
1.13 Geographic Information System (GIS) Management, Data Integration, Access and Reporting	18
1.14 Environmental Planning.....	19
2.0 EXISTING CONDITIONS	21
2.1 Climate.....	21
2.1.1 Climate Change	21
2.2 Physiography and Soils.....	22
2.3 Water Resources Hydrology	24
2.3.1 Surface Water	24
2.3.2 Groundwater	24
2.3.3 Floodplains	25
2.3.4 Wetlands	26
2.3.5 Nearshore Environment.....	27
2.4 Flora.....	30
2.4.1 Ecological Communities.....	32
2.5 Fauna.....	34
2.5.1 Mammals	35
2.5.2 Amphibians and Reptiles.....	37
2.5.3 Fish	37
2.5.4 Birds	39

Table of Contents

2.6	Rare, Threatened, and Endangered Species and Significant Ecological Communities	40
3.0	NATURAL RESOURCES PROGRAM OVERVIEW.....	45
3.1	Marine Resources Protection	45
3.2	Coastal Zone Protection	47
3.2.1	Sea Level Rise	49
3.2.2	Shoreline Protection and Restoration	50
3.3	Wetlands and Water Quality Protection	52
3.3.1	Wetlands Protection.....	52
3.3.2	Floodplain Protection	54
3.3.3	Watershed Protection.....	54
3.3.4	Stormwater Quality	57
3.3.5	Erosion and Sediment Control.....	58
3.4	Land Management	59
3.4.1	Installation Restoration Program Sites	59
3.4.2	Oil and Hazardous Substance Spill Prevention and Response	60
3.5	Urban Forestry Management	61
3.6	Fish and Wildlife Management.....	63
3.6.1	Migratory Bird Management	64
3.6.2	Bird/Animal Aircraft Strike Hazard	69
3.6.3	Fisheries Management.....	70
3.6.4	General Fish and Wildlife Management.....	73
3.7	Threatened and Endangered Species Protection	75
3.8	Habitat Conservation and Restoration	78
3.8.1	Beneficial Landscaping	78
3.8.2	Pollinators.....	81
3.9	Invasive Species and Pest Management	82
3.9.1	Nuisance Wildlife	82
3.9.2	Mosquitos	86
3.9.3	Invasive Plant Species	87
3.10	Outdoor Recreation and Environmental Awareness.....	89
3.10.1	Outdoor Recreation	89
3.10.2	Environmental Awareness.....	90
3.11	Conservation Law Enforcement	91
4.0	NATURAL RESOURCES MANAGEMENT UNITS	93
4.1	NSN Nearshore Area Management Unit	93
4.2	NSN Airfield Operations Area Management Unit.....	95
4.3	NSN Developed Areas Management Unit.....	98
4.4	NSN Open Areas Management Unit.....	99
4.5	CI Nearshore Area Management Unit	103
4.6	CI Eastern End Management Unit	104
4.7	CI Western End Management Unit.....	106
5.0	INRMP IMPLEMENTATION	109

Table of Contents

5.1	Project Implementation Schedule	109
5.2	Natural Resources Consultation Requirements	110
5.3	Achieving No Net Loss.....	111
5.4	NEPA Compliance.....	112
5.5	Project Development and Classification.....	114
5.5.1	Programming Hierarchy	114
5.5.2	Project Classification.....	115
5.6	Funding Sources.....	117
5.6.1	O&MN Environmental Funds	117
5.6.2	Sikes Act Revenues	117
5.6.3	The Legacy Resource Management Program.....	118
5.6.4	Navy Forestry Revenues.....	118
5.6.5	Agricultural Outleases	119
5.6.6	Recycling Funds	119
5.6.7	Strategic Environmental Research and Development (SERDP) Funds.....	120
5.6.8	Non-DOD Funds	120
5.7	Commitment	120
5.8	Use of Cooperative Agreements	120
6.0	REFERENCES.....	123

APPENDICES

APPENDIX A – NAVAL STATION NORFOLK AND CRANEY ISLAND INRMP PROJECTS TABLE

APPENDIX B – AGENCY CORRESPONDENCE AND MUTUAL AGREEMENT LETTERS

Enclosure 1 Agency Correspondence

Enclosure 2 Agency Mutual Agreement Letters

APPENDIX C – PROJECT PLANNING ENVIRONMENTAL CHECKLIST

APPENDIX D – TABLES

Table 1-1. Stakeholders of Naval Station Norfolk (NSN) and Craney Island Fuel Terminal (CI) Natural Resources.

Table 1-2. Natural Resources Training Opportunities.

Table 2-1. Weather Data Recorded at Norfolk International Airport, 1946–2012.

Table 2-2. General Characteristics of Naval Station Norfolk (NSN) and Craney Island Fuel Terminal (CI) Soils.

Table 2-3. Waterbodies Summary for Craney Island, Portsmouth, Virginia.

Table 2-4. Wetland Feature Summary for Craney Island, Portsmouth, Virginia.

Table 3-1. Essential Fish Habitat Designations for Fish Collected during Seasonal

Nearshore Surveys of Naval Station Norfolk.

APPENDIX E – FISH AND WILDLIFE SPECIES OF NSN AND CI

APPENDIX F – FLORA SPECIES CHECKLIST FOR NSN AND CI

APPENDIX G – REGIONAL NATIVE LANDSCAPING SPECIES CHECKLIST FOR NSN AND CI

APPENDIX H – NSN CHAMBERS FIELD BIRD/ANIMAL AIRCRAFT STRIKE HAZARD (BASH)
SAFETY PROGRAM

APPENDIX I – ENVIRONMENTAL ASSESSMENT ON IMPLEMENTATION OF THE INRMP

APPENDIX J – MAPS/FIGURES

- Figure 1-1. Naval Station Norfolk Command Organization.
- Figure 1-2. General Location of Naval Station Norfolk and Craney Island Fuel Terminal.
- Figure 1-3. Naval Station Norfolk Installation Area, City of Norfolk, Virginia.
- Figure 1-4. Craney Island Fuel Terminal Installation Area, City of Portsmouth, Virginia.
- Figure 2-1. Soils of Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-2. Soils of Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-3. Aquatic Resources of Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-4. Aquatic Resources of Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-5. Flood Zones of Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-6. Flood Zones of Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-7. Land Cover Types at Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-8. Land Cover Types at Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-9. 2015 Vegetation Survey Tracks at Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-10. 2015 Vegetation Survey Tracks at Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-11. 2015 Bird and Bat Surveys at Naval Station Norfolk, City of Norfolk, Virginia.

- Figure 2-12. 2015 Bird and Bat Surveys at Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 4-1. Natural Resources Management Units of Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 4-2. Natural Resources Management Units of Craney Island Fuel Terminal, City of Portsmouth, Virginia.

This page intentionally left blank.

LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
%	percent
ac.	acre(s)
BASH	Bird/Animal Aircraft Strike Hazard
BMPs	best management practices
CAA	Clean Air Act
CECOS	Naval Civil Engineer Corps Officers School
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
ChesMMAP	Chesapeake Bay Multispecies Monitoring and Assessment Program
CI	Craney Island Fuel Terminal
CLEP	Conservation Law Enforcement Program
CNIC	Commander, Navy Installations Command
CNO	Chief of Naval Operations
CNRMA	Commander, Navy Region, Mid-Atlantic
CO	Commanding Officer
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	[Airfield] Clear Zone Management Plan
DDT	dichlorodiphenyltrichloroethane
DENIX	Defense Environmental Network and Information Exchange
DLA	Defense Logistics Agency
DOD	Department of Defense
DODI	Department of Defense Instruction
DON	Department of the Navy
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPR	environmental program requirements

Acronyms

ERL	environmental readiness level
ESA	Endangered Species Act
ESI	environmental sensitivity index
FFA	Federal Facilities Agreement
FONSI	finding of no significant impact
FR	Federal Register
FRP	Facility Response Plan
ft.	foot/feet
FY	fiscal year
GIS	geographic information system
ha	hectare(s)
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IPM	integrated pest management
IRP	installation restoration program
JD	jurisdictional determination
JEB	Joint Expeditionary Base
km	kilometer(s)
Legacy	Legacy Resource Management Program
m	meter(s)
MBTA	Migratory Bird Treaty Act
mi.	mile(s)
MLLW	mean lower low water
MOU	memorandum of understanding
MSAT	Marine Species Awareness Training
msl	[above] mean sea level
MSF	Magnetic Silencing Facility
MWR	Morale, Welfare, and Recreation
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command
NAVFAC Environmental	Naval Facilities Engineering Command, Environmental Program
NAVFAC MIDLANT	Naval Facilities Engineering Command Mid-Atlantic
NAVFAC P-73	Naval Facilities Engineering Command Real Estate Operations and Natural Resources Management Procedural Manual 73
Navy	United States Navy

Acronyms

NCCA	National Coastal Condition Assessment
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOB	Naval Operating Base
NRC	natural resources conservation
NRM	Natural Resources Manager
NSN	Naval Station Norfolk
NWP	Nationwide Permit
NWS	Naval Weapons Station
O&MN	Operations and Maintenance, Navy
ODCP	Oil Discharge Contingency Plan
OHS	oil and hazardous substances
OPNAVINST	Chief of Naval Operations Operating Instruction
OSD	Office of the Secretary of Defense
OWWT	Oily Wastewater Treatment [Plant]
PARC	Partners in Amphibian and Reptile Conservation
PIF	Partners in Flight
ppb	parts per billion
PWD	Public Works Department
QRP	Qualified Recycling Program
RTE	rare, threatened, or endangered [species]
SAV	submerged aquatic vegetation
SCS	Soil Conservation Service
SECNAVINST	Secretary of the Navy Instruction
SERDP	Strategic Environmental Research and Development Program
SLR	sea-level rise
SMP	Site Management Plan
SPCA	Society for the Prevention of Cruelty to Animals
SPCC	Spill Prevention, Control, and Countermeasures Plan
SWAP	State Wildlife Action Plan
SWP3	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
U.S.	United States

Acronyms

USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
VAC	Virginia Administrative Code
VADEQ	Virginia Department of Environmental Quality
VaFWIS	Virginia Fish and Wildlife Information Service
VDCR	Virginia Department of Conservation and Recreation
VDCR-DNH	Virginia Department of Conservation and Recreation, Division of Natural Heritage
VDGIF	Virginia Department of Game and Inland Fisheries
VIMS	Virginia Institute of Marine Science
VMRC	Virginia Marine Resources Commission
VPDES	Virginia Pollutant Discharge Elimination System
VWP	Virginia Water Protection
WS	United States Department of Agriculture – Wildlife Services

1.0 INTRODUCTION

1.1 PURPOSE AND AUTHORITY

In accordance with the Sikes Act, as amended, (16 U.S. Code [U.S.C.] §670a–f); 32 Code of Federal Regulations (CFR) Part 190; Department of Defense (DOD) Instruction (DODI) 4715.03; Chief of Naval Operations Operating Instruction (OPNAVINST) 5090.1D (Navy 2014a); and Naval Facilities Engineering Command (NAVFAC) Real Estate Operations and Natural Resources Management Procedural Manual 73 (NAVFAC P-73); the United States (U.S.) Department of the Navy (DON) must implement and maintain a balanced and integrated program for the management of natural resources. To facilitate the natural resources management program, the Secretary of the Navy is further directed to prepare and implement an Integrated Natural Resources Management Plan (INRMP) for each military installation that has significant natural resources. Although the U.S. Navy (Navy) had formerly determined that an INRMP was not warranted for Naval Station Norfolk (NSN or Installation) or Craney Island Fuel Terminal (CI or Fuel Terminal), the development of this document has been triggered by the completion of surveys confirming nearshore resources present around the Installation (Tetra Tech 2016; Hager 2015), including the federally endangered Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*); the recent listing under the Endangered Species Act (ESA) of species that have the potential to occur (i.e., northern long-eared bat [*Myotis septentrionalis*]; USFWS 2015); and the importance of migratory bird protection with relation to the Bird/Animal Aircraft Strike Hazard (BASH) Program. This is the first INRMP to be completed for NSN and CI; it is intended to help guide the natural resources management activities on the Installation and the Fuel Terminal.

The Navy intends to implement this INRMP within the framework of regulatory compliance, mission obligations, anti-terrorism and force protection limitations, and funding constraints. In accordance with Navy policy, it must incorporate ecosystem management as the basis for planning and management. In addition, the Sikes Act, as amended, requires the INRMP be prepared in cooperation with the Secretary of the Department of Interior, acting through the Director of the U.S. Fish and Wildlife Service (USFWS), and the head of the appropriate fish and wildlife agencies of the state in which the military installation is located—in this case, the Virginia Department of Game and Inland Fisheries (VDGIF). Cooperative preparation with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) is not required by the Sikes Act as amended, but coordination with NMFS is appropriate when the nearshore environment will benefit from INRMP implementation (Navy 2014b). The INRMP must reflect the mutual agreement of these parties concerning conservation, protection, and management of fish and wildlife resources. Such mutual agreement and cooperation will support the principles of ecosystem management by improving the management of ecosystems that cross federal, state, and private boundaries. Federal and state agency correspondence is included in Appendix B, and mutual agreement letters will be inserted into Appendix B upon receipt. Under the Sikes Act (including all amendments), all new INRMPs must also be submitted for public review and comment before final acceptance. To fulfill this requirement, National Environmental Policy Act (NEPA) documentation has been prepared for the INRMP and is presented in Appendix I; the Pre-Final INRMP has been made available to the public for a 30-day comment period.

1.2 SCOPE

An INRMP's scope comprises all lands, ranges, nearshore areas, and leased areas 1) owned by the U.S. and administered by the Navy; 2) used by the Navy via license, permit, or lease for which the Navy has been assigned management responsibility; or 3) withdrawn from the public domain for use by the Navy for which the Navy has been assigned management responsibility (Navy 2006).

This INRMP encompasses 4,373.12 acres (ac.) (1,769.7 hectares [ha]) in total of Navy-owned lands and waters. The vast majority of this acreage comprises the 3,638.32 ac. (1,472.4 ha) occupied by NSN in the Sewells Point area in Norfolk, Virginia. In addition, because CI is managed by Public Works Department (PWD) Norfolk, it is included in this INRMP as well. Located in Portsmouth, Virginia, just across the Elizabeth River from NSN, CI encompasses 734.8 ac. (297.4 ha), which has been largely created by land reclamation/fill. Lastly, the INRMP includes the Norfolk Magnetic Silencing Facility (MSF), which comprises the Elizabeth River Channel Deperming Station, located in the Elizabeth River, and Sewells Point Degaussing Range, in Hampton Roads (the water body and harbor located between the mouth of the James River, to the west, and the Chesapeake Bay, to the east).

NSN and CI do not have any leased properties or agricultural outleases, and as such, this INRMP does not cover management of leased areas.

This INRMP outlines 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 this INRMP included input from state and federal stakeholders. As required under the Sikes Act (16 U.S.C. 670a *et seq.*) as amended, this INRMP reflects mutual agreement of agencies concerned with the conservation, protection, and management of fish and wildlife resources, including the USFWS and the VDGIF. This INRMP provides the direction for natural resources management at NSN and CI; however, it does not replace or affect any federal laws, or state responsibility and authority for protecting fish and wildlife resources.

1.3 GOALS AND OBJECTIVES

The objectives of this INRMP are to ensure natural resources are managed in accordance with federal and state regulations and Navy policies and that environmental considerations are an integral part of planning activities at NSN and CI.

This INRMP is a long-term planning document that guides implementation of the natural resources management program in a manner that supports the Installation mission, while protecting and enhancing natural resources and providing a variety of outdoor recreational opportunities for Installation personnel. In accordance with 32 CFR 190, the Sikes Act (16 U.S.C. 670a *et seq.*) as amended, and OPNAVINST 5090.1D, this plan must provide for the following:

- management of fish and wildlife, land, and forest resources;

- identification of fish- and wildlife-oriented recreational use activities and areas;
- enhancement or modification of fish and wildlife habitat;
- protection, enhancement, and restoration of wetlands where necessary for support of fish, wildlife, or plants;
- integration of, and consistency among, the various activities conducted under the INRMP;
- establishment of specific natural resources management goals and objectives, and time frames for proposed actions;
- sustainable use by the public of natural resources to the extent that 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;
- no net loss in the capability of military lands to support the military mission of the Installation; and
- annual review of this INRMP and its effects, and updated if necessary as determined from the formal review that will be conducted no less often than every five years.

The goals and objectives that follow have been defined to address INRMP regulatory requirements and the specific operational needs of the Installation and the Fuel Terminal.

Goal 1. Protect wetlands and water quality at NSN and CI.

Objective 1.1 Coordinate with the U.S. Army Corps of Engineers (USACE) and Virginia Department of Environmental Quality (VADEQ) for the delineation of wetlands and application of best management practices for protecting water quality.

Objective 1.2 Require avoidance, minimize, or mitigate impacts to wetlands by restoration, enhancement, or compensatory banking, when a mission change, activity, or development will adversely impact jurisdictional wetlands.

Objective 1.3 Promote landscaping techniques that reduce water and fertilizer usage, require low maintenance, and eliminate or reduce the need for herbicide and pesticide usage while incorporating low impact development design of stormwater systems.

Goal 2. Protect forested areas and urban tree canopy at NSN and CI.

Objective 2.1 Maintain Tree City USA status with an annual forestry expenditure of at least \$2.00 per capita and through continual tree mitigation planting efforts.

Objective 2.2 Inventory and assess the amount of tree canopy that currently exists and the amount that could exist to improve air quality, water quality, wildlife habitat, and public benefits on the Installation.

Introduction

Objective 2.3 Develop a tree ordinance and management plan that focuses on the retention, care, mitigation, and improvement of existing forested areas, urban tree canopy, and significantly recognized trees.

Objective 2.4 Achieve no net loss of tree canopy on the Installation in 5 years, and increase the overall tree canopy by 30% in future years.

Objective 2.5 Establish a 2:1 mitigation ratio for tree removal and/or mortality associated with development.

Goal 3. Protect listed flora and fauna at NSN and CI.

Objective 3.1 Coordinate with the USFWS, VDGIF, and NMFS regarding the potential presence and conservation of rare, threatened, or endangered (RTE) species.

Objective 3.2 Inventory and assess the presence and absence of RTE species when it is determined the Installation is undergoing a mission change, activity, or development that may potentially impact RTE species or habitats critical to their survival.

Objective 3.3 Require avoidance, minimization, and proper mitigation actions when a mission change, activity, or development will adversely affect RTE species known to occur on NSN and CI.

Objective 3.4 Develop a volunteer stewardship program and partner with local governments and organizations that actively support and carry out conservation and restoration activities within the local watershed.

Goal 4. Protect, conserve, and restore vulnerable and specialized habitats at NSN and CI.

Objective 4.1 Coordinate with the Virginia Institute of Marine Science (VIMS), the Virginia Marine Resources Commission (VMRC), VADEQ, and the Virginia Department of Conservation and Recreation (VDNR), Division of Chesapeake Bay Local Assistance, for the protection and stabilization of the shoreline, and the restoration and natural reinforcement of the coastal zone.

Objective 4.2 Identify and designate no-mow or low-mow areas such as environmental corridors, green space, and other grounds maintenance boundaries for the promotion and establishment of native pollinator habitats.

Objective 4.3 Pursue cost-effective invasive species control treatments on and near the airfield, environmental restoration sites, forested areas, and other specialized habitats.

Objective 4.4 Investigate climate change vulnerability and adaption to floodplains, wetlands, and nearshore habitats and their dependent wildlife species.

Goal 5. Reduce conflicts with hazardous or nuisance wildlife species at NSN and CI.

Objective 5.1 Coordinate and provide technical assistance to Air Operations to ensure management actions and projects in the INRMP and the BASH Plan are mutually supportive.

Objective 5.2 Manage populations or occurrences of hazardous and nuisance wildlife species to minimize wildlife strikes to aircraft, prevent transmission of zoonotic diseases from animals to humans, and mitigate perceived human-wildlife conflicts.

Objective 5.3 Coordinate with installation leadership, legal, and security to develop enforceable ordinance and penalties that prohibit wildlife or animal feeding.

1.4 RESPONSIBILITIES

The Sikes Act (16 U.S.C. 670a *et seq.*) as amended requires a qualified professional to implement environmental management programs. Implementation of the INRMP at NSN and CI is the responsibility of all natural resources personnel at the Installation, including the NSN Commanding Officer (CO), who is responsible for managing all aspects of the Installation's natural resources, the NSN Environmental Program Director, the NAVFAC Mid-Atlantic Regional Natural Resources Manager, Installation Natural Resource Manager (NRM), and other Installation personnel. The CO has delegated the authority to an Environmental Program Director within the Environmental Office to implement natural resources management activities through the Installation's NRM. Other Installation personnel, such as: Security; Grounds Maintenance; Morale, Welfare and Recreation (MWR); Housing; and Safety have functions overlapping the natural resources program, but report to the Environmental Program Director on natural resources-related issues. The NAVFAC Mid-Atlantic Regional Natural Resources Manager also oversees natural resources management for all Installations in the Mid-Atlantic's Area of Responsibility. The Installation NRM for NSN and CI also serves as the NRM for Naval Weapons Station (NWS) Yorktown, Virginia.

The Installation CO's Environmental Policy (U.S. Navy 2014c) has made certain commitments that include, but are not limited to:

- Ensure implementation of pollution prevention measures and waste minimization programs.
- Develop objectives and targets and implement sustainable practices to reduce environmental impacts.
- Educate employees about their responsibilities to the environment.
- Foster communication throughout appropriate levels of our organization about NSN's environmental commitments and performance.
- Sustain NSN's partnerships with local, State, and Federal regulatory agencies and maintain continuous environmental compliance with existing and new regulations and guidelines.

Stakeholders of NSN and CI natural resources include federal and state natural resource agencies, local governments and landowners, civic and conservation groups, and the Navy. For this INRMP, a stakeholder is an individual, group, or agency that has the responsibility or mandate to preserve and manage the Installation's natural resources, that has a right or privilege to make use of the natural resources, or that may be affected directly or indirectly by natural resources management actions conducted at the Installation.

1.4.1 Installation Stakeholders

The organization chart in Figure 1-1 (Appendix J) illustrates the Navy chain of command for NSN and CI. OPNAV M-5090.1, Section 1-4 (Responsibilities), provides a detailed description of environmental responsibilities associated with different positions within the Navy (Navy 2014b). To implement the INRMP while ensuring successful accomplishment of the military mission, the Commander, Navy Region Mid-Atlantic (CNRMA), acts as a trustee for NSN and CI. At the Installation level, the NSN CO and the NRM are directly involved in implementation of this INRMP, while ensuring successful implementation of the military mission. The NSN CO is responsible for ensuring that NSN and CI personnel comply with the laws and requirements relevant to the conservation and management of natural resources. The NRM is responsible for the daily implementation and coordination of the INRMP, as well as ensuring this INRMP is reviewed annually and updated as necessary to reflect current natural resources conditions, and is reviewed for operation and effect every five (5) years, and updated as necessary, as required by the Sikes Act (16 U.S.C. 670a *et seq.*) as amended.

Although these positions hold the primary responsibilities, all personnel at the Installation—public works/civil engineering personnel, legal staff, public affairs, logistics, resource management, contracting, the local fire department, and the waterfront security officers—play important roles in supporting the plans and objectives laid out in the INRMP, including ensuring environmental compliance within military operations. Other Navy stakeholders, including the NSN Environmental Office, PWD Norfolk, MWR Department, Navy contractors working at NSN and CI, and the NSN tenant commands, are responsible for sustaining natural resources for economic and recreational purposes, and/or with natural resources management and protection. Table 1-1 (Appendix D) provides a list of stakeholders currently involved with natural resources management at NSN and CI.

1.4.2 External Stakeholders

State and federal agencies—such as USFWS, NMFS, VDGIF, U.S. Department of Agriculture (USDA) Wildlife Services (WS) and Natural Resources Conservation Service, U.S. Environmental Protection Agency (EPA), and the USACE—are the primary external stakeholders responsible for natural resources protection and preservation. The Sikes Act (16 U.S.C. 670a *et seq.*) as amended requires that this INRMP be prepared in cooperation with, and reflect mutual agreement of the USFWS and the VDGIF. This requirement affords them signatory authority as external stakeholders and approving officials of this INRMP. Cooperation and coordination with these agencies is an integral part of the Navy's natural resources program.

Other external stakeholders include federal, state, and local government agencies and programs (Table 1-1, Appendix D) that provide support or collaborate with NSN for the implementation of its natural resources program, and the non-governmental organizations (NGOs) and individuals who make use of those natural resources, such as civilian groups, including residents of the surrounding communities who have access to, or are affected by, the condition of NSN and CI natural resources, and private conservation organizations.

NSN has established several partnerships with government and non-governmental organizations to manage. These are described in Section 1.11 (Partnerships and Outreach).

1.4.3 Technical Assistance

Technical assistance to implement this INRMP may be provided to the CO and NRM from the Navy or by outside agencies. Assistance from outside agencies is normally provided through individual agency requests and formal cooperative agreements, while assistance from within the Navy is normally less formal. During the five-year management period of this INRMP, additional cooperative agreements may be implemented. Technical assistance from organizations outside the Navy may include USFWS, VDGIF, USDA Natural Resources Conservation Service, USDA Forest Service, and The Nature Conservancy (TNC). Technical assistance from within the Navy may be provided by staff from the Installation Environmental Office, NAVFAC biologists, foresters, and soil conservationists, and additional staff, as needed and subject to funding, to be hired by the Installation to complete the continuous work to ensure successful implementation of this INRMP. Options for supplemental labor resources from outside the Navy for implementation of this INRMP include volunteers from local organizations and groups such as Boy Scouts of America, students from local public and private schools and universities, ecology clubs and conservation groups, retired and/or senior citizens. Options for supplemental labor resources would also be available from volunteer civilian and military personnel, and their dependents.

1.5 COMPLIANCE AND STEWARDSHIP

Compliance in terms of an INRMP refers to actions that must be taken in order to abide by the statutes and regulations applicable to natural resources. These are actions that an installation is legally mandated or obligated to take in order to meet current or recurring natural resources conservation management requirements, and for which it must obtain funding. Examples of compliance actions include developing, updating, and revising INRMPs; conducting biological surveys to determine population status of endangered, threatened, and sensitive species; and conducting wetland surveys for planning, monitoring, and/or permit applications. Compliance is essential, so these projects are of the utmost priority.

Stewardship is the responsibility to inventory, manage, conserve, protect, and enhance the natural resources entrusted to one's care in a way that respects the intrinsic value of those resources and the needs of present and future generations (OPNAVINST 5090.1D). Installations are required to recognize and balance environmental stewardship with mission readiness in retaining control and use of Navy land, sea, and air space for the purpose of

maintaining the military mission. Conscious and active concern for the inherent value of natural resources must be given in all Navy plans, actions, and programs (OPNAVINST 5090.1D). Stewardship projects and programs enhance an installation's natural resources, promote proactive conservation measures, and support investments that demonstrate Navy environmental leadership. Examples include education and public awareness projects, biological surveys or habitat protection for non-listed species, or management and execution of volunteer and partnership programs. Stewardship is an important component of the Navy's Environmental Readiness Program, and because stewardship projects can occur on an indefinite time-scale, these projects are prioritized after compliance projects.

1.6 LOCATION AND REGIONAL SETTING

NSN is located in the northwest corner of the City of Norfolk at the mouth of the Chesapeake Bay in the Tidewater area of Virginia (Figure 1-2, Appendix J). The NSN Master Plan (NSN 2011) divides the Installation into the following Districts, from west to east: Waterfront, Fleet Mall Support, Central Campus, Airfield Support, Chambers Field, Magazine (southeast corner), and Willoughby housing area (northeast tip). The Districts designated by the Installation Development Plan (in process at the same time as this INRMP's development) are, from west to east: Waterfront, Central Core, Base Support, Chambers Field, Munitions, Airfield Support, and Willoughby (Salonen 2016).

The Installation is bordered by the Chesapeake Bay and Willoughby Bay to the north, the Elizabeth River to the west, and the City of Norfolk to the east and south (Figure 1-3, Appendix J). Across the Elizabeth River, to the southwest of NSN, lies the CI Fuel Terminal (Figure 1-2). The surrounding land area is densely developed with residential, commercial, industrial developments, and recreational facilities. Several other military installations including Fort Monroe, Naval Weapons Station Yorktown, Joint Expeditionary Base (JEB) Little Creek, JEB Fort Story, Naval Air Station (NAS) Oceana, and the Fleet Combat Training Center Atlantic at NAS Oceana Dam Neck Annex (including the Camp Pendleton Annex) (NAS Oceana Dam Neck) are also located in proximity to NSN and CI.

CI is located in the city of Portsmouth, Virginia, at the confluence of the Elizabeth River (to the east of the Installation) and Hampton Roads (a subpart of the Chesapeake Bay where ships can be anchored, to the north). An entrance road through Merrifield village provides access to the facility from the southwest, and the western end of the facility is a simple network of roads and drainage ditches, providing access to the Fuel Terminal at the eastern end (Figure 1-4, Appendix J). To the south, the Fuel Terminal is bounded by Craney Island Creek, across which sits a U.S. Coast Guard (USCG) station, and at the West End, Churchland Middle and High schools. The western property boundary is abutted by housing developments. Craney Island is primarily man-made from dredged river sediments, and to the north a USACE Dredged Material Management Area sprawls northward into Hampton Roads/Chesapeake Bay.

CI is ecologically important to the region, as it is known for its bird-watching opportunities. More than 270 bird species have been observed utilizing CI and the adjacent dredge spoil

facility operated by the USACE since 1988 (USACE Norfolk District 2011), and in the past, the NRM has hosted bird-watching trips with members of the Cape Henry Audubon Society.

The Elizabeth River Channel Deperming Station is located in the Elizabeth River, adjacent to the Lamberts Bend section of the Norfolk Harbor Federal navigation channel (Figure 1-2). The facility consists of two roughly parallel concrete piers approximately 1,500 feet long and 240 feet apart, and an adjacent wooden pier. The three piers form two deperming slips. Slip A, between the concrete piers, contains two groups of passive sensors installed in the floor of the riverbed to monitor the magnetic treatment process at deep and medium depths. Slip B, located between the wooden pier and a concrete pier, contains a shallow sensor array. Other ancillary facilities include two operations buildings, a pump house and pump station, a storage building, and two shelters (NAVFAC Atlantic 2005).

The Sewells Point Degaussing Range is located immediately north of NSN in the Entrance Reach section of the Norfolk Harbor Federal navigation channel within Hampton Roads (Figure 1-2). The range consists of three groups of sensors installed below the floor of the channel. A linear array of shallow sensors is located immediately east of the main access channel, and medium-depth and deep arrays are co-located linearly across the channel (NAVFAC Atlantic 2005).

1.7 MILITARY MISSION

1.7.1 Historical Overview and Military Mission

Naval Station Norfolk

The land on which NSN is located was purchased by the Navy immediately after the United States entered World War I in April 1917. A bill was passed for the purchase of 474 acres. It also set aside the sum of \$1.6 million for development of the base, including piers, aviation facilities, storehouses, facilities for fuel, oil storage, a recruit training station, a submarine base, and recreation areas for fleet personnel. The next six months saw the establishment of the Fifth Naval Headquarters, the Naval Operating Base (NOB), Naval Training Station Naval Hospital, and Submarine Station. By Armistice Day, 1918, there were 34,000 enlisted men at the base. An airfield for seaplanes was established at the NOB in October 1917. In August 1918, it was detached from NOB and became Naval Air Station (NAS) Hampton Roads. It was renamed NAS Norfolk in July 1921 (Commander, Navy Installations Command [CNIC] n.d.).

During World War I, the Navy concluded that the available land was insufficient. It was decided to fill a large part of the flats on the west and north by dredging the Elizabeth River to a depth sufficient for large ships to dock at NOB. During the fall and winter of 1917, approximately eight million cubic yards was dredged, moving the northern shoreline from along Dillingham Boulevard to approximately its current location (CNIC n.d.).

During the late thirties and early forties, much construction took place at the NOB and NAS Norfolk as war again loomed on the horizon. New buildings and piers were constructed and new runways, hangars, and ramps were constructed for the large landplanes and seaplanes

flown by the Navy in World War II. In December 1942, recruit training at the base was discontinued in order to focus on advanced training for men going directly to the fleet (CNIC n.d.). The NOB and NAS, then collectively referred to as Naval Base Norfolk, continued their significant role as the home of the Atlantic Fleet after World War II. In January 1953, Naval Base Norfolk was renamed Naval Station Norfolk as part of a Navy effort to standardize base names. On 5 February 1999, NAS Norfolk was disestablished and Chambers Field became part of NSN.

Today, NSN is the largest military port in the world. In addition to being the home for the Navy's largest concentration of naval forces, NSN also hosts personnel from the Marine Corps, Army, Air Force, and USCG, and supports significant Joint missions as well. The Installation thereby supports the operational readiness of the U.S. Atlantic Fleet, providing facilities and services to enable mission accomplishment (CNIC n.d.). Components of NSN's mission include: providing direct support to afloat and air units to maintain the highest level of readiness; providing facilities and programs to enhance quality of life for military and civilian members; and providing, if feasible, facilities and support to other Navy, DOD, and shore activities (Environmental Management Commander, Naval Base Norfolk 1997).

The Norfolk MSF sites provide magnetic treatment, including deperming (stabilizing or reducing permanent magnetization) and degaussing (masking of a ship's magnetic field), and check ranging for Navy, USCG, Military Sealift Command, U.S. Government, and friendly nation ships/submarines. The Elizabeth River Channel Deperming Station is the only magnetic treatment facility in the world capable of supporting aircraft carriers (NAVFAC Atlantic 2005).

Craney Island Fuel Terminal

The island that became known as Craney Island was documented by Captain John Smith in 1633 as an island populated by cranes (i.e., heron). The island was used for a variety of purposes following the Revolution, but remained in its original condition until World War I, when the island was greatly enlarged and eventually converted into a peninsula from its original size of 34 ac. by deposits of dredged spoil from the Elizabeth River. Continued dredge placement over the years has expanded Craney Island to its current size of 734.8 ac. Since 1918, the Navy has constructed fuel storage tanks and additional facilities on Craney Island, turning it into the CI Fuel Terminal, the largest single government fuel storage facility in the continental United States.

In the late 1900's, the CI Fuel Terminal, along with Cheatham Annex and Yorktown Fuel Depot, were managed as the Fleet and Industrial Supply Installations. As a result of CNRMA regionalization of the Hampton Roads Area around the turn of the century, Cheatham Annex and Yorktown Fuels were moved under the responsibility of NWS Yorktown, and CI became the responsibility of the installation known at that time as Naval Air Base Little Creek. Today, NSN has authority over the operations at CI, which have expanded over time to include oily wastewater treatment and bioremediation in addition to maintaining the primary mission as a fuel storage depot and supply terminal.

1.7.2 Mission Impacts on the Environment

Naval Station Norfolk

NSN is the world's largest naval base and the center of naval operations on the East Coast. The military mission of NSN encompasses a broad range of activities and areas—from air and water operations and training, to industrial, storage, administrative, and residential—performed on intensely developed real estate with very little open space that remains in natural condition. The large amount of paved areas and the industrial nature of many operations results in a significant potential for non-point source pollution hazards. The close proximity to major bodies of water which receive all drainage from NSN is an issue of concern. Care must be exercised in application to the surface (e.g., land, pavement) of all chemicals (e.g., pesticides, fertilizers) to reduce hazards of non-point source pollution. In addition, the base must continue to actively ensure measures are taken to prevent oils and other chemicals associated with air and water operations and training, as well as industrial and storage operations, from entering wetlands and bodies of water.

The Navy recognizes that military training and operational activities have the potential to impact the environment and require precautions to avoid or minimize degradation or harm to natural resources. Mission-related impacts are potentially greatest in the operational areas such as the waterfront, where ships are berthed, repaired, and supplied with fuel, clean water, ordnance, and other necessities; and Chambers Field, where the vegetation of open fields, wetlands, and riparian areas must be maintained at set heights (in compliance with unified facilities criteria for airfields) to minimize natural habitat for birds and other wildlife, harassment of hazardous wildlife species, and may include permitted take as an integrated approach to managing BASH on the airfield.

In spite of the high level of development and necessity to mow and maintain many of the Installation's open areas, NSN benefits the local natural resources by its commitment to integrated, ecosystem-based, natural resources management, including minimizing and mitigation of unavoidable damage due to the military mission. NSN provides many sizeable green spaces and natural areas in an otherwise highly congested urban setting. Local flora and fauna, and the people who enjoy them, benefit from their conservation and presence at NSN.

Craney Island Fuel Terminal

In 1978, an Oily Wastewater Treatment Plant (OWWTP) was built at CI, which is currently the only wastewater treatment plant located on a Navy petroleum terminal. In 1980, CI and NAS Norfolk were connected by a 10-inch diesel fuel marine and 8-inch JP-5 fuel pipelines, thus improving the facility's capability to minimize the environmental impact of this complex on surrounding regions. In 1996, an accident at the Fuel Terminal caused the release of approximately 127,000 gallons of JP-5 jet fuel into an onsite containment area. The fuel spill did not reach the Elizabeth River, though the event highlighted the need for continued strategic oil spill response planning and training (see Section 3.4.2).

The fuel pipelines no longer function; instead, fuel is delivered to CI by barge, and Oily Waste is removed by barge (Markwood 2016). Ballast water from fleet vessels and effluent from oil/water separators located throughout the facility are treated on site. Oil/water separation is important to the mission for compliance with the Chesapeake Bay Preservation Act.

1.7.3 Integration of Military Mission and Sustainable Use

The Navy has taken a proactive approach towards integrating the military mission with concepts of sustainable land use by recognizing that efficient and effective land use planning supports military readiness and sustainability, and strives to protect and enhance the natural resources for multiple use, sustained yield, and biological integrity. Development and human use are inherently limited on military lands that are kept in their natural condition to support the military mission, often resulting in lands that have extremely high ecological value due to high biodiversity, an abundance of rare species, and presence of specialized habitats. As a result, DOD's land management responsibilities include acting as a steward for hundreds of our nation's rarest species and most characteristic habitats (Stein 2008) without compromising the preparedness of the Armed Forces. At the same time, using the land in a sustainable way that preserves the integrity of the ecosystem is vital to ensuring that military mission activities may continue to be conducted on these lands over the long term.

To that end, NSN has championed innovative, low-impact development (LID), leading the Navy in installing the first "green roof" on the Navy Legal Services Office, Building A-50, in 2010 (McCaffrey 2011b). Building LP-50 has also had a green roof installed since (Markwood 2016). In addition, NSN received a Chief of Naval Operations (CNO) Environmental Award for Fiscal Year (FY) 2010 in recognition of the Installation's exceptional environmental stewardship for achieving an unparalleled partnership with EPA and VADEQ for the restoration of Boush Creek (McCaffrey 2011a).

Navy understands the role INRMPs play in identifying potential conflicts between an installation's mission and natural resources, and identifying actions necessary to maintain the availability of mission-essential properties and acreage. An INRMP balances the management of natural resources unique to the installation with military mission requirements and other land use activities affecting an installation's natural resources (DOD and USFWS 2002). The NRM is responsible for ensuring the accomplishment of the military mission in a way that sustains and enhances the natural resources on the Installation. The NRM accomplishes this requirement by working in close cooperation with military organizations to ensure mutual support and understanding.

1.7.4 Impact to the Military Mission

The use and management of lands that support military training and readiness, and the decision-making associated with such land use, directly affect the sustainability of the ecosystem. Specific components of land management include vegetation management, urban forest management, wetlands management, conservation of specialized habitats, invasive species control, soil conservation and erosion control, water quality control, and floodplain management. The INRMP projects that support these areas of natural resources management

provide a broad range of benefits the military mission. For example, completion of a jurisdictional wetland delineation will inform planning for training and operations, and will thereby reduce delays for future actions. Mapping invasive species and developing a strategic plan to apply control treatments will enable NSN to restore potential use of land for training, operations, recreation, etc., and will greatly improve visibility in densely infested areas (such as road sides), thereby enhancing operational safety and security. Projects that increase and enhance living shorelines will not only result in cleaner water in the nearshore area for training and recreational use; they will also provide reinforcement to protect NSN and CI from the impacts of coastal erosion and storm damage.

Projects that focus on the management of fish and wildlife—including nuisance species, migratory birds, and bats—go hand in hand with the management of land and water resources, and likewise, benefit the mission in a variety of ways. For example, conducting fauna surveys and confirming presence/absence of threatened and endangered species will help identify specialized habitats, which will inform planning, lead to species protection and conservation, and support the maintenance of critical habitat exemptions. Active habitat management in conjunction with permitted harassment, capture, or lethal take of hazardous wildlife species that are considered a threat may improve the safety of air operations and the residents and employees of NSN.

To protect and maintain natural resources while ensuring the continuation of the military mission, NSN has implemented an ecosystem management approach for environmental stewardship of the Installation natural resources. The management strategy maximizes land use that supports military training and operations while minimizing impacts to natural resources.

1.8 CONSTRAINTS AND OPPORTUNITIES

NSN is located in the world's largest natural harbor, Hampton Roads, with excellent access to the Atlantic Ocean through the Chesapeake Bay. The landform provides a protective site for the Base's primary function as a homeport to a substantial portion of the Atlantic Fleet. The single most significant concern with respect to the natural environment is the potential for damage from hurricanes or flooding because of the site's proximity to the ocean and James River as well as the high water table underlying most of the property on the Installation.

Due to the urban nature of the Installation, traditional natural resources management activities (such as forestry, wildlife management, and outdoor recreation) are limited. However, opportunities exist for habitat improvement, wetlands and water quality protection, green space preservation, and urban forestry. The foremost way in which natural resources pose constraints on training and other mission-related activities at NSN and CI is in the management of migratory birds, particularly at the airfield, where ongoing monitoring and dispersal activities are required for the reduction of BASH. The clear zone areas surrounding the airfield are required to be maintained with vegetation at set heights, void of buildings or structures except those permitted by Uniform Fire Code. Natural resources management, development, and most other land uses are also constrained by explosive safety quantity

distance arcs associated with ordnance loading and storage in the southeastern portion of the Installation.

Natural resources management issues, policies, and regulatory requirements pose the following constraints to NSN and CI's military mission and to the further development of facility land:

- constant vigilance during air operations for the presence (and need for dispersal/removal) of migratory birds and other wildlife on or around the airfield (Figure 1-3) and maintenance of clear zones surrounding the airfield;
- consideration of surface waters, wetlands, tidal marshes, riparian buffer areas (Figure 2-3 and Figure 2-4); coastal zone areas, and floodplains (Figure 2-5 and Figure 2-6); sea-level rise and tidal storm surge (Section 2.1.1) during the planning phase for new construction or recapitalization;
- conservation and encouragement of flora and fauna habitat of protected species, or to a lesser extent, species of special concern (Figure 2-11); sensitive and protected resources that inhabit in the nearshore marine environment; and forested/shrub-scrub natural areas (Figure 2-7 and Figure 2-8);
- land use controls in areas where landfills, installation restoration sites, and underground storage tanks (USTs) are present (grouped under the term, "Environmental Constraints," on Figure 1-3 and Figure 1-4); and
- limitations on ordnance storage related to explosive safety quantity distance arc requirements and available land.

Outside of the areas where natural resources pose constraints to the military mission, the remaining areas of NSN and CI represent opportunity areas where mission activities would not be restricted by mission or natural resources management issues. Opportunity areas include existing developed areas of the Installation and the Fuel Terminal, including ship docks and wharfs, buildings and structures, paved surfaces, maintained recreation areas and playgrounds (Figure 1-3 and Figure 1-4), as well as non-specialized habitat areas, but excluding the environmental constraint areas.

1.9 INRMP INTEGRATION WITH OTHER INSTALLATION PLANS

The preparation and development of an INRMP must be coordinated with the development of other installation plans, planning processes, and NEPA documents as required by DOD guidance (August 2006). Examples of some of these plans include installation range plans, training plans, integrated cultural resource and pest management plans, and installation restoration plans. A Master Plan was prepared for NSN in 2011. NSN and CI have Integrated Cultural Resources Management Plans (ICRMPs) in place; historical buildings and archeological resources are not covered within this INRMP, but they should be considered (and avoided) when carrying out future natural resources surveys or soil disturbing activities (e.g., planting). There is not a wildland fire management plan, nor a pest management plan in place for consideration in this INRMP. The Final Airfield Clear Zone

Management Plan (CZMP) for NSN Chambers Field (Geo-Marine 2011) has been reviewed and considered, and is appropriately cross-referenced in this INRMP. The Chambers Field BASH Safety Program has been incorporated as an in-tact component of this INRMP (see Appendix H). Implementation of the BASH Program and the Installation Restoration Program (IRP) (see Section 3.4) will be conducted in consideration of this INRMP going forward, and future updates will be made in coordination with the NRM.

NSN and CI does not have any range complex management plans or other operation plans in place that would need to be coordinated with implementation of this INRMP. Planning for training activities and natural resources activities are coordinated between the NRM and the Environmental Planning and Conservation Group. This ensures that the military mission is not compromised and that the Installation is meeting the mandated environmental regulatory requirements. Environmental resources must be considered during the planning and development of future training areas and facilities at NSN and CI, and prior to construction of piers or development and paving of vegetated areas.

1.10 ENCROACHMENT AND ADJACENT LAND USE

The DOD has established an Encroachment Partnering program, which was authorized under 10 U.S.C. §2684a (Agreements to Limit Encroachments and other Constraints on Military Training, Testing and Operations), and authorizes military services to enter into cost-sharing partnerships with states, their political subdivisions, and/or conservation minded NGOs to acquire lands from willing sellers. This serves to limit development or use of the acquired property, or preservation of habitat that supports military readiness requirements. Undeveloped habitat areas that border military installations present ideal opportunities for the Navy to establish buffers to separate the Installation from encroaching development; however, there are essentially no such undeveloped land areas around NSN or CI.

The City of Norfolk adopted a comprehensive plan in 2013, called *plaNorfolk2030*, which outlines how the physical development of the City of Norfolk should be directed for at least the next 20 years. As the primary employer and the largest land owner in the City of Norfolk, the Navy has played an important role in the development of the city; the vitality of each is dependent on the other. As such, the City of Norfolk is working with the Navy on issues relating to the natural and built environment around NSN. For example, the City has incorporated the Navy's recommendations for land use in noise zone and accident prone zones into its long-term plan (City of Norfolk 2015). In addition, the two parties are working together to evaluate potential reuse opportunities of the federally owned land at 4th View Street (in Willoughby), and the city has made it a priority to establish a light rail extension to NSN (City of Norfolk 2015). It is critical that Navy representatives continue to participate in the joint decision making process to ensure continued compatible land use around the numerous naval stations in the region.

CI does not have any encroachment conflicts identified. Operations at the West End—where the Installation abuts public schools and private citizens' residences—have no perceptible impact outside of the Installation. The City of Portsmouth's landfill to the north of CI serves as a natural buffer to isolate the East End from the general public.

1.11 PARTNERSHIPS AND OUTREACH

To develop and implement sound management practices for the full spectrum of natural resources found at NSN and CI requires a wide range of expertise. The development of partnerships with federal and state resources agencies, local colleges and universities, and local conservation groups makes such expertise available to assist natural resources personnel, and fosters good community relationships. The following is a list of groups and agencies that have formed significant partnerships with the Installation.

- The VDGIF is the primary wildlife and freshwater fish management agency in the state. VDGIF provides environmental analysis of projects or permit applications to determine likely impacts on fish and wildlife resources and habitats, and recommends appropriate measures to avoid such impacts. VDGIF was consulted during the process of developing this INRMP (Appendix B).
- The USFWS is the federal agency with regulatory oversight of federally listed threatened and endangered species and designates critical habitat for such species. The USFWS provides technical assistance with plans on fish and wildlife issues, identification of threatened and endangered species and critical habitat consultation under Section 7 of the ESA of 1973, fish and wildlife census surveys, and law enforcement. As with VDGIF, the USFWS provided input to the INRMP during the review process (Appendix B).
- NAVFAC MIDLANT has partnered with Chesapeake Scientific, the USCG, and the Chesapeake Bay Bridge and Tunnel Commission (as well as USFWS) to carry out the Atlantic sturgeon research program in the vicinity of NSN.
- The DOD Partners in Amphibian and Reptile Conservation (PARC) program is currently updating herpetofauna species lists for the approximately 80 Navy installations that have INRMPs (NAVFAC Mid-Atlantic 2013). The database that is being developed will provide DOD installations with accurate and up-to-date lists of amphibian and reptile species in support of future data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions.
- The DOD Partners in Flight (PIF) develops cooperative agreements for implementing bird conservation programs and projects on military lands, facilitates communication and information sharing across geographic and political boundaries, and provides military natural resources professionals with the most up-to-date information on bird conservation.
- The Virginia Institute of Marine Science (VIMS) partners with the Navy and the communities of the entire region to provide research and monitoring related to marine plant and animal species, habitats, and the ocean ecosystem, and to operate the Sea Turtle Stranding Program.
- NSN's NRM recently began a partnership with the City of Norfolk Tree Commission and Norfolk Master Gardeners in support of the effort to increase the urban tree canopy on the Installation.

- The DOD’s Strategic Environmental Research and Development Program (SERDP) just completed a vulnerability and impact assessment focused on NSN, with applicability for the development of adaptation strategies for several coastal installations that are threatened by climate change issues such as rising sea-levels (SERDP 2013).

The DOD recognizes that regional partnerships are the most appropriate means to conduct climate change vulnerability and impact assessments. The South Atlantic Landscape Conservation Cooperative, established as part of the U.S. Department of the Interior’s Climate Change Response Strategy, is designed to provide a partnership in which the private, state, tribal, and federal conservation community can work together to address increasing land use pressures and widespread resource threats and uncertainties amplified by a rapidly changing climate. The NSN and CI NRM should continue to pursue partnerships with SERDP, South Atlantic Landscape Conservation Cooperative, Society for Ecological Restoration International, and other regional conservation partners in an effort to develop adaptation strategies to deal with climate change.

1.12 TRAINING OF NATURAL RESOURCES PERSONNEL

Section 107 of the Sikes Act, as amended, (16 U.S.C. *et seq.*) requires, “...sufficient numbers of professionally trained natural resources management personnel and natural resources law enforcement personnel to be available and assigned responsibility to perform tasks necessary to carry out Title I of the Sikes Act, including the preparation and implementation of integrated natural resource management plans.” The effectiveness of this INRMP is greatly enhanced by the professional development of natural resources management staff through participation in training, conferences, and workshops.

NSN’s Environmental Management System requires personnel to receive the appropriate job-specific education and training to perform their assigned tasks. Natural resources managers shall receive, at a minimum, the following education and training:

- 1) Basic environmental law (completion of Naval Civil Engineer Corps Officers School (CECOS) Basic Environmental Law (A-4A-0058) will satisfy this requirement);
- 2) Natural resources compliance (completion of CECOS Natural Resources Compliance (A-4A-0087) will satisfy this requirement);
- 3) Environmental protection (completion of CECOS Environmental Protection (A-4A-0036) will satisfy this requirement);
- 4) Introduction to NEPA (completion of CECOS National Environmental Protection Act (NEPA) Application (A-4A-0077) will satisfy this requirement);
- 5) Environmental negotiation (completion of CECOS Environmental Negotiation Workshop (A-4A-0067) will satisfy this requirement); and
- 6) Program funding (EPRWeb online training will satisfy this requirement).

In addition to completing the above-listed, required CECOS and EPRWeb training, natural resources personnel typically hold science-based degrees, and acquire professional skills by

attending training through the Shipley Group, USFWS (National Conservation Training Center), USACE, the Wetland Training Institute, various university and non-governmental programs, and Defense Environmental Network and Information Exchange (DENIX). Table 1-2 (Appendix D) lists contact information and Websites of regional and online programs for natural resources training and continuing education.

Natural resources staff also keeps abreast of current issues by attending annual workshops or conferences held by various professional societies. Societies such as National Military Fish and Wildlife Association, The Wildlife Society, Society of American Foresters, and Society for Ecological Restoration all host annual meetings focused on the management of natural resources. The NRM attends annual training programs, such as the National Military Fish and Wildlife Training, and maintains job-related certifications, such as Airport Biologist, Wildlife Biologist, Arborist, and DOD Pesticide Applicator.

Natural resources training projects scheduled under this INRMP include:

- **Project: SIKES NAVSTA/CI-Airport Biologist Certification**
- **Project: SIKES NAVSTA/CI- National Military Fish & Wildlife Training**
- **Project: SIKES NAVSTA/CI- DoD Pesticide Applicator Certification**
- **Project: SIKES NAVSTA/CI-Integrated Pest Management Coordinator Course**
- **Project: SIKES NAVSTA/CI-Wildlife Biologist Certification**

1.13 GEOGRAPHIC INFORMATION SYSTEM (GIS) MANAGEMENT, DATA INTEGRATION, ACCESS AND REPORTING

Geographic information system (GIS) management is an integral part of natural resources and environmental protection and planning. The CNRMA's GeoReadiness Center is the single, authoritative source and distribution point for all geospatial information within the area of responsibility of the Navy Mid-Atlantic Region and is managed by the Mid-Atlantic Facility Engineering Command GIS Division. The GeoReadiness Center houses the most current geospatial information (including aerial photography) for the entire Navy Mid-Atlantic Region and provides access to the comprehensive data set and analysis tools to Regional and DOD decision makers/managers, sponsored contractors, and other sponsored individuals via a secure government Internet site. GIS data for NSN and CI, including the environmental layers used for the development of this INRMP, can be accessed through the portal at: https://portal.navfac.navy.mil/portal/page/portal/am/mid-atlantic/am_ml_au/gis.

Baseline environmental data layers used to develop the figures for this INRMP include:

- Installation boundary and site details (e.g., buildings, infrastructure, recreation areas)
- Chambers Field Air Operations Area
- Soils
- Aquatic resources from the National Wetlands Inventory, using USACE Jurisdictional wetlands, where data is available

- Flood zones
- Forested/natural areas
- Mowed/maintained areas
- Land cover types

Environmental planners, project managers, engineers, and sponsored contractors are encouraged to use the portal to access GIS data for analysis, development of maps and project planning. In addition, the portal provides guidance documentation for the collection of new geospatial data.

1.14 ENVIRONMENTAL PLANNING

The proponent of any action at NSN and CI that has the potential to impact natural resources or may require federal or state permits must coordinate the proposed actions with the NAVFAC Planning Department. The NAVFAC Planning Department is responsible for initiating the Environmental Checklist (Appendix C) through the Environmental Core NEPA Group. Additional review of the proposed actions will also be conducted by the NRM for potential environmental impacts.

Advanced planning and coordination are required to ensure compliance with a number of federal environmental regulations including:

- NEPA, 42 U.S.C. §4231 *et seq.*;
- Sikes Act, as amended, 16 U.S.C. 670a *et seq.*;
- Clean Air Act (CAA), 42 U.S.C. §7401 *et seq.*;
- Clean Water Act (CWA), 33 U.S.C. §1251–1387;
- Migratory Bird Treaty Act (MBTA), 16 U.S.C. §703–712;
- Coastal Zone Management Act (CZMA), 16 U.S.C. §1451 *et seq.*; and
- ESA, 16 U.S.C. §1531 *et seq.*

A summary of laws relevant to natural resources management on Navy lands is located in OPNAV M-5090.1 and at the DENIX website:

<http://www.denix.osd.mil/nr/LegislationandPolicy/LawsandStatutes/Index.cfm>.

This page intentionally left blank

2.0 EXISTING CONDITIONS

2.1 CLIMATE

An understanding of general climate patterns is important to the planning and success of natural resources management and construction activities. NSN and CI are located in an area where temperature extremes are moderated by the Atlantic Ocean. The average yearly temperature is 60 degrees Fahrenheit (°F) (16 degrees Celsius [°C]). January is the coldest month with an average low of 32.6°F (0.3°C) and July is the warmest month with an average high of 87.4°F (30.8°C). The average growing season (daily minimum temperatures higher than 32°F for a light frost) lasts approximately 250 days from the middle of March to late November. The average annual precipitation is approximately 45.7 inches (116 centimeters) and is generally concentrated in the late summer. The prevailing wind is from the southwest in summer and northeast in winter at an average speed of 10 mi (16 km) per hour. During hurricane events that typically occur during June through September, torrential rainfall may accompany winds greater than 75 miles (121 km) per hour. The average relative humidity is 62 percent (%). The climate summary in Table 2-1 (Appendix D) includes data recorded at the Southeast Regional Climate Center at the Norfolk International Airport from 1946 to April 2012.

2.1.1 Climate Change

DODI 4715.03 requires the Navy to consider climate change in the development of INRMPs to help mitigate impacts on military installations. Impacts that must be considered include shifts in species' ranges and distributions, changes in phenology, rising sea levels, and variations in ecological processes such as drought, fire, and flood (DOD 2011a). Assessing the impacts of climate change is best approached by identifying an environmental baseline for the future that considers the differences in landscape form and function caused by climate change and other stressors on the landscape (Commander, Navy Installations Command [CNIC] 2012).

In 2009, the U.S. Global Climate Research Program released its *Second National Climate Assessment*, which was written under the authority of the Federal Advisory Committee Act. The report identified several trends and project impacts related to climate change throughout the U.S. as well as within specific regions of the country. The annual average temperature in the southeastern U.S. has risen 2°F (-17°C) since 1970 with the greatest seasonal increase in the winter months. There has been a 30% increase in fall precipitation over most the region and summer precipitation has decreased over almost the entire region. Additionally, the power of Atlantic hurricanes has increased since 1970, associated with an increase in sea surface temperature. Continued warming is projected with a lower emission scenario projecting a 4.5°F (-15°C) increase in average annual temperatures. Sea-level rise (SLR) is also projected to increase, as will the associated threats of coastal flooding, shoreline retreat and higher intensity hurricanes.

The impacts of these projected increases include more heat-related illness, declines in forest growth and agricultural crop production, declines in cattle production, increased buckling of

pavements and railways, and reduced oxygen levels in streams and lakes causing fish kills and declines in aquatic species diversity. The report indicates that SLR and increases in hurricane intensity will be among the most serious consequences of climate change, especially for low-lying areas along the Atlantic coast (U.S. Global Change Research Program 2009).

To develop adaptation strategies for several coastal DOD installations that are threatened by climate change issues such as rising sea-levels, the SERDP completed a climate change vulnerability and impact assessment, for which NSN was the primary case study. The project, which was entitled, *Risk Quantification for Sustaining Coastal Military Installation Assets and Mission Capabilities*, examined approaches that can quantify potential impacts to critical infrastructure and mission performance in the Hampton Roads area of Virginia. While the study is specifically focused on NSN, the assessment framework will help policymakers and natural resource managers develop strategies that support mission adaptation and long-term sustainability at DOD installations in the region (SERDP 2013).

2.2 PHYSIOGRAPHY AND SOILS

NSN and CI are located in the lowland sub province of Virginia's Middle Atlantic Coastal Plain. The topography of the Coastal Plain region is a terraced landscape that stair-steps down to the coast and to the major rivers (College of William and Mary, Department of Geology n.d.). Elevations at NSN range from mean sea level to approximately 16 ft. (5m) above mean sea level in the inland/developed areas. The site is nearly flat, and slopes slightly toward the west (Taylor et al 2008).

Craney Island or CI occupies a low peninsula at the mouth of the Elizabeth River. The area is characterized as nearly flat, with gently eastward sloping plains separated by eastward-facing scarps. Elevations at CI range from mean sea level to approximately 16 ft. (5m) above mean sea level (U.S. Navy 1999, Taylor et al 2008). Drainage is primarily by means of constructed ditches and canals throughout the station. On the western end of the island, surface drainage is to the southeast and southwest, following the surface contours to the tributary of Craney Island Creek.

A review of current USDA soil survey data indicate that nine soil mapping units occur on NSN, and seven soil mapping units occur on CI (USDA-NRCS 2013). Of the soils at NSN, three are identified as hydric and five are characterized as containing hydric inclusions. Hydric soils form under conditions of saturation, flooding, or ponding that last long enough during the growing season to develop anaerobic conditions in the upper soil layers, and may indicate the presence of a wetland. The hydric soils at NSN are Bohicket muck, 0 to 1% slopes; Duckston fine sand, 0 to 2% slopes; and Tomotley-Urban land complex, 0 to 2% slopes. The five soils at NSN characterized as containing hydric inclusions, but not classified as hydric are:

- Altavista-Urban land complex, 0 to 3% slopes
- Altavista-Urban land complex, 0 to 2% slopes

- Seabrook-Urban land complex, 0 to 2% slopes
- Udorthents-Dumps complex
- Urban land

The last soil type present at NSN is State-Urban land complex, 0 to 3% slopes.

Of the soils at CI, three are identified as hydric and three are characterized as containing hydric inclusions. The hydric soils on CI are Bohicket muck, 0 to 1% slopes, Johnston silt loam, 0 to 2% slopes, and Lawnes loam, 0 to 1% slopes. The three soils at CI characterized as containing hydric inclusions, but not characterized as hydric are:

- Altavista-Urban land complex, 0 to 3% slopes
- Altavista-Urban land complex, 0 to 2% slopes
- Udorthents-Dumps complex

The last soil type present at CI is State-Urban land complex, 0 to 3% slopes.

A large percentage of the soils at NSN and CI are mapped as Udorthents, Dumps, or Urban Land, including complexes associated with these soil types (USDA-NRCS 2013). There are few natural soil types at NSN, as the area is highly developed. Soils at much of NSN, including Chambers Field, are primarily urban fill with very little original soil remaining (NAVFAC MIDLANT 2012). CI is primarily man-made from dredged river sediment.

Table 2-2 (Appendix D) provides a brief description of some of the major soil characteristics, and Figure 2-1 and Figure 2-2 (Appendix J) show their locations at NSN and CI, respectively. The USDA rates the non-irrigated Land Capability Class of soils on a scale of 1 (best) to 8 (worst), considering factors such as landscape location, slope, depth of soil, and texture of soil (ESRI n.d.). Class I (1) soils have slight limitations that restrict their use. Class II (2) soils have moderate limitations that reduce the choice of plants or require moderate conservation practices. A comparison of Figures 2-1 and 2-2 to the USDA Agricultural Capability of Soils map online viewer (<http://www.arcgis.com/apps/OnePane/basicviewer/index.html?appid=ff3af737ebb942d99bcf2140a8ec2082>) reveals that the only Class I soils at NSN and CI are those in the State-Urban land complex soil series, with 0 to 3% slopes; and the only Class II soils are those in the Altavista-Urban land complex, with 0 to 3% slopes. These higher quality soils are located in the Magazine District and the Central Campus of NSN, and in the southwest corner of CI. All other classified soils at the Installation and the Fuel Terminal have very severe limitations for cultivation.

The list of hydric soils in Virginia is available on the USDA Natural Resources Conservation Service website: <http://soils.usda.gov/use/hydric/>.

2.3 WATER RESOURCES HYDROLOGY

Specific methods for characterizing and evaluating the soils, vegetation, and hydrologic indicators are described for NSN in the 2012 Clear Zone Management Plan for Chambers Field (2012) and the 2013 wetland delineation report for CI (Tetra Tech, Inc. 2013). As part of the wetland delineation survey, data were collected for the streams, channels, ditches, and tidal creeks, and ponds (there are no lakes present). The data collected for these surface water features are depicted aggregately (i.e., without detail on individual waterbodies) in Figure 2-3 and Figure 2-4.

2.3.1 Surface Water

Surface water represents an important natural resource at NSN and CI. Approximately 5.28 ac. (2.14 ha) and 5.29 ac. (2.14 ha), respectively, of the Installation are covered by non-wetland waters, not including jurisdictional streams or ditches. The majority of the surface area is supported by a storm drainage collection system which consists of both subsurface pipe lines and open ditches with outfalls at the waterfront. A comprehensive map outlining the stormwater drain system is contained in the Base Master Plan. The primary surface water resources at NSN are the estuarine and marine deepwaters that dip inside the Installation property boundary along the waterfront and Willoughby Bay, including Salt Marsh Pond, the marina, and the Restricted Area along the northwest shore (Figure 2-3). One small finger of Mason Creek, which borders the Installation to the east, pokes inside the boundary north of the airfield, and drainage ditches around the airfield are numerous. Boush Creek was formerly part of the Naval Station, but the property to the south of NSN that encompassed the creek has been exscessed.

Figure 2-4 reveals that CI contains one open water body, the remediation pond, located due west of the storage tanks, and two very small waterbodies classified as freshwater ponds. A review of the waterbodies summary (see Table 2-3, Appendix D) from the request for a Preliminary Jurisdictional Determination (Tetra Tech, Inc. 2013) indicates that the Fuel Terminal contains one stream, which is fed by an outflow pipe from the parking lot; 11 man-made ditches; 6 concrete-lined ditches; 2 grass-lined ditches; another drainage ditch; and a non-jurisdictional overland flow connecting a wetland to a roadside ditch.

NSN and CI lie entirely within the Chesapeake Bay watershed. The major tributaries to the bay from NSN and CI are the James River and the Elizabeth River, which directly or indirectly drain therein.

2.3.2 Groundwater

The shallow aquifer system of the City of Norfolk comprises the Columbia aquifer, the Yorktown confining unit, and the Yorktown-Eastover aquifer. The Columbia aquifer is predominantly composed of sandy surficial deposits that lie above the Yorktown confining unit. The Yorktown confining unit is composed of a series of very fine sandy to silty clay units at or near the top of the Yorktown Formation. The Yorktown–Eastover aquifer is predominantly composed of sandy deposits of the Yorktown Formation and the upper part of

the Eastover Formation. The shallow aquifer system is separated from deeper units by the continuous St. Mary's confining unit.

Domestic supplies of groundwater in the City of Norfolk are available from depths generally less than 200 ft. (60 m) deep. In some places, however, the taste of ground water is unpleasant or unpalatable because of naturally high concentrations of dissolved iron, manganese, and chloride. Contamination of the shallow aquifers is also possible from nitrates, pesticides, herbicides, fertilizers, heavy metals, and trace amounts of hydrocarbons or other toxic compounds. The potential also exists for contamination of the shallow aquifers by the intrusion of saltwater. Water from depths greater than approximately 200 ft. (60 m) is generally too saline to drink.

CI has a relatively shallow water table, and groundwater flow is generally toward the Elizabeth River and Craney Island Creek. Interception trenches are in place for recovery of spilled fuel oil. Storm drains which could intercept spilled oil product discharge to oil/water separators which help prevent release of fuel oil to the creek and river. The separated water then discharges to the Elizabeth River and Craney Island Creek. A clay layer above the aquifer on the eastern end of the Island is thought to provide a barrier to contaminant transport to aquifers (U.S. Navy 1999).

Because of concerns about the groundwater withdrawals and declining water levels in southeastern Virginia, the entire region, including the City of Norfolk, was designated a Groundwater Management Area by the state in 1976 (Smith and Harlow 2002). The Eastern Groundwater Management Area includes a portion or all of 13 counties and 11 cities located around the Chesapeake Bay and the Potomac River in the Coastal Plain Province, although more than 10 counties are currently being considered for inclusion. An additional Groundwater Management Area exists on the northeastern shore of Chesapeake Bay that includes two counties. In Virginia's two Groundwater Management Areas, the VADEQ has the authority to deny or limit requests for large groundwater withdrawals. Pursuant to the Groundwater Management Act of 1992, state permits are required for withdrawal of more than 300,000 gallons/month (1,135,624 liters/month) from wells in a designated Groundwater Management Area (VADEQ 2012).

2.3.3 Floodplains

The Federal Emergency Management Agency defines the 100-year floodplain as an area that has a 1.0% chance of being equaled or exceeded in any given year. The 500-year floodplain is an area that has a 0.2% chance of a flood in a year. Both the 100-year and 500-year floodplain are the standard used by federal agencies for floodplain management.

NSN is currently unmapped in reference to Federal Emergency Management Agency (FEMA) flood insurance rates. However, based on the contour intervals of the Installation and surge calculations completed by the City of Norfolk, with adjacent insurance rates mapped outside the Installation, NSN is likely susceptible to flooding, particularly in reference to the 500-year floodplain (Figure 2-5, Appendix J). NSN is a relatively flat site with a mean elevation of approximately 11 feet. The 100-year floodplain is 8.5 feet above

mean sea level (msl), or within 2.5 feet of the average elevation at NSN. Some areas would be flooded between 1/2 to 3 feet in the 100 year flood. The highest elevations of the site are Runway 10/28 at Chambers Field, and the south side of Admiral Taussig Boulevard, east and west of Hampton Boulevard. Some southern portions of NSN in the Fleet Mall Support District and the Magazine District, and areas near the shoreline of Willoughby Bay in the Airfield Support District and Willoughby District, are as low as 3 feet. The latter areas are susceptible to substantial coastal flooding. A tide gate is located on NSN that is typically closed in advance of an anticipated storm surge event, providing protection to Mason Creek from coastal surges (Fugro Atlantic 2012).

FEMA flood insurance rate maps show that a large portion of CI lie within the 100-year and 500-year floodplain associated with the Elizabeth River (Figure 2-6, Appendix J). Approximately 304.83 ac. (123.36 ha) are included at risk locations for storm surges associated with the 100- and 500-year floodplains. Because floodplains cover much of the Installation, several buildings, large portions of infrastructure, and developed areas occur within the 100- and 500-year floodplains.

2.3.4 Wetlands

A wetland delineation of NSN was completed in 2000 by Geo-Marine; the objective of the project was to support facilities planning, so a formal jurisdictional determination (JD) was not requested of the USACE, Norfolk District (Geo-Marine 2000). Wetland delineations were performed at CI by Tetra Tech in 2013 (Appendix D); the area delineated comprised the majority of the Fuel Terminal. Field delineation (i.e., determination and boundary flagging) of wetlands, open water areas (pond, retention areas, etc.), and linear features (i.e., streams) were performed for potentially jurisdictional waters of the U.S. regulated by Section 404 of the CWA. The surveyed areas of the Installation were evaluated for the presence and extent of wetlands using the routine wetland delineation methods described in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region* (USACE 2010). USFWS National Wetlands Inventory (USFWS 2003), U.S. Geological Survey (USGS) 7.5-minute topographic maps, and digital soil maps were used to support the delineation effort. Identified wetlands were classified by wetland type in accordance with *Classification of Wetlands and Deepwater Habitats of the United States*, which groups wetlands into five major systems: marine, estuarine, riverine, lacustrine, and palustrine (Cowardin et al. 1979).

Marine systems consist of the open ocean and its associated coastline. Estuarine systems are those that are periodically flooded with tidally influenced salty or brackish waters and have salinity greater than 0.5 parts per thousand (ppt). The lacustrine system includes areas of open water that are greater than 20 ac. (8 ha) or deeper than 6.6 ft. (2.0 m) at low water. Palustrine systems include nontidal vegetated wetlands or open freshwater habitats less than 20 ac. (8 ha) or 6.6 ft. (2.0 m) deep that have salinity less than 0.5 ppt. Riverine systems include natural and artificially created wetlands that are contained within a channel and are not dominated by persistent vegetation nor have salinity greater than 0.5 ppt. No riverine wetlands have been delineated at CI and NSN.

NSN has not had an Installation-wide jurisdictional delineation of wetlands completed. However, the non-jurisdictional delineation of the Installation completed in 2000 identified 102.9 ac. of wetlands (Geo-Marine 2000); of these, 58.80 ac. (23.7 ha) of jurisdictional wetlands and open waters were delineated in 2009 at Chambers Field for the Airfield Obstructions Management Plan (Geo-Marine 2012). GIS analysis of these jurisdictional wetlands data determined that 56.4 ac. lie within the Installation under the current property boundary, which is presently north of its former location; property directly south of the Installation, including Boush Creek and the golf course, has been excessed.

Mapped wetlands for NSN in Figure 2-3 are provided in a composite format, including multiple methods of prior mapping (i.e., delineations, field assessment, and National Wetland Inventory [NWI]). Outside of the drainage areas surrounding the airstrip, the main wetland areas are: in the northeast corner, the Monkey Bottom Wetland Mitigation Area (estuarine intertidal emergent); and in the northwest corner, Salt Marsh Park (estuarine intertidal emergent and estuarine subtidal), areas of subsidence on the three-hole golf course (temporarily flooded emergent), and the small beach (estuarine intertidal unconsolidated shore [Geo-Marine 2000]). According to the NWI, the Installation contains 382.06 ac. (154.61 ha) of wetlands and open water. Of the NWI wetlands, 133.19 ac. (53.9 ha) are palustrine emergent, scrub-shrub, or forested; and 203.59 ac. (82.39 ha) of estuarine. Estuarine wetlands include brackish marsh, tidal flats, and open water. Site assessments performed in 2015 by Tetra Tech confirmed the presence of these wetlands but indicate a need for more accurate mapping in the future.

Delineated wetland types occurring within the CI boundary are composed of palustrine emergent, scrub shrub, and forested wetlands as well as estuarine emergent wetlands (Figure 2-4). Out of the total acreage of CI, 82.83 ac. (33.52 ha) consist of wetlands and open water, with 19.71 ac. (7.98 ha) composed of palustrine wetlands. A majority of the wetlands on the Fuel Terminal are estuarine emergent, 55.85 ac. (22.60 ha), and primarily run along the southern extent of the property in association with Craney Island Creek, and the Elizabeth River. CI has two verified open waterbodies, with fringe emergent wetlands, that total 7.25 ac. (2.93 ha). The wetland features identified in the request for a Preliminary Jurisdictional Determination for Craney Island are summarized in Table 2-4, Appendix D. Figure 2-4 displays the delineated wetlands identified for CI, as well as the NWI wetlands for the area at the west end that was not included in the JD.

2.3.5 Nearshore Environment

For the purposes of natural resources management, the Navy's nearshore areas, as defined in DODI 4715.03 and OPNAVINST 5090.1D, include all submerged lands titled to the Navy and all other submerged lands that are adjacent to the Installation that extend from the mean high water level, offshore to the boundary of any secure areas that are controlled by the Navy. VIMS defines the nearshore environment in the Chesapeake Bay as the habitats from the marine riparian zone to the shallow subtidal waters, approximately 6.6 ft. (2 m) in depth. Nearshore habitats are highly vulnerable to impacts from development and climate change. Significant stressors in the Chesapeake Bay include SLR, shoreline hardening, land development, and nutrient enhancement (VIMS 2013).

Tidal ranges at Hampton Roads vary approximately from 0.5 feet (ft.) below the mean lower low water (MLLW) to 3.5 ft. above MLLW (NOAA 2014). The surrounding areas support many commercially important fish and shellfish species, as well as nesting bird colonies along Rip Raps Island (VDOT 2012).

Seasonal nearshore surveys were conducted at NSN, and included sampling efforts in the fall of 2014, and winter, spring, and summer of 2015. The survey area extended from the shoreline out 250 m, consistent with concurrent nearshore surveys at other Navy Mid-Atlantic installations. The survey plan (Tetra Tech 2014) provides a comprehensive outline of the surveys that were performed in order to characterize the identified nearshore environment, by surveying benthic habitat, submerged aquatic vegetation (SAV), fish, threatened and endangered species, water quality, marine mammals, and intertidal areas. The subsequent nearshore survey report (Tetra Tech 2016) presents and analyzes the findings of the field surveys, with pertinent information incorporated into the following sections.

The physical habitat of the NSN nearshore environment is dominated by silt and clay particles (Tetra Tech 2016). On the western side of the Installation, near the piers, the bottom has been characterized in maps as gravel and hard bottom, while Willoughby Bay has been classified as mud (NOAA 2015d). Although the visibility was low during the underwater imagery survey conducted in the summer, sand was observed exclusively, with only a few pieces of evidence of other organisms or debris.

Benthic infaunal communities analyzed from samples collected in the nearshore area differed slightly from the spring to the summer, which may be due to the location, substrate size, season, or a combination of factors. Although community parameters like species richness, diversity, and evenness were very similar between seasons, density was over twice as high in the spring (1,870 individuals/m²) compared to summer (820 individuals/m²). Polychaetes were the most dominant phylum for both the spring and summer, which was also true at the species-level in the spring (i.e., *Streblospio benedicti*), but a nematode was the most abundant species in the summer. An EPA survey of the coast, called the National Coastal Condition Assessment (NCCA), investigated the physical and biological characteristics of stations in U.S. waters (U.S. EPA 2015). The most recent data available, from the summer of 2006 and 2001, includes two stations in close proximity to NSN and CI. In the Elizabeth River south of both NSN and CI, site VA06-0059, sampled in 2006, had a density of 682 individuals/m², collecting 13 total species (U.S. EPA 2015). At this NCCA site, the most abundant species was a polychaete, *Mediomastus ambiseta*, which was not identified in the nearshore study's infauna samples. Another site close to NSN and CI was VA01-0016, located in the Lafayette River, south of NSN and east of CI. At this site, density was 1,051 individuals/m², with the polychaete *Streblospio benedicti* dominating the 14 species observed (U.S. EPA 2015). The site sampled in the Lafayette River was similar to this nearshore study in terms of dominant infauna and species richness, but the nearshore study found much higher density, indicating a productive infauna community around NSN. In the broader surrounding waters of Norfolk, the benthic habitat index of biological integrity met its goal in 2014 (Weinberg 2015a); however, the benthic index of biotic integrity for freshwater streams surrounding Norfolk were rated "very poor" (Irani 2013).

Intertidal habitats are well studied and are known to be one of the harshest environments on the planet (Tomanek and Helmuth 2002), as a construct of abiotic and biotic factors. Desiccation and rapid temperature change and extremes top the abiotic forces (Denny and Wethey 2001), while competition for space and predation are the main drivers on the biotic side (Connell 1961; Sebens 1982). As a result, distinct zonation along the intertidal zones (e.g., upper, mid, and low) occur (Paine 1994), as is evident at the intertidal sampling site that was included as part of the nearshore study at NSN. Generally, species diversity increases down the shore from high tide into the low intertidal and shallow subtidal zones (Menge and Sutherland 1976), which was the case at NSN. The intertidal fauna and flora species quantified during the nearshore survey were representative and typical of the area. The surveys provided a one-day snapshot at the one site; while representative, other ephemeral or transient species may occur at other times of years or at other locations in NSN. Increased spatial and temporal sampling would likely yield documentation of additional species at the Installation.

Water quality measured during the nearshore survey at NSN was mostly in agreement with expected values, for both *in situ* measurements and laboratory analyses. The temperature, salinity, and dissolved oxygen showed seasonal variation. In addition to intra-annual comparisons, it is also useful to compare the *in situ* values with readings from other surveys. VIMS conducts a seasonal trawl survey called the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAAP). The 2010 water quality data, which is the most recent available, measured seasonal ranges of temperatures over the course of the survey and found surface waters were 5–10°C in March, 15–20°C in May and November, and 25–30°C in July and September; bottom waters were the same, except slightly cooler in July (Bonzek et al. 2011), potentially providing a thermal refuge in the summer. Surface salinity, averaged from 1985 to 2006, ranged from 18.1 to 24.0 psu in the fall and 15.1 to 18.0 psu in the spring around NSN (Weinberg 2008a, b). Dissolved oxygen remained above 4 mg/L throughout the 2010 ChesMMAAP survey, which indicates levels should not pose serious problems to fish (Bonzek et al. 2011). Overall, the broader area around Norfolk has been characterized as impaired by polychlorinated biphenyls (PCBs) (Weinberg 2013), but the water quality goals for bay grasses was passed in 2014 (Weinberg 2015b).

Nitrogen as nitrate is found in seawater at concentrations of 0.7 parts per million (ppm, which is about equivalent to mg/L) (Stanford University SUE 2015), but it is usually lower at the surface, reaching 0.1 parts per billion (Lenntech 2015). The concentrations found in the winter, spring, and summer at NSN (0.05 mg/L) were on the low side, indicating that nitrate was somewhat available to plants and organisms. In the fall, however, nitrate was measured as 5 mg/L, which is extraordinarily high. The Chesapeake Bay is one of the most nutrient-impaired estuaries in the U.S. and the relationships of nitrogen and phosphorus limitation are highly complex (Boesch et al. 2001; Doering et al. 1995) and can vary on a seasonal basis, shifting to a phosphorus-limited system as the growing season advances (Fisher et al. 1992). Therefore, while nitrate levels measured at 5 mg/L are high, it may not necessarily result in increased primary productivity or phytoplankton growth (Doering et al. 1995). Nitrogen, Kjeldahl includes all organic nitrogen, as well as nitrogen in the form of ammonia (NH₃) and ammonium (NH₄⁺), and occurs as 0.25 ppm in seawater (Stanford University SUE 2015), which is slightly lower than the levels (0.37–0.65 ppm) observed at NSN. Ortho-phosphate is

usually found in seawater at 0.1 ppm (Stanford University SUE 2015); this concentration often gets depleted, particularly in surface waters, due to biological uptake, since it is the most bioavailable form of phosphorous (WHOI 2015). Ortho-phosphate was moderately depleted at NSN, in concentrations of 0.023–0.05 mg/L. Deeper water is then replenished with ortho-phosphate as plankton sinks. Phosphorous is present in concentrations of 0.016 ppm (Stanford University SUE 2015), so levels at NSN (0.052–0.19 ppm) indicate that this important nutrient was above average concentrations. Total suspended solids were moderate, and should be monitored, because high concentrations of particles in the water may negatively impact fish physiology, benthic settlement, and animal migrations. Total nitrogen is often 1.0 ppm in seawater (Stanford University SUE 2015), more than levels measured at NSN (0.37–0.65 ppm). Nutrients in NSN's nearshore waters, particularly nitrogen and phosphorous, do not appear to be present at levels that would result in excessive phytoplankton growth or enhance eutrophication above baseline levels for the Chesapeake Bay, so water quality is good.

2.4 FLORA

In preparation for this INRMP, a plant species inventory and land cover assessment was conducted at NSN and CI by Tetra Tech in May and September 2015. The majority of the land area at NSN is developed, with vegetation types primarily consisting of mowed lawn, shade trees, and planted ornamental trees and shrubs. Vegetative communities consist of intensely managed developed areas dominated by turf grasses (such as airfields, clear zones, buildings and associated urban areas), recreational/open areas (such as maintained landscaped lawns, mowed fields, created wetlands and recreational fields), sporadic patches of forested communities, unmanaged scrub-shrub, and wetland communities (NAVFAC MIDLANT 2012). Most maintained and natural vegetative communities at NSN and CI coincide with the mowed/maintained and natural/forested areas, shown in Figure 2-7 and Figure 2-8, respectively.

A basic inventory of plant species was compiled by conducting meander surveys of the larger forested parcels and some windshield surveys of the highly developed areas at NSN. Survey routes for NSN and CI are provided in Figure 2-9 and Figure 2-10, respectively. Survey results were used to confirm species occurrences and possibly add to the comprehensive list of all plant species found on NSN and CI (Appendix F). The general location where each species was observed (i.e., NSN or CI, inland or nearshore) is indicated in this list. No state or federally threatened or endangered plant species, or plant species of special concern, were identified at either NSN or CI.

As the land cover map of NSN (Figure 2-7) shows, the Installation contains very few natural communities. Chambers Airfield at NSN encompasses a large portion of the Installation and largely consists of paved areas and intensely maintained lawns dominated by species such as common Bermuda grass (*Cynodon dactylon*) and fescue (*Festuca* sp.) (NAVFAC MIDLANT 2012). The western portion of NSN contains mostly urban developed areas and pier complexes, with a mowed field containing emergent wetlands towards the northern perimeter, a small saltmarsh and pond (Salt Marsh Park) adjacent to the recreational fishing pier, and a few small open recreational fields. Natural areas to the west and southwest of

Chambers field include scrubby forest and wetland communities associated with Boush Creek, and an abandoned recreational field. The few scrub-shrub communities at NSN contain species such as sweetgum (*Liquidambar styraciflua*), black willow (*Salix nigra*), eastern red cedar (*Juniperus virginiana*), smooth sumac (*Rhus glabra*), red maple (*Acer rubrum*), and wax myrtle (*Morella cerifera*) (NAVFAC MIDLANT 2012).

While NSN is highly developed and disturbed across much of the base, several areas hold a higher diversity of plant species. The restored tidal wetland at the northern corner of the facility, known as Monkey Bottom, contains a variety of saltmarsh species and is one of the few areas along the coast line not highly rip-rapped (although there is some still there). Monkey Bottom is dominated by common reed (*Phragmites australis*) and saltmarsh grasses (*Spartina sp.*), and is located to the east of the solar array (NAVFAC MIDLANT 2012). To the south of the solar array is a designated Chesapeake Bay Wildlife Habitat no mow zone that juts out into Willoughby Bay, which is dominated by unmaintained native grasses and coastal shrubs such as Jesuit's bark (*Iva frutescens*) and wax myrtle (NAVFAC MIDLANT 2012). The small wetland edge along the edge of Patrol Road also has potential to provide specialized habitat. Despite a high cover of common reed in the area, seasonal water level changes support a diversity of wetland plants, and could potentially provide habitat for state species of interest such as yellow-eyed grass (*Xyris sp.*). This species might be present but could not be confirmed because the area was mowed shortly prior to the flora survey in fall 2015 (Tetra Tech 2015d).

The southeastern corner of the facility contains most of the disturbed and fragmented natural forested communities that exist on NSN (Figure 2-7). The forest communities exist in small sporadic patches with no commercial value, and are largely dominated by loblolly pine (*Pinus taeda*) and mixed hardwoods (NAVFAC MIDLANT 2012). Common invasive species, such as lespedeza (*Lespedeza sp.*), honeysuckle (*Lonicera sp.*), and common reed, are widespread across upland areas of the base, occurring predominately around the edges of forested parcels and roads. Minimal dense invasion was observed within the interior or the forested parcels (Tetra Tech 2015d).

One notable tree at NSN worth mentioning is the Willoughby Oak, a live oak (*Quercus virginiana*) of such great age and stature that it was a state champion Virginia "big tree" in 2006; most recently measured on 16 October 2015 with a circumference of 288 inches, a height of 48 ft. and crown of 65 ft. The Willoughby Oak is located in a grassy area north of Gate 4, at the southeastern "corner" of Willoughby Bay; the tree is fenced off for its protection. English ivy (*Hedera helix*) and other noxious plants are encroaching onto the tree, the Navy is planning vine removal (Virginia Tech 2016).

CI contains fewer developed areas than NSN, with the easternmost quarter of the facility devoted to above ground fuel storage tanks and composing the urban/developed land cover of the Fuel Terminal (Figure 2-8). This portion of the facility includes paved areas, highly disturbed mowed areas, and a few patchy disturbed forested communities. The western portion of the facility houses mostly inactive underground fuel storage tanks, and contains many highly disturbed and fragmented forested communities separated by small roads and open fields. The southern boundary of CI is fringed by tidal salt marsh wetlands associated

with Craney Island Creek. The maintained and natural vegetative communities at CI coincide with the mowed/maintained and natural/forested areas, shown in Figure 2-8.

A plant species inventory and land cover assessment was conducted at Craney Island during May and September 2015. A basic inventory of plant species was compiled by conducting meander surveys of the larger forested parcels and some windshield surveys of the highly developed areas at Craney Island. (Refer to Appendix F for the full species list.)

Small pockets of forest across the Fuel Terminal support little diversity. The large, mostly contiguous section of forest on the western edge of the base is composed of species common to the flat, mesic to wet woods of the region, such as loblolly pine, red maple, and sweetgum. The sparse understory and shrub layer is composed of switchcane (*Arundinaria tecta*), sweet pepperbush (*Clethra alnifolia*), and *Smilax* spp. The ditches along much of the pipelines and cutting across most of the site support a reasonably wide variety of herbaceous species, even more so where connected to tidal influences (for example, near the intersection of Main Street and Rail Road). Additional plant species are listed below under the ecological communities to which they correspond.

Similar to NSN, most of the upland invasive species at CI occur along the edges of forested parcels and roads, including white mulberry (*Morus alba*), white pine (*Pinus strobus*), Bradford pear (*Pyrus calleryana*), Chinese privet (*Ligustrum sinense*), saltcedar (*Tamarix* spp.); examples of herbaceous species include field bindweed (*Convolvulus arvensis*), Bermuda grass, Queen Anne's lace (*Daucus carota*), crabgrass (*Digitaria* spp.), ground ivy (*Glechoma hederacea*), Chinese lespedeza (*Lespedeza cuneate*), and Japanese stiltgrass (*Microstegium vimineum*); invasive inland vines include English ivy (*Hedera helix*) and Japanese honeysuckle (*Lonicera japonica*). The CI East End and the nearshore area have relatively minimal vegetation due to the large amounts of pavement and riprap. Only a handful of invasive species were identified in the nearshore area, including birdsfoot trefoil (*Lotus corniculatus*), spear saltbush (*Atriplex prostrata*), and the two omnipotent species, chickweed (*Stellaria media*) and bulbous buttercup (*Ranunculus bulbosus*). In the full species list in Appendix F, the native or invasive status of each plant species is indicated.

2.4.1 Ecological Communities

The 2015 site visits were also used to identify the ecological communities present on the facilities. Based upon the Virginia classification of ecological communities (Fleming et al. 2013), two natural wetland community types exist at NSN and CI: tidal oligohaline marsh, and coastal plain depression wetlands. These wetland communities make up a very small proportion of CI and NSN (Figure 2-3 and Figure 2-4, in Appendix J). NSN and CI's forested areas—the majority of which are located in the southeast corner of NSN and the West End of CI—are depicted as “Natural/Forested” on the land cover type maps, Figure 2-7 and Figure 2-8 (Appendix J). The forest communities were classified using the U.S. National Vegetation Classification system (USNVC), and it was determined that communities at both NSN and CI consist of: Great Dismal Swamp successional peat dome pine-hardwood forest, early to mid-successional loblolly pine forest, and successional tuliptree-loblolly pine upland forest, which are all common forest types associated with the region. Based on the species composition

observed during the site visits, most of the forested areas of NSN and CI are believed to pertain to the former ecological community.

Tidal Oligohaline Marsh

Tidal oligohaline marsh habitat is primarily a graminoid-dominated type of wetland located within slightly brackish zones along tidal rivers and streams of the Coastal Plain. A variety of species are common within the tidal oligohaline marsh habitat, but this habitat type is typically dominated by big cordgrass (*Spartina cynosuroides*), forming extensive, tall stands along edges of main tidal channels. Associated species include saltmeadow cordgrass, saltgrass (*Distichlis spicata*), smooth cordgrass (*Spartina alterniflora*), seaside goldenrod, chairmaker's bulrush (*Schoenoplectus americanus*), Virginia glasswort (*Salicornia depressa*), Jesuit's bark, and common reed (Fleming 2013). These habitats encompass a very small portion of the two facilities, occurring along the southern perimeter of CI, and in two created marshes at NSN: Monkey Bottom and Salt Marsh Park.

Coastal Plain Depression Wetlands

Coastal plain depression wetlands are poorly drained wetlands that are characteristic of Coastal Plain terraces that have fluctuating, seasonally perched water tables. Vegetation ranges from nearly forested to entirely herbaceous. Common species include black willow (genus and species if applicable), bald cypress (*Taxodium distichum*), eastern baccharis (*Baccharis halimifolia*), and wax myrtle. The herbaceous stratum is dominated by royal fern (*Osmunda regalis*), panicgrass (*Panicum* spp.), foxtail clubmoss (*Lycopodiella alopecuroides*), shore little bluestem, winter bentgrass (*Agrostis hyemalis*), broomsedge bluestem (*Andropogon virginicus*), common reed, narrowleaf cattail (*Typha angustifolia*), common rush (*Juncus effusus*), woolgrass (*Scirpus cyperinus*), narrowleaf plantain (*Plantago lanceolata*), grape (*Vitis* sp.), and slender lespedeza (*Lespedeza virginica*). Other species that may occur include American holly (*Ilex opaca*), swamp rosemallow (*Hibiscus moscheutos*), and climbing hempvine (*Mikania scandens*) (Fleming 2013).

Great Dismal Swamp Successional Peat Dome Pine – Hardwood Forest

This community is extensively distributed in the northern portion of the Great Dismal Swamp, on the margins of large peat domes, where peat feathers out into mineral soil. The type is a young, successional type which has probably replaced both hydrophytic oak forests and nearly treeless canebrakes following extensive cutting, fire suppression, and hydrologic alteration. Hydrology is saturated by permanently high water tables, with occasional shallow surface ponding during extended wet periods. Soils range from loamy sands to silty clay loams, with or without an organic mantle up to 30 cm deep. Loblolly pine, Carolina red maple (*Acer rubrum* var. *trilobum*), and sweetgum dominate the canopy in various combinations and proportions. The sparse subcanopy can include red maple, sweetgum, blackgum (*Nyssa sylvatica*), white ash (*Fraxinus pensylvanica*), sweetbay magnolia (*Magnolia virginiana*), swamp laurel oak (*Quercus laurifolia*), water oak (*Quercus nigra*), swamp chestnut oak (*Quercus michauxii*), and white oak (*Quercus alba*). Switchcane occurs in dense (or sometimes patchy) stands. Other shrubs include sweet pepperbush, southern

blueberry (*Vaccinium formosum*), black highbush blueberry (*Vaccinium fuscatum*), roundleaf greenbrier, cat greenbrier (*Smilax glauca*), American holly, inkberry (*Ilex glabra*), wax myrtle, swamp bay (*Persea palustris*), sweetbells (*Leucothoe racemose*), and Eastern poison ivy. Locally, fetterbush lyonia (*Lyonia lucida*) and pawpaw (*Asimina triloba*) may occur, as well. Herbaceous species are sparse to essentially lacking, but can include netted chainfern (*Woodwardia areolata*), Virginia chainfern (*Woodwardia virginica*), cinnamon fern (*Osmunda cinnamomea*), and royal fern (*Osmunda regalis* var. *spectabilis*) (Fleming 2013).

Early to Mid-Successional Loblolly Pine Forest

This wide-ranging association is most common from the Piedmont of Virginia, through North Carolina, South Carolina, Georgia and Alabama, likely extending throughout the adjacent Coastal Plain. A large amount of variability exists in species composition and density due to geographic and disturbance factors. It represents stands in which loblolly pine is the monospecific dominant tree in the overstory. Stands typically have more-or-less closed canopies, understories dominated by fire-intolerant hardwoods, and shrub-dominated lower strata. These are generally early- to mid-successional forests where the pines have reached tree size (as opposed to saplings) and have been established for a long enough period to have developed a closed canopy. Below the canopy of loblolly pine, a well-developed subcanopy of hardwoods is present. Red maple and sweetgum are often the dominant species in the subcanopy. If significant numbers of these species enter the canopy, the stand would instead be classified as Loblolly – Sweetgum Ruderal Forest. Although this forest may result from a planted stand, it is distinguished from young pine plantations by tree height and the formation of distinct stratal layers, especially a well-developed subcanopy. This type may also develop following site preparation, with or without site conversion, and following agriculture (Fleming 2013).

Successional Tuliptree – Loblolly Pine Upland Forest

The vegetation in this community develops on slopes following cropping. This forest is strongly dominated by tuliptree (*Liriodendron tulipifera*) and loblolly pine, which together contribute more than 75% canopy cover. Other canopy species include sweetgum and red maple. Flowering dogwood (*Cornus florida*) sometimes occurs in the subcanopy, and vines such as Japanese honeysuckle (exotic), roundleaf greenbrier (*Smilax rotundifolia*) and Eastern poison ivy (*Toxicodendron radicans*) may be abundant. The understory and ground layers are very sparse with much open ground present. The invasive exotic Japanese stiltgrass may be present in the herbaceous layer (Fleming 2013).

2.5 FAUNA

Extensively developed and built largely on fill, NSN and CI have very few natural areas—even those that they have are highly fragmented—therefore, they support a limited diversity of fauna that are either highly mobile (e.g., birds and bats) or highly adaptable to urban environments. Comprehensive fauna surveys have not been conducted at either facility. However, a list of fauna species that are either known or have the potential to occur at NSN and CI has been developed for this INRMP based on information obtained from VDGIF,

Navy personnel, various ecological/environmental studies conducted on the Installation, and personal communication and observations. To confirm and augment the fauna species list, three-season site walkover surveys for birds and bats were conducted for the development of this INRMP. The surveys are described in the sections that follow. In addition, the species lists in the *Annual Monitoring Report for the Wildlife Hazard Assessment for Naval Station Norfolk – Chambers Field* (WS 2015) were consulted for comparison, and confirmed occurrence(s) of species has been noted. The draft report for the nearshore survey of NSN (Tetra Tech 2016) served as the primary source for information on marine species that inhabit waters around the Installation. A comprehensive list of fish and wildlife species—including mammals, amphibians and reptiles (herpetofauna), fish (ichthyofauna), and birds (avifauna) that occur or have the potential to occur within 3 miles of NSN and CI and within adjacent waters—is provided in Table E-3, Appendix E.

2.5.1 Mammals

The urban environment and lack of large forested areas at NSN and surrounding community limit the number of mammals that are likely to occur. Those that do occur are generally species adapted to urban and open habitats. Common large to medium-sized mammals include red fox (*Vulpes vulpes*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), Virginia opossum (*Didelphis virginiana virginiana*), raccoon (*Procyon lotor*), eastern cottontail (*Sylvilagus floridanus*), eastern gray squirrel (*Sciurus carolinensis*), and muskrat (*Ondatra zibethicus*). Smaller insectivores include the southeastern shrew (*Sorex longirostris longirostris*), eastern mole (*Scalopus aquaticus*), Norway rat (*Rattus norvegicus*), and several species of mice including the house mouse (*Mus musculus*) and white-footed mouse (*Peromyscus leucopus*).

CI contains more natural/forested habitat (although highly disturbed) and supports a greater number of large mammals. In addition to the species listed above, white-tailed deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*) are reported to be present or at least occasionally transient at the Fuel Terminal.

In preparation for this INRMP, roving bat acoustic surveys were conducted at NSN and CI in the spring, summer, and fall of 2015. A combination of slow driving and walking transects were conducted throughout non-restricted areas on the base (active transects). Two pieces of equipment from Wildlife Acoustics were used: for walking surveys, an Echometer 3 (a handheld device with a real-time spectrogram and on-demand recording capability); and for driving surveys, an SM2 (a passive recording device with a microphone mounted on a pole out the sunroof, and remaining operational for the entire survey period to maximize call recordings). In the spring, only a single big brown bat (*Eptesicus fuscus*) was recorded at NSN, whereas in the summer and fall, 69 and 8 bat calls were recorded, respectively, with maximum likelihood estimates suggesting that eastern red bat (*Lasiurus borealis*), silver haired bat (*Lasionycteris noctivagans*), and tri-colored bat (*Perimyotis subflavus*) are present at NSN; the latter is a Virginia state-endangered species. Stationary observations were made at five locations (see Figure 2-11); bat activity was concentrated at observation sites 1 and 4, which were open space areas. Site 1 consistently had close to half of the total call sequences logged—33 of 69 in the summer and 4 of 8 in the fall (48% average)—followed by site 4,

with 23% of NSN's bat acoustic recordings in the summer, but devoid of activity in the fall. Site 2 was also seasonally important, with 38% of the calls logged during the fall survey. A single call was classified as northern long-eared bat (*Myotis septentrionalis*); manual call analysis determined that the call more closely resembled the Rafinesque's eastern big eared bat (*Corynorhinus rafinesquii macrotis*), a state-endangered species that has been previously documented at NSN. Although calls detected in the summer survey were auto-classified by the software as the state endangered little brown bat (*Myotis lucifugus*), the maximum likelihood estimates indicated that the species was unlikely to be present, and manual analysis of the call sequences concluded that these calls were, in fact, eastern red bat.

There appeared to be a high level of diversity at CI, with nearly 450 bat call sequences documented across at least 5 species between the spring and fall surveys. Most recordings were made and the greatest species diversity was documented in the northwest corner of CI in a small clearing not far from a residential reservoir (see Figure 2-12). Most activity occurred on roads with the canopy forming a type of tunnel or flyway. The second highest activity levels were found in small clearing with irrigation ditches. Notably, no activity was recorded on the East End, near the wells. Multiple species of bats were recorded on the Fuel Terminal, including the state-endangered tri-colored bat (only confirmed in the fall), as well as the big brown bat, eastern red bat, silver haired bat, and the evening bat (*Nycticeius humeralis*). A small number of calls were classified as gray bat (*Myotis grisescens*), but could not be definitively confirmed upon further analysis. Although calls in both spring and fall were auto-classified as the little brown bat, manual analysis of the call sequences concluded (as at NSN) that these calls were the eastern red bat. The vast majority of call sequences at CI were attributed to the eastern red bat, with at least 35% of call sequences in the spring and 87% of call sequences in the fall (Tetra Tech 2015a, b, c).

In summary, two bat species rated Tier Ia (critical conservation need) in the Virginia State *Wildlife Action Plan* (SWAP)—the Rafinesque's eastern big-eared bat and the tri-colored bat—and two species rated Tier IVa (moderate concern)—the silver-haired bat and eastern red bat—were confirmed at NSN. In total, one species rated Tier Ia (critical conservation need) in the Virginia SWAP—the tri-colored bat—and two bat species rated Tier IVa (moderate concern)—the silver-haired bat and the eastern red bat—and were confirmed at CI.

Of the marine mammals that may utilize the waters adjacent to NSN and CI, the bottlenose dolphin (*Tursiops truncatus*) is the most common, and the only species whose presence has been recently documented.. Bottlenose dolphins were observed around NSN in three of the four seasons surveyed (fall, spring, and summer) during nearshore surveys in 2015. These dolphins are commonly in groups of 2 to 15 (NOAA 2015b), which was consistent with the fall and summer sightings; however, the one spring sighting included only a single individual. Bottlenose dolphins are classified as inshore or offshore, where inshore populations tend to be smaller and lighter in color, with a focus more on benthic invertebrates and demersal fishes as opposed to pelagic fishes and squid (NOAA 2015b). In order to track and capture prey, both inshore and offshore dolphins rely on echolocation. Sexual maturity varies, between 5 and 14 years old, with calves born every 3 to 7 years (NOAA 2015b).

They appear to be somewhat common around NSN, but the population trends for U.S. stocks are still unknown (NOAA 2015b).

The West Indian manatee (*Trichechus manatus*) was once documented in Willoughby Bay; however, this was a singular event that occurred in 1995. Although relatively rare, manatee sightings have occurred in the Chesapeake Bay since this time (Hankerson 2016). A list of mammal species that have been identified in surveys or incidental observations at NSN and CI is included in Table E-3 (Appendix E).

2.5.2 Amphibians and Reptiles

Wetlands and the associated scrub-shrub woodland communities support amphibians and reptiles at NSN and CI. According to the Virginia Fish and Wildlife Information System, a total of 50 reptiles and 35 amphibians (herpetofauna) species are known to occur or may potentially occur on NSN and CI (VDGIF 2016a, b). Species may include greater siren (*Siren lacertian*), spotted salamander (*Ambystoma maculatum*), bullfrog (*Rana catesbeiana*), stinkpot (*Sternotherus odoratus*), northern fence lizard (*Sceloporus undulatus hyacinthinus*), and eastern garter snake (*Thamnophis sirtalis sirtalis*). Resident herpetofauna documented at CI include treefrogs (*Hyla* spp.), copperheads (*Agkistrodon contortix*), water snakes (*Nerodia* spp.), snapping turtles (*Chelydra serpentina*), mud turtles (*Kinosternon* spp.), and various salamanders (U.S. Navy 1999). In addition, CI personnel reported during recent site visits that the eastern cottonmouth snake (*Agkistrodon piscivorous piscivorous*) is present at the Fuel Terminal (Austin 2016). Refer to Appendix E for a comprehensive list of herpetofauna species with potential occurrence; this list was updated based on VDGIF's wildlife data (VDGIF 2016a, b) with the intention to conduct herpetofauna surveys for presence or absence under this INRMP. When updating this INRMP in the future, the Navy Environmental Portal (<https://eprportal.cnic.navy.mil/eprwebnet/logon.aspx>) should be referred to as a source for the lists of amphibian and reptile species found at other nearby installations, and once NSN and CI's list of confirmed species has been updated in coordination with the DOD PARC program, it should be uploaded and stored in the online database as well.

2.5.3 Fish

The nearshore biological and environmental surveys conducted at NSN (Tetra Tech 2015) included trawls and ichthyoplankton tows to document the presence of fishes of various life stages. Fish diversity and abundance in the nearshore and tidal/brackish waters varied seasonally, but were generally heightened by the variation in the type of nearshore environment around NSN. Overall, the abundance and diversity of the nearshore survey at NSN was high, especially in the fall and spring, with the lowest catches in the winter. A total of 48 species were collected in the nearshore waters of NSN; of these, 26 were caught in only one season, suggesting many transient species use the area. Only the oyster toadfish was present year-round. VIMS's seasonal trawl survey, ChesMMA, targets 80 stations in the bay from spring to fall with a 45 ft. balloon otter trawl with 6 in. mesh for 20 minute tows (VIMS Multispecies Research Group 2016). From the most recent data available (from the year 2012), 75 species were collected, which totaled 17,329 individuals (VIMS Multispecies

Research Group 2016). Over the previous 10 years, a maximum of 103 species and 47,622 individuals were collected in a given year (VIMS Multispecies Research Group 2016). Out of the great diversity observed throughout the bay in the ChesMMAP survey, the number of species collected nearshore at NSN represented 64% of the number of species collected bay-wide by ChesMMAP in 2012. Bay anchovy (*Anchoa mitchilli*) were the most numerically abundant species in the fall and summer, with low numbers in the spring and no abundance in the winter. These fish are distributed from the Mid-Atlantic through the Gulf of Mexico from marine to brackish waters, often in shallow tidal areas with muddy bottoms (Binohlan 2015). A recent study found that in the Chesapeake Bay ecosystem, bay anchovy are a more important prey resource than Atlantic menhaden (*Brevoortia tyrannus*) (Blakenship 2015). Blueback herring (*Alosa aestivalis*), dominant in the winter, are an anadromous, schooling fish distributed from Nova Scotia to Florida. They usually overwinter offshore, moving into coastal waters and upriver to spawn from March to May (NOAA 2007), so it is possible that the fish collected by the nearshore survey were starting their spawning run. Atlantic croaker (*Micropogonias undulatus*) were the most abundant fish in the spring, with low numbers in the fall and summer, and absent in the winter. This coastal fish is one of the most abundant demersal fish along the U.S. East Coast from New York to North Carolina, moving north and inshore in the summer and south in the winter (ASMFC 2007); in the Chesapeake Bay, they have been observed to be most abundant mid-year in higher salinity waters, declining in the fall as fish move out of the bay (Bonzek et al. 2011).

Of the diverse fish species collected, the habitat usage of NSN's nearshore waters throughout all lifestages of the most abundant fish—bay anchovy and Atlantic croaker—were of particular interest. Bay anchovy spawn in less than 20 m of water along the continental shelf during spring or early summer and are generally more inshore than the related striped anchovy (*Anchoa hepsetus*) (Robinette et al. 1983). Since bay anchovies mature around 1 year old, or 49 to 75 mm (Robinette et al. 1983), the individuals collected in the nearshore of NSN in both the fall and summer were a combination of juveniles and adults. Additionally, bay anchovy eggs were very prolific in the summer. Therefore, all lifestages of bay anchovy utilize NSN's nearshore area. After hatching, Atlantic croaker larvae move into estuaries, with juveniles remaining in lower salinity habitats until the late summer and fall, when they move into higher salinity waters (ASMFC 2007). Atlantic croaker mature between 1 and 2 years old, or approximately 173 mm for females and 183 mm for males (ASMFC 2007), so fish collected in the fall and spring nearshore surveys were both juveniles and adults, but all fish collected in the summer were likely adults. Even though the demographics of the Atlantic croaker population in the Chesapeake Bay varies considerably from year to year (Bonzek et al. 2011), it would be expected that both adults and juveniles would frequent the waters around NSN, since the fish prefer higher salinity waters as they mature.

Ichthyoplankton collected in the nearshore survey showed variability throughout the year. There was lower abundance and diversity in eggs and larvae compared to that observed in fish trawls. Only single individuals of five species were collected in the fall, no eggs or larvae were collected in the winter, only Atlantic silversides (*Menidia menidia*) were collected in the spring, and summer samples were dominated by bay anchovy. The eggs and larvae identified are common to the Mid-Atlantic.

Of the fish species that have been confirmed at NSN, three are rated as Tier IV (moderate concern) in the Virginia SWAP: blueback herring (*Alosa aestivalis*), alewife herring (*Alosa pseudoharengus*), and American shad (*Alosa sapidissima*). In addition, the federally and state-endangered Atlantic sturgeon (*Acipenser oxyrinchus*), ranked Tier I (critical conservation need) in the SWAP, has been documented near NSN during other Navy surveys; refer to Section 2.6 for this discussion. The comprehensive list of fauna species included in Table E-3 (Appendix E) includes the fish species that are known or expected to occur in the waters surrounding NSN and CI; those that were observed in the NSN nearshore survey have been noted as confirmed.

2.5.4 Birds

NSN and CI are located in the Atlantic migratory flyway, and the coastal region is an important stopover for migratory birds during the spring and fall migration. The open fields, urban areas, and wetlands, as well as the open water of the nearby bays and rivers, provide habitat for a wide range of avian species. In fact, the avifaunal community is the most diverse faunal community present at the Installation. The two largest bird groups occurring at NSN and CI are the Passeriformes (perching birds), which utilize forested, open grounds, and other terrestrial areas, and the Charadriiformes (shorebirds), which are associated with the shoreline habitats during different times of the year. Several species of gulls (*Larus* spp.), terns (*Sterna* spp.), ducks (*Anas* spp.), and geese (*Branta* spp.) are common offshore as well as in beach and inland areas.

Naval Station Norfolk

During the bird surveys conducted in the year 2015, a walking transect in the southern-most portion of the base composed the bulk of the survey, as this location boasted the highest tree cover, and habitat diversity (mature forest, fields, early successional, and wetland habitats). Another walking transect focused on shore birds located adjacent to the marina. Stationary observations were made at seven locations (see Figure 2-11). Almost 40 species were observed in each of the spring and summer surveys, with 12 new species in the summer, whereas the fall survey tallied only 15 species, 5 of which were unique to that season. No state or federally threatened or endangered species were detected. In total, 56 bird species were confirmed at NSN, including six species rated Tier IV (moderate concern) in the Virginia SWAP, two species rated Tier II (very high conservation need)—the yellow-crowned night-heron (*Nyctanassa violacea*) and the black skimmer (*Rynchops niger*)—and three species not previously included in the Installation’s bird species list: eastern wild turkey (*Meleagris gallopavo*), Eurasian collared dove (*Streptopelia decaocto*), and white-throated sparrow (*Zonotrichia albicollis*). Locations of the Tier II species are noted on Figure 2-11. The greatest number and diversity of bird species was observed at Site 2 (Environmental Area), including all of the Tier IV species. Combining the survey observations (Tetra Tech 2015a) with the list of species from the FY15 *Annual Monitoring Report for the Wildlife Hazard Assessment for Naval Station Norfolk – Chambers Field* (WS 2015), a total of 103 species of birds have been confirmed, or 35% of the bird species that have the potential to occur on NSN (VDGIF 2016b). Species include pied-billed grebe (*Podilymbus podiceps*), green-backed heron (*Butorides virescens*), sharp-shinned hawk (*Accipiter striatus*), killdeer (*Charadrius vociferus*), ring-billed gull (*Larus delawarensis*), common flicker (*Colaptes*

auratus), fish crow (*Corvus ossifragus*), American robin (*Turdus migratorius*), and rock pigeon (*Columba livia*). Species that were incidentally observed in greatest abundance during the survey were the black skimmer (a flock of about 90 was seen on the small beach by the marina), Canada goose (*Branta canadensis*), and European starling (*Sturnus vulgaris*). Osprey (*Pandion haliaetus*) nest on natural and man-made structures at NSN, primarily along Mason Creek and in Willoughby Bay. For the full species list, refer to Table E-3 (Appendix E).

Craney Island

Similar methods were used for the bird surveys at CI, except that access for the summer survey was not granted, so only spring and fall surveys were conducted. Audio and visual detections were logged. A walking transect in the eastern most portion of the base comprised the bulk of the survey; additional roving transects were done at the western end when birds were observed (see Figure 2-8). Habitats included mature forest, edge, early successional (transmission line corridor). No state or federally threatened or endangered species were detected. In total, 47 bird species were confirmed at CI, including one rated Tier III (high conservation need) in the Virginia SWAP—the eastern whip-poor-will (*Antrostomus vociferus*)—and six species rated Tier IV (moderate concern). The American bittern (*Botaurus lentiginosus*), which was formerly rated Tier II (very high conservation need) but is no longer ranked in the SWAP, was also seen flying over (Tetra Tech 2015b). Indigo buntings (*Passerina cyanea*) were seen in great abundance around the power line, and various species of gulls (*Larus* spp.) were seen flying about. Examples of species observed include the barred owl (*Strix varia*), blue grosbeak (*Passerina caerulea*), blue jay (*Cyanocitta cristata*), broad-winged hawk (*Buteo platypterus*), great blue heron (*Ardea herodias*), northern flicker (*Colaptes auratus*), ovenbird (*Seiurus aurocapilla*), pine warbler (*Setophaga pinus*), red-headed woodpecker (*Melanerpes erythrocephalus*), red-winged blackbird (*Agelaius phoeniceus*), and sora (*Porzana carolina*). All species detected had been previously included in the list of bird species occurring at CI, which totals 185 in number. For the full species list, refer to Table E-3 (Appendix E).

2.6 RARE, THREATENED, AND ENDANGERED SPECIES AND SIGNIFICANT ECOLOGICAL COMMUNITIES

No federally endangered, threatened, or candidate species of flora or fauna are known to be present at either NSN or CI. However, the federally endangered Atlantic sturgeon has been detected offshore, and (although inconclusive) survey data indicates that there could potentially be two or more federally listed bat species present.

Five Distinct Population Segments (DPSs) of Atlantic sturgeon were listed under the ESA as threatened or endangered in 2012 (77 FR 5880–5912); the Chesapeake Bay DPS is listed as federally endangered. In order to define habitat use and migration patterns within the lower Chesapeake Bay and near installations, the Navy has funded a telemetry tracking study, with a focus on Atlantic sturgeon. From December 2012 to January 2014, 653 Atlantic sturgeon, with origins from Connecticut to Georgia, have been detected within the 75-receiver array (Hager 2015). Specifically around NSN, 11 receivers have been deployed. NSN was the

military zone with the largest number of detections (86,904) and detection days (585), which were attributed to 161 individual Atlantic sturgeon in 2013 and 211 in 2014 (Hager 2015). Atlantic sturgeon were detected year-round, but the number of fish near NSN peaked in the fall (September–November) in both years (Hager 2015). While it appeared that juvenile Atlantic sturgeon were foraging in the area, adults passed through without spending extended periods of time. In the Elizabeth River zone, by CI, there were 2,196 detections on 4 receivers, with the greatest number of detections in August (Hager 2015). Lower detection volume and number of fish recorded in the Elizabeth River likely reflected its reduced use as habitat. The tracking study provided evidence that the system is used intensely by sturgeon of native origin, while used less frequently by transient sub-adults and adults (Hager 2015). Both adults and sub-adults are capable of long-distance movements. Adults move up rivers in the spring (April to May in the Mid-Atlantic) to spawn, and males may remain in the river or estuary until the fall, whereas females usually leave the river within four to six weeks (NOAA 2015a), traveling to other coastal estuaries until outmigration to marine waters in the fall (NOAA 2016a). Recent evidence confirmed that the Chesapeake Bay DPS has a second spawning season in the fall; specifically in the James River, adults begin to move out of the river in late September to early October, occupy only lower river sites by November, and are undetected on tracking arrays by December (NOAA 2016a). In June 2016, NMFS proposed critical habitat for the Chesapeake Bay DPS to be designated in five river systems, including the James River from Boshers Dam downstream for 160 river kilometers to where the main stem river discharges at its mouth into the Chesapeake Bay at Hampton Roads (NOAA 2016a). In subsequent letters to the Navy, including coordination for the development of this INRMP, NMFS has affirmed that the proposed critical habitat for Atlantic sturgeon does not overlap with NSN and CI (Bullard 2016, Murray-Brown 2016; see Appendix B). NMFS plans to submit final rules on critical habitat for the Chesapeake Bay DPS of Atlantic sturgeon to the Federal Register no later than 03 June 2017 (NOAA Greater Atlantic Regional Fisheries Office 2016).

No federal or state-listed marine species were identified at NSN and CI during the nearshore surveys conducted by Tetra Tech in 2015, but additional protected marine species have the potential to occur. Four federally listed species of sea turtles are known to occur in Chesapeake Bay from May to mid-November, with peak abundance from June through October (Lutcavage and Musick 1985; Murray-Brown 2016). The federally and state endangered Kemp's ridley sea turtle (*Lepidochelys kempii*) and the federally threatened Northwest Atlantic Ocean DPS of loggerhead sea turtle (*Caretta caretta*) are the most abundant, followed by the federally endangered leatherback sea turtle (*Dermochelys coriacea*) and the federally threatened North Atlantic DPS of green sea turtle (*Chelonia mydas*). Sea turtles are known to come into the bay to feed. Recent surveys and interviews with state agency representatives have confirmed the rare presence of green, loggerhead, and Kemp's ridley sea turtles (NAVFAC Mid-Atlantic 2013). However, there has been no documented use of NSN beaches by sea turtles for nesting. Loggerhead sea turtles reportedly nested on CI at one time (VDGIF 1998) but there is no longer a suitable beach at the Installation on which for them to do so. It is believed the current condition of the shoreline habitats at both NSN and CI is not favored for nesting by any of the federally listed sea turtle species, however, they do use the lower rivers of the Chesapeake for foraging, and potentially traverse the Elizabeth River.

One additional federally protected species reportedly occurred at NSN in the 1990's: the federally and state-endangered West Indian manatee (*Trichechus manatus*). In late September 1995, a lone West Indian manatee was sighted in the Mason Creek Bridge Road area of Willoughby Bay. This manatee had been observed during the summer on the east coast as far north as Boston and was evidently heading south at the time of its visit to the Base. This sighting is considered to be highly unusual (NAVFAC MIDLANT 1999).

The state-endangered tri-colored bat was identified at both NSN and CI during the fall 2015 acoustic surveys. At NSN, a single bat call was acoustically classified as the federally and state-threatened northern long-eared bat; manual analysis determined that the call more closely resembled the Rafinesque's eastern big eared bat, a state-endangered species that has been previously documented at NSN. Desktop analysis of the acoustic call data has concluded that the northern long-eared bat was not identified at NSN, but it is possible that the federally and state-threatened species could be transiently present. It is likely that the Rafinesque's eastern big eared bat is present at NSN. In total, two species rated Tier Ia (critical conservation need)—the Rafinesque's eastern big-eared bat and the tri-colored bat—and two bat species rated Tier IVa (moderate concern) in the Virginia State *Wildlife Action Plan* (SWAP)—the silver-haired bat and eastern red bat—were confirmed at NSN.

At CI, a small number of calls were auto-classified by KPro bat acoustic analysis software as the state- and federally endangered gray bat, but could not be definitively confirmed upon further analysis, due to the strong call sequence traits common among *Myotis* species. The gray bat is not known to be present within a four-mile radius around CI (VDGIF 2016a), nor is the species in VDCR's list of Natural Heritage Resources occurring anywhere in either the City of Portsmouth or City of Norfolk, Virginia (VDCR 2014); therefore, its presence at CI is unlikely. Although calls in each season were classified as the state-endangered little brown bat, the maximum likelihood estimates indicated that the species was unlikely to be present, and manual analysis of the call sequences concluded that these calls were, in fact, eastern red bat. In total, two bat species rated Tier IVa (moderate concern) in the Virginia SWAP—the silver-haired bat and the eastern red bat—and one species rated Tier Ia (critical conservation need)—the tri-colored bat—were confirmed at CI.

Two species of birds that are listed as either endangered, threatened or of special concern by the Commonwealth of Virginia have been observed at NSN. The state-endangered Wilson's plover (*Charadrius wilsonia*) and state-threatened peregrine falcon (*Falco peregrinus*) were not recorded during formal surveys in FY15, but both species have been observed on or near the airfield during wildlife dispersal operations by WS (WS 2015).

VDGIF's Virginia Fish and Wildlife Information Service (VaFWIS) online searchable database (VDGIF 2016a, b) was consulted to determine if other federal or state protected wildlife species, federal species of concern, or state species of conservation concern under the SWAP, had been documented within a three-mile radius around NSN and CI. The results indicated that, in the region in and around NSN, 24 federal or state-threatened or endangered species, 2 federal species of concern, and 38 state species of conservation concern Tier I (critical) or Tier II (very high) were known or likely to occur (VDGIF 2016b). Likewise, in the region in and around CI, 22 federal or state-threatened or endangered species, 2 federal

species of concern, and 38 state species of conservation concern Tier I or Tier II were known or likely to occur (VDGIF 2016a); refer to Table E-2 for the full list. The full lists of these rare species with potential to occur at NSN and CI are included in Appendix E, Table E-1 and Table E-2, respectively; confirmed species occurrences are noted in Table E-3.

Of these, two Tier II species of conservation concern were observed during the 2015 surveys at NSN. A flock of black skimmers (90 individuals) was observed on a small beach toward the northwest corner of the Installation along the marina walking transect during the spring survey (Tetra Tech 2015b). In the fall survey, a single yellow-crowned night-heron, was seen in an adjacent area that serves as a storm surge basin and has a network of ditches bordered by grasses and shrubs (see locations as marked on Figure 2-11). Six Tier IV (moderate conservation need) species were also detected at NSN in the Environmental Monitoring Area (Avian survey Site 2, on Figure 2-11), including black and white warbler (*Mniotilta varia*), brown thrasher (*Toxostoma rufum*), eastern kingbird (*Tyrannus tyrannus*), gray catbird (*Dumetella carolinensis*), prairie warbler (*Setophaga discolor*), and yellow warbler (*Setophaga petechial*); and three Tier IV fish were identified in NSN's nearshore waters: blueback herring, alewife herring, and American shad. In addition, the VaFWIS list was compared against the *Annual Monitoring Report for the Wildlife Hazard Assessment for Naval Station Norfolk – Chambers Field* for FY15, which listed species that had been observed or struck since 1990. This exercise revealed that four additional Tier II species—American black duck (*Anas rubripes*), American oystercatcher (*Haematopus palliatus*), American woodcock (*Scolopax minor*) and common tern (*Sterna hirundo*); three additional Tier III species—brant (*Branta bernicla brota*), least tern (*Sterna antillarum*) and Forster's tern (*Sterna forsteri*); and three additional Tier IV species—clapper rail (*Rallus crepitans*), eastern meadowlark (*Sturnella magna*), and royal tern (*Sterna maxima maximus*)—had been present at the airfield, either observed within the past year or involved in a strike during the period FY10–15 (WS 2015).

Other SWAP-species of conservation concern at CI include the Tier III (high conservation need) eastern whip-poor-will, and six Tier IV (moderate conservation need) species: eastern towhee, brown thrasher, eastern kingbird, gray catbird, laughing gull (*Leucophaeus atricilla*), and northern flicker (*Colaptes auratus*) (Tetra Tech 2015 a, b).

Lists of the special plants, animals, and ecological communities of Virginia may be accessed at the Virginia Department of Conservation and Recreation Department of Natural Heritage (VDCR-DNH) website:

http://www.dcr.virginia.gov/natural_heritage/infoservices.shtml

VDGIF's Virginia Fish and Wildlife Information Service (VaFWIS) searchable database of endangered, threatened, special concern, and conservation status species is available at:

<http://vafwis.org/fwis/?Menu=Home>

No state rare plant species have been confirmed at NSN or CI. However, the vegetation survey suggested that the marsh pea/vetchling (*Lathyrus palustris*), a critically imperiled (S1)

species, could be present in a wet, tidally influenced ditch in the middle of the old parade grounds (i.e., the northwest corner of the Installation); and *Xyris platylepis* (S2) could be present in the mowed meadow in the Magazine District that borders Patrol Road by the clover leaf exit ramp from Route 564. Neither species could be confirmed, as the areas had been mowed in September, shortly prior to the fall survey, and neither species is on the VDCR-Department of Natural Heritage (VDCR-DNH) list of rare plants found in Norfolk or Portsmouth (VDCR 2014), making their occurrence less likely.

3.0 NATURAL RESOURCES PROGRAM OVERVIEW

This section provides detailed information on the 11 natural resources management issues identified for NSN and CI. These include marine resources protection, coastal zone protection, wetlands and water quality protection, land management, urban forestry management, fish and wildlife management, threatened and endangered species protection, habitat conservation and restoration, invasive species and pest management, outdoor recreation and environmental awareness, and conservation law enforcement.

3.1 MARINE RESOURCES PROTECTION

Marine resources, including marine mammals, sea turtles, fish, and shellfish, that occur or have the potential to occur in the nearshore environment and off the coast of NSN and CI, are protected by several federal and state laws and executive orders (EOs). Regulations such as the Marine Mammal Protection Act (16 U.S.C. §1361 et seq.), the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801-1884), and the ESA require the Navy to coordinate with the NMFS and USFWS to obtain relevant permits prior to implementing actions that have the potential to impact protected species. It is illegal to harass, harm, capture, or collect eggs, live or dead hatchlings, juveniles, or adults of any species protected under the ESA, including the Atlantic sturgeon, all sea turtles, and many marine mammals. (Refer to Section 3.7 for the discussion of Atlantic sturgeon management.) To protect all marine mammals, the Marine Mammal Protection Act established a moratorium, with certain exceptions, on the “taking” of marine mammals in U.S. waters and by U.S. citizens on the high seas, and on the importing of marine mammals and marine mammal products into the United States.

In accordance with the Marine Mammal Protection Act, and NAVFAC’s Interim Environmental Policy No. 10-001, Marine Mammal Protection Act Compliance for In-Water Construction (February 2011), the Installation should evaluate any action that produces sound in water where marine mammals are present to determine if a “take” authorization is required in the form of an Incidental Harassment Authorization or a Letter of Authorization from NMFS’ Office of Protected Resources. Accordingly, all training and other Installation activities that have the potential to impact marine resources are coordinated and permitted through the appropriate federal and state agencies. The Environmental Core is responsible for preparing NEPA documentation and facilitating and coordinating the receipt of required natural resources permits for the Installation.

The NMFS administers NOAA’s programs, which support the domestic and international conservation and management of living marine resources. To these ends, several marine mammal stranding centers were established to assist and aid stranded or beached animals. Shore patrols and other units that may occasionally encounter stranded marine mammals or sea turtles should adhere to the protocol established by the Chief of Naval Operations (CNO) (OPNAVINST 3100.6H REF A, Special Incident Reporting) Environmental Readiness Division, as outlined in the recommendations provided below. These recommendations apply to any stranded marine mammal that appears to be injured, disoriented, or dead:

- The Installation Commander will immediately contact the NMFS Regional Stranding Coordinator in the event of a live or dead marine mammal stranding at the Installation, with notification to CNO Environmental Readiness Division (OPNAV N45) occurring immediately thereafter. The NMFS Regional Stranding Coordinator for the Greater Atlantic Region, including Virginia, is Mendy Garron, who can be reached at (978) 282-8478, or Sara McNulty (978) 281-9351.
- In addition to contacting the NMFS Regional Stranding Coordinator and notifying CNO Environmental Readiness Division (OPNAV N45), the Northeast Region Stranding Network Marine Mammal and Sea Turtle Stranding and Entanglement Hotline will be contacted at (866) 755-6622. The members of this network are authorized by federal law to respond to marine mammal and sea turtle strandings. The Virginia Aquarium and Marine Science Center responds to most strandings in the vicinity of NSN and CI and should be contacted immediately in the case of a stranding. The Virginia Marine Resources Commission contact information has been provided as an alternate contact, if necessary.

Virginia Aquarium and Marine Science Center

Virginia Beach, VA
(757) 385-7575 (dead)
(757) 385-7576 (alive)

Virginia Marine Resources Commission

Newport News, VA
(757) 247-2200

- Monitor the animal from a safe distance. Remain a minimum of 100 yards (274 m) from the stranded animal. Crowding the animal is unsafe for the observer as well as the animal. Do not touch the animal, alive or dead, as wild animals can carry many diseases, parasites, and bacteria, some of which can be transmitted to humans. Do not attempt to push the animal back into the water and if it goes back into the water on its own, do not attempt to follow after or swim with it.
- Carefully observe the animal. Observe the position of the alive or dead animal and monitor its breathing. Wait for responders from NMFS and or the Northeast Stranding Network to arrive and direct them to the animal. Relay all observations to the responders so that they can provide the best possible care for the stranded mammal or sea turtle.

To report a stranded marine animal to the Virginia Aquarium's Stranding Response Team, call (757) 385-7575 (dead animals) or (757) 385-7576 (alive animals). These lines are open 24 hours a day. More information is available on the Virginia Aquarium website: <http://www.virginiaaquarium.com/research-conservation/pages/report-a-stranding.aspx>.

The Navy has developed the U.S. Navy Afloat Environmental Compliance Training Series to help ensure Navy-wide compliance with environmental requirements, and to help personnel gain a better understanding of their personal roles and responsibilities (NAVFAC Environmental 2014). One of the available modules is U.S. Navy Marine Species Awareness Training (MSAT). MSAT provides information on sighting cues, visual observation tools and techniques, and sighting notification procedures. The MSAT module, version 4.0, was recently updated and is designed to improve the effectiveness of visual observations for marine resources, including marine mammals and sea turtles.

- **Management action: Participate in U.S. Navy Marine Species Awareness Training (MSAT), module 4.0, available for viewing at:**
<https://www.youtube.com/watch?v=KKo3r1vVBBA>.

3.2 COASTAL ZONE PROTECTION

The Coastal Zone Management Act (CZMA) encourages states to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, beaches, dunes, estuaries, barrier islands, and coral reefs, as well as the fish and wildlife supported by these habitats. Virginia's coastal management area includes the entire Tidewater region. Although federal lands are excluded from state coastal management areas, activities on federal lands that are reasonably likely to affect use of lands or waters, or natural resources of Virginia's coastal zone must comply, to the maximum extent practicable, with the enforceable policies of the Virginia Coastal Zone Management Program. Federal activities affecting Virginia's coastal zone must be fully consistent with Virginia's enforceable policies unless full consistency is exempted by other provisions of federal law.

An outline of Virginia's federal consistency review process is available on the VADEQ website: <http://www.deq.state.va.us/Programs/EnvironmentalImpactReview/FederalConsistencyReviews.aspx>

Enforceable policies of Virginia's Coastal Zone Management Program include, but are not limited to, the following:

- *Tidal and Nontidal Wetlands Management.* This program preserves tidal wetlands, prevents their despoliation, and accommodates economic development in a manner consistent with wetlands preservation. The Virginia Water Protection Permit Program administered by the VADEQ includes protection of wetlands, both tidal and nontidal. This program is authorized by Code of Virginia §62.1-44.15.20 and the Water Quality Certification requirements of Section 401 of the CWA of 1972. The tidal wetlands program (Code of Virginia §28.2-1300 through §28.2-1320) is administered by the VMRC.
- *Fisheries Management.* The program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational

fisheries to maximize food production and recreational opportunities. This program is administered by the VMRC (Code of Virginia §28.2-200 through §28.2-713) and the VDGIF (Code of Virginia §29.1-100 through §29.1-570). The State Tributyltin Regulatory Program is part of the Fisheries Management Program. The General Assembly amended the Virginia Pesticide Use and Application Act as it related to the possession, sale, or use of marine antifoulant paints containing Tributyltin, as the use of Tributyltin in boat paint constitutes a serious threat to important marine animal species. The Tributyltin program monitors boating activities and boat painting activities to ensure compliance with Tributyltin regulations promulgated pursuant to the amendment. The VMRC, VDGIF, and Virginia Department of Agriculture and Consumer Services share enforcement responsibilities (Code of Virginia §3.1-249.59 through 3.1-249.62).

- *Subaqueous Lands Management.* This program establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects on marine and fisheries resources, wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by the VADEQ, Water Division. The program is administered by the VMRC (Code of Virginia §28.2-1200 through §28.2-1213).
- *Point Source Pollution Control.* The point source program is administered by the VADEQ State Water Control Board (Code of Virginia §62.1-44.15) and the State Air Pollution Control Board (Code of Virginia §10-1.1300). The Point Source Pollution Control Program regulates discharges into state waters through Virginia Pollutant Discharge Elimination System (VPDES) and Virginia Pollution Abatement Permits, and through implementation of the National Pollutant Discharge Elimination System permit program established pursuant to Section 402 of the CWA.
- *Nonpoint Source Pollution Control.* Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by VDCR (Code of Virginia §10.1-560 et. seq.), which regulates activities in Chesapeake Bay Resource Management Areas and Resource Protection Areas within 84 of Virginia's coastal zone localities.
- *Shoreline Sanitation.* The Virginia Department of Health regulates the installation of septic tanks, sets standards concerning soil types suitable for septic tanks, and specifies minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth. This program includes shellfish closures due to bacterial contamination, and is administered by the Department of Health through Code of Virginia §32.1-164 through §32.1-165.
- *Coastal Lands Management.* VDCR, Division of Chesapeake Bay Local Assistance regulates activities in Chesapeake Bay Resource Management Areas and Resource Protection Areas within 84 localities in the state's coastal zone through a state-local cooperative program established pursuant to the Chesapeake Bay Preservation Act (Code of Virginia §10.1-2100 through §10.1-2114) and Chesapeake Bay Preservation

Area Designation and Management Regulations (9 Virginia Administrative Code [VAC] 10-20-10 et seq.).

- *Air Pollution Control.* The VADEQ implements the federal CAA to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board (Code of Virginia §10-1.1300).
- *Dunes and Beaches Management.* VMRC administers dune protection pursuant to the Coastal Primary Sand Dune Protection Act (Code of Virginia §28.2-1400 through 28.2-1420) to prevent the destruction or permanent alteration of primary dunes, to include impairment of natural function, physical alteration of the dune contour, or destruction of vegetation growing thereon.

As evident by the many issue areas above, coastal zone protection is inter-related to many other aspects of natural resources management. The specific management at NSN and CI under each of these issue areas is covered in this INRMP under the issue-specific topic. For discussion of tidal wetlands, refer to Section 3.3.1; for protection and improvement of water quality in the Chesapeake Bay watershed, including restoration of oyster reefs and SAV, refer to Section 3.3.3; for pollution prevention, refer to Section 3.3.4; for fisheries management, refer to Section 3.6.3; and for establishment of living shorelines, refer to Section 3.8.1.

A full nearshore survey was conducted at NSN, concurrent with other surveys completed in preparation for this INRMP, and the findings have been incorporated with respect to the description of the nearshore environment and marine mammals, reptiles, and fish known to occur in the nearshore area. In order to characterize the nearshore environment around the Fuel Terminal, seasonal nearshore surveys are planned to occur at CI, using the same methods as were employed at NSN. The survey area will extend from the shoreline out 250 m, consistent with nearshore surveys that have been conducted at other Navy Mid-Atlantic installations. The study will characterize the identified nearshore environment by surveying benthic habitat, SAV, fish, threatened and endangered species, water quality, marine mammals, and intertidal areas.

➤ ***Project: SIKES CI-Nearshore habitat assessment and species inventory***

3.2.1 Sea Level Rise

Awareness of the climate change impacts to the coastal zone environment is crucial for natural resources management at NSN and CI. Sea-level rise has the potential to affect existing coastal infrastructure critical to the DOD. Installations located on the coast, such as NSN and CI, are expected to experience significant changes to environmental resources and man-made infrastructure. The DOD's SERDP is currently pursuing a number of areas of investigation to address the information and decision support needs of DOD coastal installations under the threat of climate change. Project RC-1701 has developed (and tested) a risk-based methodology to evaluate threats to critical installation assets and quantify the potential loss of mission performance when installation capabilities were impacted by a combination of rising sea levels and coastal storm hazards (U.S. Army Engineer Research

and Development Center 2014). NSN was selected as a case study to test the effectiveness of this approach. All modeling efforts for the case study focused on a series of 25 scenarios comprised of five prescribed SLR conditions ranging from 0.0 m to 2.0 m (by 2100) in combination with five simulated coastal storms ranging in intensity from 1-yr to 100-yr return intervals.

The report found that flooding increased exponentially with increased SLR and storm intensities: surge generated by all five storms inundated approximately 50–80% of NSN under the 2.0 m SLR scenario, and even under baseline (existing) conditions, most of the Installation was under the maximum surge level, and partially inundated, post-storm. Much of CI remained dry, however, where the 12-meter dikes built surrounding the USACE disposal site offer protection from the most severe storms and the highest SLR scenarios (U.S. Army Engineer Research and Development Center 2014). Considered without storm surge, the regular tidal condition flooded NSN for the 1.5 m and the 2.0 m SLR scenarios. In assessing NSN’s vulnerability and capability to perform the military mission under different SLR scenarios, the report found that the probabilities of damage to infrastructure and losses in mission performance (e.g., ability to provide water, steam, oily waste removal, electricity, and wastewater to berthed vessels) increased dramatically once 0.5 meters of SLR was experienced, indicating a “tipping point” or threshold that should be considered when undertaking future planning or operational activities on the installation (U.S. Army Engineer Research and Development Center 2014). Although not a primary objective of this study, it is important to note that it has also generated a series of GIS-based maps of forcings (winds, waves, surge, flooding, etc.) for the entire Hampton Roads area (for each of the SLR-storm scenarios studied) that can now be used to assess vulnerability of assets both inside and outside the Installation, supporting community efforts to address the threats of SLR and coastal storm hazards from a regional perspective. As a follow-on to the SERDP risk quantification study, NSN has scheduled the completion of a comprehensive climate change vulnerability assessment and adaptation plan as a project under this INRMP.

➤ **Project: Climate Change Vulnerability Assessment and Adaptation Plan**

3.2.2 Shoreline Protection and Restoration

Protection and restoration of the shoreline is an ongoing natural resources issue at NSN and CI. Protecting the shoreline is critical to the maintenance of (1) the riparian buffers along Mason Creek; (2) recreational areas for Navy personnel and their families along Willoughby Bay and in Monkey Bottom; and (3) operational areas including the function of oil/water separators along Craney Island Creek. Much of the shoreline of both NSN and CI is hardened with riprap and bulkheads. Although effective at protecting the land on which it is placed from receding, rip rap causes the key ecological functions served by natural, living shorelines to be lost, and can actually exacerbate erosion at the base of the structure. In contrast, the extensive root systems of shoreline plants like smooth cordgrass (*Spartina alterniflora*) not only help anchor shoreline sediments, but even narrow strips of these tidal wetlands systems are effective at filtering runoff before it enters the marine, brackish, or aquatic environments. Where established, cordgrass stands should not be cut. If a 25-foot shoreline buffer no-mow

zone can be reserved, it would reduce grounds maintenance costs, filter stormwater runoff, slow velocity of runoff, and provide nesting habitat.

The condition of the shoreline and the range of possible living shoreline options need to be assessed to evaluate specific shoreline management strategies for NSN and CI. The VIMS Center for Coastal Resources Management produced a shoreline inventory report for the City of Norfolk (VIMS Center for Coastal Resources Management 2014) that makes visible features such as bank conditions, natural buffers, shoreline protection structures, and others in a customizable online map viewer at http://cmap.vims.edu/ShlInv/Norfolk/Norfolk_ShInv.html. The inventory determined that almost the entire shoreline of NSN is protected by some type of structure, predominantly bulkheads and riprap, with multiple jetties; the removal of these structures to create new living shorelines might not be consistent with the military mission. The few unprotected areas of shore include the small beach by the north end of 10th Avenue—which is deemed stable to the south of the jetty which intercepts it, but is of unknown stability north of the jetty—and a few stretches of vegetated shoreline around the Willoughby District. NSN is proposing a project under this INRMP to protect and restore the Installation’s existing living shoreline buffer areas at the Breezy Point park along Masons Creek, and at the Monkey Bottom area on Willoughby Spit. NSN is considering employing a hybrid approach, as recommended by VIMS and VADEQ, which would combine vegetated and sand beach habitats with low-profile supporting structures of rock, rubble, shells, or wood, to protect habitats such as tidal marsh that might be exposed to higher wave energy (Duhring 2014, VADEQ 2016). Using this technique, revetment of the Monkey Bottom and Breezy Point shorelines could be supported by *Spartina* grasses.

In 2011, Virginia Senate Bill SB964 established living shorelines as the preferred approach to shoreline erosion protection. The legislation also mandated the development of a living shorelines general permit and the development of integrated guidance to direct shoreline management (Center for Coastal Resources Management 2015). Accordingly, the following management actions for shoreline protection and restoration will be implemented under this INRMP:

- ***Project: 1 CP Living Shoreline Buffer Areas***
- ***Management action: Establish and maintain a 25-foot shoreline buffer no-mow zone to protect living shorelines.***
- ***Management action: Encourage hybrid shoreline stabilization (e.g., planted marsh and rock sill) into planning and engineering designs.***
- ***Management action: A Joint Permit Application must be filed with the USACE, VMRC, VADEQ, and Local Wetlands Boards (LWB) to evaluate projects involving submerged lands, wetlands, and coastal primary sand dunes and beaches for permit review and any abbreviated application developed specifically for this general permit (VMRC 2016b).***

3.3 WETLANDS AND WATER QUALITY PROTECTION

Due to their importance to the health of the ecosystem and the human environment, a large number of federal, state, and local laws regulate land uses and actions that have the potential to impact wetlands and water quality. EO 12088, *Federal Compliance with Pollution Control Standards*, and the CWA require federal facilities to comply with all substantive and procedural requirements applicable to point and nonpoint sources of pollution. Accordingly, activities at NSN and CI must coordinate with the CNRMA to obtain certifications and permits required by federal and state pollution control laws applicable to federal agencies. To help facilitate wetland identification and the permitting process, regional and Installation natural resources personnel receive wetland delineation and regulatory training.

3.3.1 Wetlands Protection

Under Section 404 of the CWA, discharge of dredged and fill material into waters of the U.S., including wetlands is prohibited unless a permit is issued by USACE. A number of Nationwide Permits (NWP) have been established to streamline the permitting process for activities that will have minimal adverse effects on aquatic environments. Currently, NWPs authorize maintenance of existing structures, residential construction, reshaping existing drainage ditches, and recreational facilities that do not alter existing landscape. There are a number of NWPs with a range of thresholds, based on the specific activity, available from the USACE. If project impacts don't qualify for a NWP, the Navy can get general permits from the USACE and VADEQ for project impacts up to 1 acre. If the project impacts are between 1 acre and 2 acres, an individual permit from the USACE and a general permit from VADEQ would be required. Permits greater than 2 acres would require an individual permit for both agencies. For further clarification regarding the permitting requirements for any project expected to have wetlands impacts, consult with the NAVFAC MIDLANT Wetlands subject matter expert.

*Detailed information regarding current regulatory programs of the USACE
is available at:*

<http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx>

The Virginia Water Protection Permit Program (9 VAC 25-210) requires additional state permits for any impacts to state waters and wetlands, including isolated wetlands. Activities requiring a permit include dredging, filling, or discharging any pollutant into or adjacent to surface waters; otherwise altering the physical, chemical, or biological properties of surface waters; excavating in wetlands; or conducting any of the following activities in a wetland:

- new activities, including draining, that would result in significant alteration or degradation of existing wetland acreage or functions;
- filling or dumping; or
- permanent flooding or impounding.

Information on individual and state permit requirements and application procedures is available on the VADEQ website:

<http://www.deq.state.va.us/Programs/Water/WetlandsStreams/PermitsFeesRegulations.aspx>

Military construction and other projects with the potential to disturb wetlands are reviewed individually with regard to wetland impacts, and appropriate permits obtained as needed. Although permits may be obtained that allow for the filling of wetlands, in accordance with EO 11990, *Protection of Wetlands*, federal agencies may do so only after evaluating alternatives that avoid or minimize impacts to aquatic resources to the maximum extent practicable.

In 2014, VADEQ issued Virginia Water Protection (VWP) General Permit Authorization Number WP4-14-1071 to NAVFAC MIDLANT, Natural Resources, for construction activities at NSN Chambers Field, to permanently impact 1.333 acres of nontidal forested wetlands via permanent conversion to nontidal emergent wetlands and temporarily impact 0.167 acres of nontidal emergent and scrub-shrub wetlands to remove vegetation that exceeds height tolerances allowed under Navy and Federal Aviation Administration regulations (VADEQ 2014). This VWP Permit requires the Navy to compensate for the permanent impacts by purchasing 1.333 acres of wetland mitigation bank credits from either the Middle Peninsula Environmental Bank or the Great Dismal Swamp Restoration Bank – Lewis Farm Bank. This authorization will expire 7 years from the issue date, in October 2021.

The Navy will coordinate with VADEQ, USACE, VMRC, and LWB, as appropriate, to apply for permits as needed for any unavoidable impacts to wetlands and aquatic resources from future construction and development projects. However, the Master Plan (NSN 2011) emphasizes low impact development (LID) techniques such as bioswales and natural detention in open space areas, which retain the Installation's current wetlands. In addition, the open space system would preserve the natural wetland areas to the west of Chambers Airfield as naturalized areas using vegetation and planting techniques consistent with the BASH standards.

NSN is currently developing an Installation Development Plan that, when complete, will supersede the Installation Base General Plan. A jurisdictional wetlands delineation is warranted to support this plans, and to ensure that NSN takes proper precautions to avoid future impacts to all jurisdictional wetlands, while not being limited by the inaccurate mapping of NWI wetlands. Through the implementation of this INRMP, NSN will seek to complete a jurisdictional wetland delineation of the entire area within the property boundary of NSN. Although a jurisdictional determination of the wetlands in the Chambers Field clear zone was made in 2009, this determination expired 5 years from its date of finding and is no longer valid. The jurisdictional wetlands delineation of CI, on the other hand, was just completed in 2014 and is valid until 2019.

Management measures that are proposed in this INRMP for the protection of wetlands include:

- **Management action: Coordinate with VADEQ, USACE, VMRC, and LWB, as appropriate, to apply for permits as needed for any unavoidable impacts to wetlands and aquatic resources from future construction and development projects.**
- **Project: CWA NAVSTA Jurisdictional Wetland Delineation Survey**

3.3.2 Floodplain Protection

The USACE also regulates discharges of dredged or fill materials within 100-year floodplains. Few NFPs are available for this purpose and almost all of these require notification of the USACE District Engineer. Floodplains receive additional protection through EO 11988, *Floodplain Management*, which instructs federal agencies to reduce the risk of flood loss by avoiding building in floodplains, and to restore and preserve the natural and beneficial values served by floodplains. However, because large portions of NSN and CI are located within the 100-year floodplain (as described in Section 2.3.3; see Figure 2-5 and Figure 2-6), and operations of the airfield, waterfront, and Fuel Terminal require use of the landscape features found within this floodplain, some impact to these areas may be unavoidable. Appropriate permits and NEPA documentation must be obtained before any ground-disturbing activities are undertaken in floodplains.

3.3.3 Watershed Protection

NSN and CI are located within the Chesapeake Bay watershed, which is recognized as one of the most important and productive estuarine ecosystems in the world and is protected by federal, state, and local regulations. The Chesapeake Bay watershed is home to more than 3,600 species and over 15 million people all competing for resources and space within this 64,000 square mile region. The Chesapeake Watershed Cooperative Ecosystem Studies Unit, which includes university/research institutions and federal agency partners such as the DOD, promotes stewardship and integrated ecosystem management of natural and cultural resources within the Chesapeake Bay watershed through collaborative research, technical assistance and education.

*The Chesapeake Bay Program Resource Library website
(<http://www.chesapeakebay.net/library>) provides several resources for public use
including photographs, maps, datasets, and publications that pertain to the
Chesapeake Bay.*

The Navy and/or DOD is a signatory to a number of Chesapeake Bay agreements, including the 1994 *Agreement of Federal Agencies on Ecosystem Management in the Chesapeake Bay*, the 1998 *Federal Agencies' Chesapeake Ecosystem Unified Plan*, the *Chesapeake 2000 The Renewed Bay Agreement*, and EO 13508, *Strategy for Protecting and Restoring the Chesapeake Bay Watershed* (2009). These agreements identify goals and commitments

aimed at the preservation and restoration of the Chesapeake Bay. Major goals of the Chesapeake Bay agreements include 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. DOD published the *Department of Defense Chesapeake Bay Strategic Action Plan* (DOD 2011b) to incorporate the goals and objectives of EO 13508 into the management of DOD installations, and to emphasize DOD's efforts in research, protection, and conservation (e.g., preparedness for SLR, remediation of oyster beds, establishment of living shorelines on Navy property).

In spite of efforts to restore the Chesapeake Bay and its tributaries over the past 25 years, insufficient progress and continued poor water quality prompted the EPA in 2010 to establish the Chesapeake Bay Total Maximum Daily Load (TMDL), with rigorous accountability measures, as required by the CWA and in response to EO 13508 (EPA 2010). Most of the Chesapeake Bay watershed is listed as impaired because of excess nitrogen, phosphorous, and sediment—pollutants which enter the water at high levels from agricultural operations, urban and suburban stormwater runoff, wastewater facilities, air pollution, and other sources. These pollutants cause algal blooms that consume oxygen in the water column and create “dead zones” where fish and shellfish cannot survive; block sunlight that is needed for sea grasses; and smother benthic organisms. The TMDL set Chesapeake Bay watershed limits that required a 25% reduction in nitrogen, 24% reduction in phosphorous, and a 20% reduction in sediment through a combination of measures addressing stormwater runoff, wastewater treatment, and regulation of agriculture (EPA 2010).

In 2014, DOD became a signatory of the *Chesapeake Watershed Agreement* (Chesapeake Bay Program Partners 2014), which reaches beyond the previous watershed agreements to address sustainable fisheries, prioritize increasing SAV habitat, address toxic contaminants within living resources (e.g., PCBs), and add goals in the areas of increasing urban tree canopy, citizen stewardship, land conservation, public access, environmental literacy, and climate resiliency. The Bay-wide goal for SAV restoration is to achieve and sustain 185,000 acres, with targets of 90,000 acres by 2017 and 130,000 acres by 2025. SAV (also called seagrass or Bay grass) is an important natural resource which provides a variety of ecological functions, including stabilizing sediments, protecting shorelines by physically baffling wave energy, reducing water column turbidity, removing/recycling excess water column nutrients (e.g., nitrogen and phosphorous), and providing high levels of primary and secondary production. SAV is considered to be of extremely high habitat value to commercially and recreationally important species of fish and shellfish, and is considered to be the primary settling habitat for young blue crabs in Chesapeake Bay (VMRC 2016c). Emergent plants, such as cord grass and marsh grass, provide similar ecosystem benefits in terms of absorbing wave energy and reducing coastal erosion, providing wildlife food and habitat, and improving water quality, particularly in the intertidal zone, so NSN will plant both emergent and aquatic vegetation in Willoughby Bay. Refer to Section 3.3.2 for a discussion of the proposed INRMP project to assess opportunities to enhance living shorelines at NSN.

Underwater imagery captured during the 2015 nearshore survey was not able to identify any SAV in the area around NSN, though due to the low visibility, its presence could not be ruled out. The SAV grow zone is a narrow ribbon extending out to a 2 m water depth (Chesapeake

Bay Program Sediment Workgroup 2007). The nearshore area south of NSN, and around CI (in the Elizabeth River), have been identified as “no grow” zones for SAV; but in other parts of the Chesapeake Bay, including areas up to 2 m depth around NSN and in Willoughby Bay, SAV has the potential to grow and be restored. The larger regional segment around NSN has achieved 100% of its Bay grass restoration goal for 2011–2013 (Weinberg 2014); while it’s possible that the localized success of SAV restoration efforts near NSN could be due to a small goal (i.e., in an area where little habitat is suitable for restoration), the watershed segment around NSN is one of the few segments of the Chesapeake Bay watershed to have achieved its annual goal during that three-year period, so it appears hopeful that planting SAV in the nearshore area could be successful. The increasing success of the Bay-wide SAV restoration program is also encouraging; between 2013 and 2014, seagrass abundance in the Chesapeake Bay rose 27%, marking a 27,600-acre increase from the last decade’s low, and an achievement of 41% of the overall goal (Chesapeake Bay Program 2015). VIMS has developed general and specific criteria for transplantation activities designed to enhance or restore the Bay’s SAV resources. These SAV Transplantation Guidelines (codified at §§28.2-103 and 28.2-1203 of the Code of Virginia) are designed to ensure that any such proposed activities have the highest likelihood of success while minimizing the potential for adversely impacting this sensitive and valuable marine resource (VMRC 2016c).

Oysters also provide numerous important benefits to the Chesapeake Bay watershed and the ecosystem. By filtering water at a rate of up to 1.3 gallons per hour, oysters consume and remove algae from the water column, thereby naturally and constantly cleaning the water. Excess algae also block sunlight from reaching the sea grasses on the sea bottom, inhibiting their growth. By eating the excess algae and cleaning the water, oysters help seagrasses to grow as well. In addition, oyster reefs provide habitat for an enormous range of organisms, including worms, snails, sea squirts, sponges, small crabs, and fishes who seek refuge in the nooks and crannies between their shells. Oyster reefs can have 50 times the surface area of an equally extensive flat bottom habitat (VADEQ n.d.). Eleven oyster reefs were built in the Elizabeth and Lafayette Rivers between 1998 and 2009, with limited restoration potential due to the consistent risk of disease, habitat degradation, and user conflicts (VIMS 2010). However, in recent years, the oyster harvest has skyrocketed, climbing from 24,000 bushels in 2003 to almost 600,000 bushels in 2015 (VMRC 2016a). NSN plans to attempt oyster reef restoration to benefit water quality in the NSN nearshore area through partnerships with Old Dominion University, Elizabeth River Project, or VIMS.

Major initiatives that will be undertaken at NSN and CI through the implementation of this INRMP, and that directly support these watershed protection goals and help fulfill Navy commitments to the Chesapeake Bay Agreements, include the increasing living shorelines in the nearshore area, sustaining or enhancing urban tree canopy, and promoting education and outreach, via the following:

- **Project: SIKES NAVSTA/CI Plant Nearshore Emergent and Aquatic Vegetation**
- **Project: SIKES NAVSTA/CI Nearshore Oyster Reef Restoration (Cooperative Service Agreements)**
- **Project: 1 CP Living Shoreline Buffer Areas**

- **Management action: Sustain or enhance urban tree canopy (supported by the following projects).**
- **Project: CBPA NAVSTA/CI-Urban Tree Assessment, Mapping, & Preservation Plan**
- **Project: CBPA NAVSTA/CI-Native Tree Planting and Establishment**
- **Project: CBPA NAVSTA/CI-Native Tree Care**

3.3.4 Stormwater Quality

Stormwater management is an important part of point source and nonpoint source pollution control; these issues are managed outside of the INRMP, under separate plans and programs. The Storm Water Pollution Prevention Plans (SWP3) prepared for NSN and CI identify and map potential pollutant sources that may contribute to the contamination of stormwater discharges from permitted industrial outfall drainage areas; additional stormwater management plans have also been developed, as well as a Best Management Practices (BMP) Inventory for existing stormwater management facilities and structures. These documents should be referred to directly for guidance and information on NSN's Stormwater Management and Pollution Prevention programs.

The storm water drainage system at NSN and CI collects runoff from impermeable surfaces throughout developed areas, which can inadvertently facilitate the transport of industrial pollutants into the Chesapeake Bay. Potential sources of pollutants include outdoor industrial activities and processing areas; material storage and handling areas; areas where hazardous material/hazardous waste/or petroleum, oil, and lubricant products are stored; construction and demolition sites; and land areas where chemicals are applied. The SWP3 was developed as a requirement of the VPDES and several other state and federal water pollution control regulations. The Chesapeake Bay TMDL requires periodic Opportunity Assessments for the repair/retrofit of existing stormwater management facilities and structures and for the location of future BMPs. The VADEQ requires NSN and CI to amend the SWP3 whenever there is a change in design, construction, operation, or maintenance that has a significant effect on the potential for the discharge of pollutants to the waters of the state. Nonpoint source pollution is monitored at all of the NSN and CI outfalls under the conditions set forth in the VPDES permit issued for the Installation.

In 2007, the U.S. Navy adopted a new LID policy for stormwater management at its facilities. The goal of the new policy is "no net increase" in the amount of stormwater volume, sediment, and nutrient loading that escapes into the ecosystems surrounding Navy and Marine Corps facilities and installations nationwide. The policy also mandates that the most cost-effective stormwater treatment techniques be applied (Buranen 2010). NSN (then called Norfolk Naval Base) tested the first innovative stormwater treatment system at Building V-88, which discharged heavy metal pollutants into a nearby stormwater outfall. The system was found to remove copper and zinc so effectively that copper, which entered at the rate of 156 parts per billion (ppb), exited at less than 5 ppb, and zinc concentrations were reduced from 1,000 ppb entering to less than 5 ppb upon exit (Buranen 2010). Continuing to seek innovative, LID solutions, NSN subsequently received the CNO Environmental Award

for leading the Navy in installing the first “green roof” on the Navy Legal Services Office, Building A-50, in 2010 (McCaffrey 2011b). Navy Region Mid-Atlantic has recently undertaken to execute 200 BMP and LID projects to meet regional goals (Salonen 2016).

The NSN Master Plan calls for application of LID measures, additional tree planting, and continued maintenance of open space areas as stormwater treatment basins (e.g., in the Fleet Mall District and the Airfield Support District) to achieve increased infiltration and the overall improvement of stormwater runoff quality (NSN 2011). In addition, stormwater mitigation areas would be developed as an integral part of the parks and open space design for the shopping district expansion. It is recommended that future planned site improvements identified in the Master Plan utilize natural and pervious surfaces and replace impervious surfaces to the extent possible; the northern and southern parking areas in the Waterfront District have been identified as opportunity areas for reducing impervious surfaces and stormwater mitigation. Impervious surface reductions are to be reported as part of the annual Chesapeake Bay data call.

To summarize, the management measures that are proposed in this INRMP for stormwater quality include:

- ***Management action: Implement BMPs, as practicable, on construction projects to reduce detrimental effects of nonpoint source pollution.***
- ***Management action: Apply LID measures to building renovations and new construction across the Installation.***
- ***Management action: Continue to maintain stormwater treatment basins in open areas around the airfield to achieve increased infiltration and the overall improvement of stormwater runoff quality.***
- ***Management action: Utilize natural and pervious surfaces for future planned site improvements (as identified in the Master Plan) and replace impervious surfaces to the extent possible.***
- ***Project: CBPA NAVSTA/CI-Native Tree Planting and Establishment***

3.3.5 Erosion and Sediment Control

Although NSN and CI are generally flat, areas of low soil permeability are susceptible to erosion and sedimentation. Activities that remove vegetation and disturb soil can greatly increase the risk of erosion and sedimentation, and require implementation of protective measures. Proposed construction projects that disturb 1.0 ac. (0.4 ha) or more must obtain authorization under a VPDES Storm Water Discharge Permit for Construction Activities. Site-specific SWP3s that address runoff control during and after construction activities must be prepared for all construction projects. As with SWP3s for industrial discharges, SWP3s for construction sites must be updated as necessary to remain consistent with any changes needed to protect surface water resources. Sediment basins are a structural control requirement for sites disturbing 3.0 ac. (1.2 ha) or more. At sites disturbing less than 3.0 ac. (1.2 ha), sediment basins are encouraged, but other control methods may be employed.

Additional erosion and sedimentation control requirements are provided by the Virginia Erosion and Sediment Control Law and Regulations (Code of Virginia §10.1-560). This law generally requires an Erosion and Sedimentation Control Plan for any land-disturbing activity equal to or exceeding 10,000 square feet (929 square meters) in area; however, because NSN and CI are located within the Chesapeake Bay Preservation Area, an Erosion and Sedimentation Control Plan must be developed for disturbed areas greater than 2,500 square feet (232 square meters) (VDCR 1992 and 2012). Land-disturbing activities include, but are not limited to, clearing, grading, excavating, transporting, and filling of land. Regulated land-disturbing activities must comply with minimum standards outlined in the Virginia Erosion and Sediment Control Handbook (VDCR 1992). For compliance with these regulations, the Environmental Impact Review of the NSN Air Field Clear Zone Management Plan required NSN to submit to VDCR an Erosion and Sediment Control Plan to cover the installation of staging areas, parking lots, roads, buildings, utilities, borrow areas, and soil stockpiles resulting in the disturbance of more than 2,500 square feet of land (VDCR 2012). Construction activities greater than or equal to 2,500 square feet within the Chesapeake Bay Preservation Area are also required to register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific SWP3.

Management measures that are proposed in this INRMP for erosion and sediment control include:

- **Management action: Develop an Erosion and Sedimentation Control Plan for disturbed areas greater than 2,500 square feet (232 square meters), and submit the plan to VDCR.**
- **Management action: Register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific SWP3 for disturbed areas greater than 2,500 square feet (232 square meters).**

3.4 LAND MANAGEMENT

3.4.1 Installation Restoration Program Sites

The Navy recognizes that adverse impacts to natural resources may result from the release of hazardous substances, pollutants, and contaminants into the environment. Land that has been contaminated must undergo restoration before it can be used for other human or natural resources functions. The Navy IRP is responsible for identifying Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) releases, considering risks and assessing impacts to human health and the environment (including impacts to endangered species, migratory birds and biotic communities), as well as developing and selecting response actions when it is likely that a release could result in an unacceptable risk to human health and the environment. This assessment must consider endangered species, migratory birds, and biotic communities. The IRP must develop and select response actions when it is likely that a release could result in an unacceptable risk to human health and the

environment. When appropriate, the NRM helps the IRP Remedial Project Manager to identify potential impacts to natural resources caused by the release of contaminants and participates, as appropriate, in the decision-making process. CERCLA and the Superfund Amendments and Reauthorization Act are the primary legal authorities governing environmental restoration activities at DOD installations. Under CERCLA, the Navy has entered into a Federal Facilities Agreement (FFA) with EPA and VADEQ to address environmental contamination. The FFA specifies how and when CERCLA activities will occur at NSN and CI.

The Site Management Plan (SMP) for NSN and CI provides detailed descriptions of IRP sites including relative risks to be used in planning, scheduling, and setting priorities for environmental remedial response activities at NSN and CI (CH2M HILL 2014). The SMP identifies all of the current or potential IR sites at the Installation. Natural resources personnel are not actively involved in the maintenance or monitoring of any of these sites.

3.4.2 Oil and Hazardous Substance Spill Prevention and Response

In order to service the Navy's fleet of ships, aircraft, and vehicles, NSN and CI transport, process, and store (above-ground and underground) vast quantities of oil, fuel, and oily water, making the threat of oil and hazardous substance (OHS) spills an important environmental concern. If a spill were to occur, NSN and CI's location adjacent to the Chesapeake Bay, the Elizabeth River, and other environmentally sensitive areas could lead to significant injury to fish, wildlife, and sensitive areas, and contaminate groundwater supplies for the Installation and adjacent communities. Following the SWP3 is imperative to prevent spills from entering the groundwater and contaminating downstream and marine resources. NSN maintains a full-time oil spill response service and equipment capable of containing and cleaning up an oil spill (NAVFAC MIDLANT n.d.).

Guidance on the storage and handling of OHS is detailed in three separate Spill Prevention, Control, and Countermeasures Plans (SPCC) that pertain to NSN, CI, and the Defense Logistics Agency (DLA) oil handling assets located onsite at CI. NSN's SPCC Plan was completed in 2013 but is being updated in 2016. The CI SPCC plan (dated March 2014) addresses two shop-fabricated tanks, two drum storage areas, two mobile refueler parking areas, and oil filled operational equipment not included in the DLA SPCC Plan. The DLA SPCC plan (dated March 2013) addresses the field-erected bulk storage tanks, all transfer pipelines, fuel pier, truck loading racks, some oil filled operational equipment and several smaller shop fabricated tanks for heating oil and emergency generators. The SPCCs were prepared in accordance with the provisions of 40 CFR Part 112 and OPNAVINST 5090.1D, and provide information for preventing discharges of oil from onshore facilities into navigable waters of the U.S. or adjoining shorelines, and procedures to ensure early detection and quick response in the event of an oil discharge. Spill controls prescribed range from drip pans and spill kits to drum spill pallets and containment berms (NSN 2003). An Oil Discharge Contingency Plan (ODCP) is required under 40 CFR 112.20 for all installations that have total aboveground oil storage or handling capacity greater than 25,000 gallons (94,635 liters). To meet this requirement, Facility Response Plans have been prepared for both NSN and CI in accordance with Commonwealth of Virginia Oil Discharge Contingency

Plan Requirements (9 VAC 25-91-170) and OPNAVINST 5090.1D. The Installation is covered under the *Consolidated Regional Facility Response Plan, Oil & Hazardous Substance Contingency Plan* for NSN, NAS Oceana, and JEB Little Creek (CNRMA 2011). CI is covered under the Naval Supply Systems Command, Fleet Logistics Center, Norfolk's *Oil & Hazardous Substance Facility Response Plan* for Defense Supply Point CI Fuel Terminal (2016). Refer to the SPCCs and FRPs for information regarding environmentally sensitive areas, spill notification and response procedures, assessments of worst-case discharge, and post-discharge review procedures at NSN and CI.

To help identify and prioritize protection of natural resources in the event of an oil spill, the NOAA Office of Response and Restoration has developed an Environmental Sensitivity Index (ESI) that identifies sensitive coastal areas (NOAA 2016b). Natural resources identified on ESI maps include shoreline types, shellfish beds, common local shellfish, finfish nurseries, nesting areas for various types of birds, bird species, and known locations of threatened and endangered species. A number of socioeconomic features that would require protective measures are also displayed on the ESI maps. Protection methods such as proposed boom placement locations, skimmer locations, and staging areas are also mapped. ESI maps are currently available from NOAA Office of Response and Restoration at the following website: <http://response.restoration.noaa.gov/esi>.

3.5 URBAN FORESTRY MANAGEMENT

Navy policies on urban forests, as stated in NAVFAC P-73, Real Estate Operations and Natural Resources Management Procedural Manual, Volume II (U.S. Navy 1987) and NAVFAC P-904, Planting Design (U.S. Department of the Army and the Navy 1976) require consideration of both forest and landscape trees in all planning decisions. Federal agencies have been required since 1994 to use regionally native plant species under EO 13148, *Greening the Government through Leadership in Environmental Management*, as further discussed in Section 3.8.1, (*Beneficial Landscaping*). Management of the urban forest resources at NSN adheres to the following guidelines:

- Right Tree, Right Place: when planting new trees, select native species that are well-suited to the habitat conditions present as well as planning for future development to avoid conflicts with utilities.
- Do not plant trees under or within 25 feet from power lines, sewer lines, etc.
- No topping or side walling of trees when pruning.
- Replace trees removed as part of new construction or maintenance projects.

***Useful Resources for Tree Planting
at NSN & CI***

**Coastal Plain Community Tree
Guide:**

http://www.fs.fed.us/psw/publications/documents/psw_gtr201/

VDCR Coastal Plain Native Plants
<http://www.dcr.virginia.gov/natural-heritage/document/cp-native-plants.pdf>

Recommended Trees for Norfolk
<http://www.norfolk.gov/index.aspx?NID=464>

General tree maintenance at the Installation and the Fuel Terminal is overseen by the Public Works Center and carried out under the grounds maintenance contract; whereas, authorization and mitigation for tree removal, inventories, canopy assessment, preservation plans, and site plans for planting are all Natural Resources responsibilities.

Urban tree canopy is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. Most of the urban tree canopy at NSN is in the south and southeastern portions of the Installation in relatively small, isolated patches that are surrounded by development. Although CI is much more vegetated than NSN, the vast majority of the trees are small patches of loblolly pine and myrtle, and urban forestry management is not applied. The urban forest resources are not managed for timber production, but they do provide a number of social, environmental, and economic benefits. Social benefits include improving the quality of life for Installation personnel and their dependents through recreational activity. Several of the forested parks, picnic areas, and other recreational areas are heavily utilized and recognized as valuable assets by the Navy community. The urban forests also provide economic benefits because of the ameliorating effects they have on the environment. Trees and shrubs that are located around urban areas reduce energy consumption by shading buildings, providing windbreaks, and cooling the air through transpiration. Other benefits provided by urban forests include water conservation and water quality improvement by reducing flow velocities, capturing and storing excess runoff, and reducing air pollution. In addition, the urban tree canopy provides habitat that attracts wildlife to the urban environment providing benefits to these species as well as recreational benefits to Installation personnel and their families (e.g., bird watching). Since BASH is an issue of foremost concern for NSN, attracting birds and other wildlife has a negative impact on the military mission in locations within and surrounding the Airfield Operations Area, and the growth and height of vegetation must be restricted to adhere to airfield obstruction criteria (Geo-Marine, Inc. 2011) and reduce the attraction of hazardous wildlife.

Urban tree canopy is a valuable community asset not just for the many environmental benefits described above, but also for its ability to enhance property values, facilitate social and educational opportunities, and provide aesthetic enjoyment (Virginia Geospatial Extension Program 2011). Urban tree and canopy assessments allow communities to prioritize planting/greening goals based on social, economic, and ecological criteria such as flooding, wildlife habitat, urban heat island/heat stress, public health, and plans for future development. Additionally, information from these assessments prioritize locations for tree planting efforts, establish urban forestry master plans, inform sustainability plans, and justify budget increases for urban forestry/ground maintenance programs. To ensure that NSN's urban trees are properly accounted for, maintained, and protected, the Installation plans to conduct an urban tree and canopy assessment, which will result in the mapping of urban forest resources, and the development of an Urban Tree Preservation Plan. Establishing tree preservation/canopy goals is an important action to ensure that trees, as a valuable green infrastructure asset, are maintained at minimum thresholds, even as NSN continues to develop. Increasing urban tree canopy also supports the goals of the *Chesapeake Watershed Agreement*, to which the DOD is a signatory partner (Chesapeake Bay Program Partners 2014).

In accordance with the NSN Master Plan, NSN will establish at least two specific tree preservation/park project areas that would include the preservation and planting of a diverse assortment of native trees with educational plaques. The recommended locations for these areas are (1) near the designated green space at the Willoughby Oak, and (2) Admiral Taussig Boulevard. A third area may be selected. The planting and ongoing care of these trees constitutes two companion projects to be included in the INRMP Projects Table (Appendix A). Tree planting will be followed by 2 years' maintenance by Environmental/Natural Resources for successful establishment, after which long-term maintenance will be provided (along with general grounds maintenance) under Facilities funds.

In support of the INRMP goals and objectives established in Section 1.3 for the protection of forested areas and urban tree canopy, as well as upholding the Navy's commitment to the Chesapeake Bay Program, NSN and CI will apply the following urban forestry management measures:

- **Management action: Maintain Tree City USA status with an annual forestry expenditure of at least \$2.00 per capita and through continual tree mitigation planting efforts.**
- **Management action: Develop a tree ordinance and management plan that focuses on the retention, care, mitigation, and improvement of existing forested areas, urban tree canopy, and significantly recognized trees.**
- **Management action: Achieve no net loss of tree canopy on the Installation in 5 years, and increase the overall tree canopy by 30% in future years.**
- **Management action: Establish a 2:1 mitigation ratio for tree removal and/or mortality associated with development.**
- **Project: CBPA NAVSTA/CI-Urban Tree Assessment, Mapping, & Preservation Plan**
- **Project: CBPA NAVSTA/CI-Native Tree Planting and Establishment**
- **Project: CBPA NAVSTA/CI-Native Tree Care**

Enhancing urban tree canopy through these projects and management actions will foster biodiversity at NSN and CI, with direct benefits to pollinator species, migratory birds, and VDGIF species of concern—to include the Eastern red bat and gray catbird.

3.6 FISH AND WILDLIFE MANAGEMENT

An important function of the natural resources management program is to maintain and enhance habitats that support wildlife species, including mammals, birds, herpetofauna, fish, and invertebrates. The basic objectives of fish and wildlife management at NSN and CI are to:

- conserve and promote conservation of game and nongame fish and wildlife and their habitats;

- balance wildlife population levels with habitat carrying capacity;
- minimize potentially harmful human-wildlife interactions; and
- provide recreational opportunities for Installation personnel, their dependents, retired military, and community members, as permitted by mission and safety constraints.

Due to the high level of development at NSN and CI and in the region, conservation and enhancement of remaining natural habitats is important to protecting Installation wildlife resources. Conservation efforts focus on maintaining existing natural habitats that provide year-round food and cover (such as coniferous stands and grassy fields) as well as seasonal food and cover (such as deciduous stands) for wildlife. Due to the inherent conflict between the presence of wildlife and the military mission of NSN, however, the Installation's management of wildlife must generally focus on discouraging and removing wildlife from areas where they would be likely to interact with humans, and limiting suitable habitat to less sensitive areas.

3.6.1 Migratory Bird Management

Applicable Legislation

The MBTA (16 U.S.C. §703–711) is the primary legislation in the U.S. established to conserve migratory birds. It implements the United States' commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. The MBTA prohibits the taking, killing, or possessing of migratory birds, their eggs, parts, and nests unless permitted by regulation. Nonnative species such as house sparrow, European starling, rock pigeon (*Columba livia*), and mute swan (*Cygnus olor*) are not protected by the MBTA. The species of birds protected by the MBTA appears in Title 50, Section 10.13, of the Code of Federal Regulations (50 CFR 10.13). On 02 December 2003 the President signed the 2003 National Defense Authorization Act. The Act provides that the Secretary of the Interior shall exercise his/her authority under the MBTA to prescribe regulations to exempt the Armed Forces from the incidental taking of migratory birds during military readiness activities authorized by the Secretary of Defense.

Congress defined military readiness activities as all training and operations of the Armed Forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Congress further provided that military readiness activities do not include the

- routine operation of installation operating support functions, such as administrative offices; military exchanges; commissaries; water treatment facilities; storage facilities; schools; housing; motor pools; laundries; moral, welfare, and recreation activities; shops; and mess halls;
- operation of industrial activities; or
- construction or demolition facilities used for the purpose described in the above two bullets.

The final rule authorizing DOD to take migratory birds during military readiness activities was published in the Federal Register on February 28, 2007. The regulation can be found at 50 CFR Part 21. The regulation provides that the Armed Forces must confer and cooperate with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects of a military readiness activity if it determines that such activity may have a significant adverse effect on a population of a migratory bird species.

The requirement to confer with the USFWS is triggered by a determination that the military readiness activity in question will have a significant adverse effect on a population of migratory bird species. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. A population is defined as, “a group of distinct, but coexisting individuals of the same species, whose breeding site fidelity, migration routes, and wintering areas are temporally and spatially stable, sufficiently distinct geographically (at some point of the year), and adequately described so that the population can be effectively monitored to discern changes in its status.” Assessment of impacts should take into account yearly variations and migratory movements of the affected species.

Migratory bird conservation relative to non-military readiness activities is addressed separately in a Memorandum of Understanding (MOU) developed in accordance with Executive Order 13186, signed 10 January 2001, “Responsibilities of Federal Agencies to Protect Migratory Birds.” The MOU between the DOD and the USFWS was signed on 21 July 2006. The MOU includes, but is not limited to, the following DOD responsibilities:

- obtaining permits for import and export, banding, scientific collection, taxidermy, special purposes, falconry, raptor propagation, and depredation activities
- encouraging incorporation of comprehensive migratory bird management objectives in the planning of DOD planning documents
- incorporating conservation measures addressed in regional or state bird conservation plans in Integrated Natural Resource Management Plans
- managing military lands and activities other than military readiness in a manner that supports migratory bird conservation
- avoiding or minimizing impacts on migratory birds, including incidental take and the pollution or detrimental alteration of the environments used by migratory birds
- developing, striving to implement, and periodically evaluating conservation measures for management actions to avoid or minimize incidental take of migratory birds, and if necessary, conferring with the USFWS on revisions to these conservation measures

Migratory Bird Management at NSN and CI

The program for management of migratory birds at NSN and CI provides data in support of programs including the USFWS’s North American Waterfowl Management Plan, USFWS’s Neotropical Migratory Bird Conservation, and Watchable Wildlife (DOD Partners in Flight

n.d.). During annual INRMP reviews, the Navy must report any migratory bird conservation measures that have been implemented and the effectiveness of the conservation measures in avoiding, minimizing, or mitigating take of migratory birds.

The DOD Partners in Flight (PIF) program develops cooperative agreements for implementing bird conservation programs and projects on military lands, facilitates communication and information sharing across geographic and political boundaries, and provides military natural resources professionals with the most up-to-date information on bird conservation. NSN can coordinate with, and seek assistance for the management of particular migratory and resident bird species from the PIF Northeast Working Group and the Bird Aircraft Strike Hazard Working Group, among others. In 2008, the DOD approved the Coordinated Bird Monitoring Plan. The objective of the plan, jointly designed by the DOD and USGS biologists and managers, is to provide a comprehensive approach for helping the DOD fulfill its responsibilities under regulations that pertain to migratory birds. The plan outlines procedures for insuring that bird monitoring and assessments address important issues for the DOD; follow accepted procedures for design, data collection, and analysis; and that the data is preserved in long-term archives. A Coordinated Bird Monitoring Database has been established by the USGS, and may be used by DOD installations for long-term storage of their bird monitoring data. This database will assist in the identification of species of concern on installations and the implementation of appropriate management strategies (DOD 2012b).

In support of the DOD PIF program and Coordinated Bird Monitoring Plan, NSN is obligated to carry out programs for the conservation of migratory birds that may occur on installation properties. NSN will conduct an annual bird monitoring study. This project is part of the overall migratory bird conservation program at NSN, and is designed to help ensure that the ecosystems upon which the migratory birds depend are appropriately managed to support biodiversity and ecological integrity of the Installation. Additionally, this project will support MBTA permit compliance and integrate bird/wildlife aircraft strike data for a more comprehensive analysis of aircraft risk and hazardous species. Meeting these requirements along with providing a conservation management program supports the Navy mission of ensuring healthy lands for long-term use of installations for military training and readiness activities. The primary purpose of this monitoring study is to contribute to DOD Coordinated Bird Monitoring to develop a comprehensive list of observed bird species, checklist of potentially occurring bird species (which will augment the species list that was compiled for this INRMP [Table E-3]), and quantitative analysis of bird strike and migratory bird take data.

In addition to participating in Coordinated Bird Monitoring, NSN plans to participate in the National Audubon Society Christmas Bird Counts and Breeding Bird Counts in order to obtain a comprehensive inventory of the species that occur regularly and transiently at the Installation and the Fuel Terminal. The NRM will also consult with the College of William & Mary's Conservation Biology Department for the status of active nests, reviewing the Virginia Bald Eagle Nest Locator in the Center for Conservation Biology's online mapping portal (<http://www.cbbirds.org/what-we-do/research/species-of-concern/virginia-eagles/nest-locator/>); as well as ground-truth the locations of bald eagle and osprey nest surveys on

the Installation and the Fuel Terminal with ground-based surveys. This will be an in-house activity.

- **Project: Department of Defense Coordinated Bird Monitoring**
- **Project: MBTA NAVSTA/CI-Migratory & Breeding Bird Surveys**
- **Management action: Conduct bald eagle nest surveys and monitoring as an in-house, ground based activity.**

Bird surveys conducted at NSN in preparation for this INRMP generated the following *management recommendations*:

- **Protect the small beach where the black skimmers were observed.**
- **Eradicate ALL feral cats.**
- **Try to retain the forested blocks on the southern portions of the Installation, such as the “Environmental Area.”**
- **Maintain the old (regrown) fields located away from the airfield;** they make excellent early successional habitat for birds such as prairie warbler and indigo bunting.
- **Protect the storm surge basin** (network of drainage ditches) in the open field in the northwest portion of the base, between the three-hole golf course and the marina, where yellow crowned night herons were observed. The areas maintained as grasses and shrubs could be expanded by setting back mowing an additional 5+ meters on each edge to allow native sedges and shrubs to grow, thus creating additional foraging habitat (Tetra Tech 2015c).

Bird surveys at CI found the Fuel Terminal to be a nice refuge amid a fairly developed to industrial landscape; nonetheless, the management of migratory birds could be improved by implementing the following *management actions*:

- **Maintain and enhance native natural habitats** (e.g., plant native, warm-season grasses in the open space areas currently maintained as lawn; plant marsh grasses along unhardened sections of shoreline).
- **Maintain the open edge and forest floor habitats** in the CI Western End Management Unit by taking action to control invasive species on a fine scale, applying targeted, species-specific control methods, before they spread extensively and form a dense understory.
- **Control nuisance wildlife** (e.g., fox, coyote, muskrat); their removal is likely to help limit natural predation of bird species.

Ospreys

Prior to the ban of dichlorodiphenyltrichloroethane (DDT) in the 1970s, osprey populations declined severely throughout the United States. In recent years, however, osprey populations have rebounded and are now common in the Tidewater region. Osprey nesting season begins

in April and continues until nestlings are fledged in July or August. At NSN and CI, ospreys nest on a variety of structures including towers and light poles, which creates a BASH concern. To discourage ospreys from nesting in these locations, NSN will retrofit light poles and other towers with anti-nesting devices.

As with all native migratory birds, ospreys are protected by the MBTA; no operations or maintenance may be performed on a structure if a nest is occupied, and no nest may be removed or damaged, except as permitted by USFWS and VDGIF. The 4 VAC 15-30-10 provides general protection for all native birds and their nests, eggs, and young, with the exception of species subject to legal harvest. Although osprey may be considered a nuisance species as defined by Code of Virginia §29.1-511, §29.1-100 specifically excludes state and federally protected species (VDGIF 2010). The NRM monitors nest activity and will inform public works personnel of nesting status if maintenance is required on any of the light poles or platforms that are occupied, or if consultation with USFWS and VDGIF is required for such activity.

Osprey Nest Relocation or Removal

Inactive Nests: An inactive nest is defined as a nest without any eggs or dependent (flightless) young and includes nests under construction. Inactive nests should only be removed if the nest or placement of the nest poses a threat to property integrity, human health, or safety. No authorization or consultation is required for removal of inactive nests from 16 September through 15 April, though affected landowners may call VDGIF or WS to informally consult on pending removals or relocations if they so desire. It can be very difficult to discern the status of a nest from below; thus, from 16 April through September 15, inactive nests should only be removed upon written confirmation of nest status (as inactive) by VDGIF or WS.

Active Nests: An active nest is defined as a nest containing eggs or occupied by dependent (flightless) young. All reasonable measures to protect an active nest until the young fledge must be considered before authorization to relocate or remove the nest is sought. Removal of active nests is generally not permitted, but a nest may be relocated or removed if it poses a direct threat to human health or safety or when the birds, nest, or eggs themselves are threatened unless they are moved. In rare situations, relocation or removal of a nest that merely constitutes a nuisance may be authorized if it interferes with the intended use of the structure.

Anyone seeking to have an active nest relocated or removed must contact VDGIF, USFWS, or WS in advance. To comply with Virginia law and VDGIF regulations, active nest relocation or removal may only be undertaken by an authorized federal, state, or local employee in the performance of their official duties as provided in 4 VAC 15-30-50, or by an individual authorized by USFWS for the nest removal. To comply with federal law, active nest relocation or removal may only be undertaken by an individual authorized by USFWS.

Due to the BASH threat posed by birds (especially large birds, like osprey) in the vicinity of Chambers Airfield, the Navy is partnering with the Illinois Department of Natural Resources (DNR) to translocate nestling osprey onboard or near NSN. This partnership is to support

osprey recovery efforts in Illinois where they are state-endangered species, while also reducing damage threats to property and aircraft safety. Translocation and hacking has been successful at re-establishing osprey as well as other raptors, including the peregrine falcon, bald eagle, and California condor (*Gymnogyps californianus*) in other parts of the country, described as follows. Four- to five-week old birds are relocated and placed in an enclosure, called a hack box, at desirable release sites away from their original location, where they remain while becoming familiar with their new surroundings. The birds are kept in the hack box isolated from human contact and fed daily until they are capable of flight (52–53 days old), at which time the hack box is opened and the birds are allowed to develop their flight skills and fledge naturally. Birds are banded prior to fledging, and fledged birds are fed and monitored daily to ensure they are successful in catching food on their own through time of migration (Illinois Department of Natural Resources 2012).

- **Management action: Retrofit light poles and other towers with anti-nesting devices.**
- **Management action: Monitor osprey nest activity and inform Public Works of nesting status if maintenance is required on any of the light poles or platforms that are occupied, or if consultation with USFWS and VDGIF is required for such activity.**
- **Management action: Translocate nestling osprey from NSN under a MBTA permit and provide to Illinois DNR for hacking (resettlement) in support of osprey recovery.**

Individuals interested in applying for a USFWS permit to remove or relocate an active nest may do so at:

<http://www.fws.gov/migratorybirds/mbpermits/ApplicationForms.html>

VDGIF's "Removal or Relocation of Osprey Nests in Virginia: A Guideline for Landowners" (June 2010) is available online at: <http://bewildvirginia.org/wildlifeplan/>

3.6.2 Bird/Animal Aircraft Strike Hazard

Reduction of hazards for bird and animal aircraft strikes is covered under the BASH Plan, which is included as an in-tact component of this INRMP. Refer to Appendix H for details on the issues and management measures comprised by the BASH Program. In support of the BASH Program, the Final CZMP for NSN Chambers Field provides management guidelines and maintenance heights for vegetation on and around the airfield, allowing for an adaptive approach, and offers guidance and management options that minimize BASH risk due to the removal of vegetative obstructions (Geo-Marine 2011). BASH reduction activities are primarily the responsibility of the airfield manager. The WS Wildlife Biologist conducts wildlife surveys, dispersal, and removal. The NRM attends quarterly BASH Working Group meetings in accordance with NAVSTANORVAINST 8020.1 to ensure coordination between the airfield manager, WS, PWD Norfolk, and the Norfolk Installation Environmental Program Director; coordinates with the WS and the NAVFAC Regional Game Warden

whenever reduction efforts relate to wildlife population controls; secures all environmental permits in cooperation with the Environmental Core Natural Resources office; and annually reviews the BASH Safety Program Plan, updating the plan every 5 years. The next update must be completed and implemented by 22 February 2017.

BASH-related projects identified in this INRMP under other sections and resources include invasive species control, migratory bird monitoring, nuisance wildlife control (e.g., resident goose round-up), osprey translocation, and recertification of the NRM as an airport biologist. To summarize, the BASH management measures proposed under this INRMP include:

- **Management action: Retrofit light poles and other towers with anti-nesting devices.**
- **Management action: Translocate nestling osprey from NSN under a MBTA permit and provide to Illinois DNR for hacking (resettlement) in support of osprey recovery.**
- **Management action: Attend quarterly BASH Working Group meetings in accordance with NAVSTANORVAINST 8020.1 to ensure coordination between the airfield manager, WS, PWD Norfolk, and the Norfolk Installation Environmental Program Director.**
- **Management action: Coordinate with the WS and the NAVFAC Regional Game Warden whenever reduction efforts relate to wildlife population controls.**
- **Management action: Secure all environmental permits in cooperation with the Environmental Core Natural Resources office.**
- **Management action: Annually review the BASH Safety Program Plan, updating the plan every 5 years.**
- **Project: SIKES NAVSTA/CI-Airport Biologist Certification**
- **Project: EO 13112 NAVSTA/CI-Invasive Species Mapping, Inventory and Control Plan**
- **Project: EO 13112 NAVSTA/CI-Invasive Species Control Treatments**
- **Project: Department of Defense Coordinated Bird Monitoring**
- **Project: SIKES NAVSTA/CI-Nuisance Wildlife Control**

3.6.3 Fisheries Management

Fishing

The Fish and Wildlife Conservation Act (Non-game or Forsythe-Chafee Act) of 1980 sets forth general management guidelines for fish and wildlife resources by encouraging all federal departments and agencies to utilize their statutory and administrative authority to conserve and promote conservation of non-game fish and wildlife, and their habitats. In addition, two other federal laws apply to the management of fish and wildlife resources: the Lacey Act of 1900, as amended by the Lacey Act of 1981, and the Magnuson-Stevens

Fishery Conservation and Management Act, as amended in 1996, and as reauthorized under the Magnuson – Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSA). It is DOD policy to allow fishing on military installations, provided that such activities are in accordance with DODI 4715.03, OPNAVINST 5090.1D (U.S. Navy 2014a), OPNAV M-5090.1 (U.S. Navy 2014b), and relevant state and federal regulations. At NSN, as the only fishing allowed is on the Sewells Point fishing pier, the Virginia Saltwater Recreational Hook & Line Fishing Regulations apply. Persons fishing on NSN are required to abide by gear and catch restrictions, and to obtain proper licenses in accordance with Virginia state law. Public fishing is prohibited on CI (Fleet and Industrial Supply Center 2008), however opportunistic fishing by CI employees is authorized when mission activities allow.

Fish Habitat

Fish habitat includes the substrate and benthic resources (e.g., submerged aquatic vegetation, shellfish beds, salt marsh wetlands), as well as the water column and prey species. As part of the MSA, the NMFS, in cooperation with regional fisheries management councils, establishes criteria for essential fish habitat (EFH) for managed species. EFH is designated to protect and conserve the waters and substrate necessary to fish, mollusks, and crustaceans for spawning, breeding, feeding, or growth to maturity. The Mid-Atlantic Fishery Management Council (MAFMC) identifies and defines the EFH for their managed species. The nearshore environment of NSN supports many fish species and has been designated as EFH for three of the species that were collected in the nearshore study (Tetra Tech 2016): black seabass, summer flounder, and windowpane flounder (Table 3-1, Appendix D).

The length distribution and lifestage of fish collected with designated EFH indicates the habitat use of NSN's nearshore waters throughout a species' life cycle. Black seabass are known as protogynous hermaphrodites, beginning life as females, then becoming males later in life, at around 229 mm (ASMFC 2009). Therefore, when black seabass mature at 190 mm, they are all females (ASMFC 2009). The fish collected in the nearshore survey, present in the spring and summer only, were all immature females. In the Mid-Atlantic, summer flounder spawn during the late fall while migrating from inshore waters in the warmer months to offshore waters in the winter (Packer et al. 1999). Half of summer flounder mature at 246 mm for males and 322 mm for females (Packer et al. 1999), so the fish collected in the fall and spring were juveniles, with the possibility of mature fish. Windowpane flounder mature at 305 mm (New Hampshire Fish and Game 2015), so the individual collected in the fall was a juvenile.

The MSA protects EFH by requiring all federal agencies to consult with the NMFS on all actions or proposed actions that are either permitted, funded, or undertaken by the agency, and that may adversely affect EFH. An adverse effect means any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct (e.g., contamination, physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site-specific, or habitat-wide impacts including individual, cumulative, or synergistic consequences of actions. Analysis of adverse effects to EFH under the MSA should focus on impacts to the habitat for all life stages of species with designated EFH, rather than individual responses of fish species.

In order to conduct an EFH consultation with the NMFS, the federal agency must submit an EFH assessment, which describes the proposed action; analyzes the effects of the action on EFH, the managed species, and associated species; and provides the agency's conclusions regarding the effects of the action on EFH. As part of the consultation, the NMFS will provide recommendations (if applicable) for the proposed mitigation: how the agency can avoid, minimize, or offset impacts on EFH. Importantly, the recommendations from the NMFS are only advisory—agencies are still authorized to act in contravention to the recommendations, though they must justify their actions in writing. The Navy Policy Regarding Essential Fish Habitat Assessments and Consultations (OPNAV M-5090.1 [U.S. Navy 2014b]) was updated in March 2011 to align with the compliance requirements of the MSA and contribute to consistency in EFH consultations across the Navy.

The NMFS, Greater Atlantic Regional Fisheries Office, has developed a worksheet to assist federal agencies in evaluating the impact of their actions on EFH and determining the magnitude of those impacts.

The EFH Assessment Worksheet for Federal Agencies (modified 3/2016) is available online as an interactive form at <https://www.greateratlantic.fisheries.noaa.gov/habitat/efh/assessworksheetfinal.pdf>.

Completion of the EFH Assessment Worksheet will assist the agency in determining whether a consultation is necessary. The worksheet may serve as the EFH Assessment if NMFS determines that there are no adverse effects to EFH; or it may be used as a guideline for development of either an abbreviated or an expanded EFH consultation, depending on the federal EFH determination.

The NOAA Habitat Conservation Division website, <http://www.greateratlantic.fisheries.noaa.gov/habitat/> contains information that is helpful for the completion of the worksheet, including: a description of the EFH consultation process; *Guide to EFH Designations*, which provides a geographic species list; *Guide to EFH Species Descriptions*, which provides the legal description of EFH as well as important ecological information for each species and life stage; and other EFH reference documents including examples of EFH assessments and EFH consultations.

SAV is considered to be of extremely high habitat value to commercially and recreationally important species of fish and shellfish, and is considered to be the primary settling habitat for young blue crabs and other invertebrates in the Chesapeake Bay. To protect and improve fish habitat on the Installation, NSN will implement a project to restore SAV beds in the nearshore area around NSN (as described in Section 3.3.3), and will continue monitoring the health and distribution of SAV to determine how successful these efforts are.

➤ **Project: SIKES NAVSTA/CI-Plant Nearshore Emergent and Aquatic Vegetation**

Specific management measures for the benefit of the Atlantic sturgeon are covered under Section 3.7, *Threatened and Endangered Species Protection*.

Shellfish Management

Although macroinvertebrates were not quantified and measured in the nearshore survey, it is worth noting the occurrence of several species. Blue crabs, present year-round in nearshore waters, are harvested commercially, generating over \$23 million (NOAA 2015c). A commercial industry also exists for crabs in general, which is valued at \$238,861 (NOAA 2015c). Horseshoe crabs, present in nearshore waters in the fall, support a fishery that generated \$339,162 in 2014 (NOAA 2015c). Other invertebrates like shrimp and polychaetes are expected to provide an important prey resource to larger invertebrates and fish.

As described in Section 3.3.3, oyster reefs are an important resource in the Chesapeake Bay which provide ecosystem benefits including water quality and habitat/shelter for many types of marine species. NSN will undertake efforts through partnerships or cooperative services agreements to enhance oyster populations in the nearshore area around NSN.

- **Project: SIKES NAVSTA/CI-Nearshore Oyster Reef Restoration (Cooperative Services Agreements)**

3.6.4 General Fish and Wildlife Management

In 2000 Congress began to provide annual funding to supplement existing state fish and wildlife conservation programs. Along with this funding came the responsibility of each state and territory to develop a Comprehensive Wildlife Conservation Strategy—an Action Plan for wildlife—by 1 October 2005.

The Virginia SWAP was adopted in 2005. This SWAP includes an evaluation of the location and relative abundance of wildlife and the habitat required to support these species; an assessment of problems facing Virginia species and habitats; recommended conservation actions to address these problems; research and survey needs; and monitoring program and needs. The SWAP also identified 925 species of greatest conservation need in Virginia, 60% of which are aquatic, 70% of which are invertebrates. These species are further grouped into four tiers of relative conservation need: critical (I), very high (II), high (III), and moderate (IV).

The Virginia State Wildlife Action Plan is available for viewing and downloading at:
<http://bewildvirginia.org/wildlifeplan/>

The SWAP identifies the six ecoregions of Virginia, and identifies species for each ecoregion that are of greatest conservation need, outlines their life history, location and relative condition of habitat, specific threats and trends, conservation actions and strategies, and research and monitoring needs. Of the 18 Tier I (critical conservation need) species that have the potential to occur, two bird species have been observed at NSN—Wilson’s plover and peregrine falcon; two bat species have been observed at NSN—Rafinesque’s eastern big-eared bat and the tri-colored bat, the latter of which was also identified at CI; and the Atlantic sturgeon is present in the nearshore area. Of the 19 Tier II (very high concern) species that have the potential to occur, six have been observed at NSN—American black duck,

American oystercatcher, American woodcock, black skimmer, common tern, and yellow-crowned night-heron—and none at CI. Of the 34 Tier III (high concern) species that have the potential to occur, seven have been observed at NSN and two at CI. Of the 132 Tier IV (moderate) species that were identified, seventeen have been observed at NSN and nine at CI (VDGIF 2005). In total, of the 11 SWAP Tier I and II species present at NSN, 8 are birds, 4 are bats, and 1 is a fish (Atlantic sturgeon). The only SWAP Tier I or II species confirmed present at CI is the tri-colored bat. Management measures for birds are covered under Section 3.6.1; management measures for the Atlantic sturgeon and for listed bat species are discussed in Section 3.7. All of the species of conservation concern identified in the SWAP that have been observed or have the potential to occur at NSN and CI are identified in Table E-3 (Appendix E).

Birds and bats were the only wildlife species surveyed at NSN and CI in 2015. An in-house survey of deer conducted in October 2015 documented 33 deer at CI. Monitoring of game animals, non-game animals, and nuisance wildlife species will continue forward as a necessary management action to prevent human-wildlife interaction. Controlled management deer hunts may be necessary to maintain a healthy and safe deer herd on CI. Aside from these groups, the verified fauna species lists for the two facilities date back 20 years or more. NSN intends to bring these lists up-to-date by conducting fish and wildlife surveys at both NSN and CI. Surveys may be conducted in-house, contracted out, or done by a partnering organization.

The DOD PARC program is currently updating herpetofauna species lists for the approximately 80 Navy installations that have INRMPs (NAVFAC Mid-Atlantic 2013). To date, Navy installations within the NAVFAC Field Engineering Command Washington, Mid-Atlantic, Mid-West, and Northwest areas of responsibility have been updated. Once all the updated species lists are completed, they will be entered into a database that will be stored on the Navy Environmental Portal (<https://eprportal.cniv.navy.mil/eprwebnet/logon.aspx>). The database will provide accurate and up-to-date lists of amphibian and reptile species in support of future data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions. With this finalized INRMP in-place, NSN will be eligible to have a herpetofauna and microhabitat inventory completed via PARC.

Natural resources management strategies and recommendations included in this INRMP also satisfy the goals and objectives of the Virginia SWAP in conserving the state's natural resources for future generations. In addition to the bird surveys included in Section 3.6.1, the following wildlife management measures are planned:

- **Management action: Continue to monitor game animals, non-game animals, and nuisance wildlife species to prevent human-wildlife interaction.**
- **Project: SIKES NAVSTA/CI-Vertebrate Species Surveys**
- **Project: Department of Defense PARC Herpetofauna and Microhabitat Inventory**

3.7 THREATENED AND ENDANGERED SPECIES PROTECTION

The VDCR-DNH is responsible for maintaining the rare plant inventory, database maintenance, and protection and management of Virginia's natural heritage resources. These resources include habitats of rare, threatened, or endangered plant and animal species; state significant communities; and other natural features. Because federal and state lists of threatened and endangered species change over time, careful tracking and periodic field surveys are needed to confirm the occurrence of rare species on the Installation. The VDCR-DNH tracks the current status of natural heritage resources in a database that is available on its website.

No federally listed plant species have been documented at NSN or CI, and no plant species that are considered very rare or rare in Virginia (including state-listed, proposed, or candidate species) are known to occur at NSN and CI.

The VDCR-DNH natural heritage resources database is available for viewing and downloading at: http://www.dcr.virginia.gov/natural_heritage/dbsearchtool.shtml

No federally listed animal species have been confirmed on Installation property at NSN or CI, but the federally endangered Atlantic sturgeon has been detected in the nearshore area of NSN, and the state-endangered Rafinesque's Eastern big-eared bat was detected in the 2015 bat acoustic surveys at NSN. In order to maintain compliance and ensure the INRMP has a comprehensive list of the protected species that occur at NSN and CI, threatened and endangered species inventories (for various species) are planned when deemed necessary.

➤ **Project: 1 S NAVSTA/CI Threatened & Endangered Species Inventories (Various Species)**

Projected climate change impacts to natural resources, as described in Section 2.1.1, could result in significant impacts to threatened and endangered species and their habitats. The effects of climate change on wildlife are highly variable, including geographic range shifts, changes in relative species abundance, phenology, and other ecological aspects of their biotic communities. There is already evidence of disruptions in community dynamics, such as predator-prey and plant-insect interactions, alterations in biogeochemical cycles, and increased disease, pest, and non-native species invasions. The rapid pace of recent environmental change has increased the threat of extinction, as species are not able to adapt to changing environments quickly enough. Specific climate change stressors that can impact threatened and endangered species include increases in sea level; increases in surface and ocean temperatures; increases in carbon dioxide concentrations; changes in precipitation; increases in diseases, pests, and non-native species; and increases in the frequency and severity of storm events (Society for Ecological Restoration International 2009).

Atlantic Sturgeon

In the Navy's 2015 telemetry surveys across the Chesapeake Bay, the Atlantic sturgeon was detected in the nearshore area of NSN, as well as in the Elizabeth River south of CI. All five

DPS's of the Atlantic sturgeon have been federally protected under the ESA since 2012 (77 FR 5880–5912), and the Chesapeake Bay DPS is listed as federally endangered, which means it has been deemed in danger of extinction throughout all, or a significant portion of, its range. In accordance with the ESA, NSN must protect and help recover any federally listed threatened and endangered species that occur on installation lands or waters. Further, NSN must avoid “taking” any listed species. Under the ESA, “take” includes harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting any threatened and endangered species, or attempting to do so. Staff at NSN is required to consult with NMFS staff in advance of any activity that may adversely affect Atlantic sturgeon. In such cases, the agency will work with installation staff to prevent or reduce takings, and, if appropriate, will issue an incidental take permit.

Atlantic sturgeon are anadromous; adults spawn in freshwater in the spring and early summer and migrate into estuarine and marine waters where they spend most of their lives. In some southern rivers a fall spawning migration also occurs, as evidence indicates is the case for the James River spawning population located closest to NSN (Hager 2015). They spawn in moderately flowing water (46–76 cm/s) in deep parts of large rivers. Sturgeon eggs are highly adhesive and are deposited on bottom substrate, usually on hard surfaces (e.g., cobble). It is likely that cold, clean water is important for proper larval development. Once larvae begin migrating downstream, they use benthic structure (especially gravel matrices) as refuges. Juveniles usually reside in estuarine waters for months to years. Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (10–50 m depth) nearshore areas dominated by gravel and sand substrates. Long distance migrations away from spawning rivers are common (NOAA 2015a).

Threats to the already depressed populations of Atlantic sturgeon include habitat degradation, vessel strikes, and being accidentally caught and potentially injured or killed by fishermen. Dredging, which occurs throughout the Chesapeake Bay DPS, can cause mortality by impingement or entrainment, and has the potential to displace sturgeon while it is occurring and affect the quality of the habitat afterwards by changing the depth, sediment characteristics, and prey availability (NOAA n.d.). Construction and development (e.g., bridge construction and repair, wastewater treatment, and water withdrawals) can also negatively impact sturgeon habitat (NMFS 2016). Water quality has also been degraded in areas throughout the range of the Chesapeake Bay DPS as a result of industrial run-off and the damming of some rivers. Dredging is a mission-critical activity at NSN and CI to maintain the slips and approach areas at appropriate depths for ship berthing, so reducing dredging around the Installation and the Fuel Terminal would be counter to the military mission.

Instead, the Navy can benefit the Atlantic sturgeon by implementing the management measures prescribed in this INRMP for the protection of water quality, improvement of nearshore habitat, and reduction of run-off. In accordance with Section 4(a)(3)(B)(i) of the ESA covering military lands, NSN and CI can be excluded from designation as Atlantic sturgeon critical habitat; refer to Section 5.2 (Natural Resources Consultation Requirements) for detail on this process. In June 2016, NMFS proposed to designate critical habitat for the Chesapeake Bay DPS in five river systems, including the James River from Boshers Dam

downstream for 160 river kilometers to where the main stem river discharges at its mouth into the Chesapeake Bay at Hampton Roads (NOAA 2016a); the southern extent of this length is due just northwest of NSN, but the proposed critical habitat for the New York Bight and Chesapeake Bay DPSs of Atlantic sturgeon does not overlap either NSN or CI [Bullard 2016, Murray-Brown 2016]. Military lands of installations with existing INRMPs were explicitly excluded from the critical habitat listing. Although NSN and CI are situated just outside the Atlantic sturgeon's proposed critical habitat boundary, implementation of this INRMP does nonetheless provide a benefit to the species and its habitat. NMFS recognizes that the NSN and CI INRMP provides a conservation benefit to the Chesapeake Bay DPS of Atlantic sturgeon by specifically providing for water quality protection via erosion and sediment control; wetland protection; monitoring of non-point source pollution; protection of watersheds from hazardous materials; use of environmentally beneficial landscaping; and rehabilitation of coastal habitat through the planting of emergent and aquatic vegetation, restoration of oyster reefs, and establishment of living shorelines. These management actions and projects provide additional benefits to other protected marine species such as the loggerhead sea turtle (and other protected sea turtles) that may use the lower rivers of the Chesapeake Bay for foraging habitat. In addition to the conservation benefits described above, the Navy can ensure the continued protection of these threatened and endangered marine species by considering the potential effects of ongoing and planned actions with regard to loss of prey, increased vessel traffic, and the effects of underwater sound pressure waves (Murray-Brown 2016).

Tri-colored Bat and Rafinesque's Eastern Big-Eared Bat

Two state-endangered bats, the tri-colored bat and Rafinesque's eastern big-eared bat, were identified at NSN by manual call analysis. While these are the only two protected bat species whose presence was confirmed during the 2015 bat acoustic surveys at NSN and CI, bat acoustic analysis software also auto-classified calls recorded during these surveys as the northern long-eared bat (federally threatened species), the gray bat (federally endangered and state endangered), and the little brown bat (state endangered). These species were not confirmed upon manual analysis, and were determined not likely to be present at NSN; however, more comprehensive surveys are warranted to definitively determine which bat species are present at the Installation. Bat species with *Myotis* call traits are very difficult to definitively distinguish/identify acoustically if not accompanied by mist netting.

White-nose syndrome has caused precipitous declines in numerous bat species across Virginia and the eastern United States, leading to the addition of the tri-colored bat and little brown bat to Virginia's endangered species list. Research designed to understand the spread of white-nose syndrome in Virginia confirmed the continued decline of the little brown bat and tri-colored bat, the two most common cave hibernating bat species. VDGIF assisted the USGS National Wildlife Health Center with a study to look at the persistence of white-nose syndrome fungal spores in caves and mines in the eastern United States, and found that tri-colored bats population was decimated in 4 short years, from a high of 388 individuals in 2009 to only 42 in 2012—a decline of almost 90% (VDGIF 2012).

Recommended projects for the protection of the tri-colored bat, Rafinesque's eastern big-eared bat, and other protected bat species that may possibly be present at NSN and CI, include (1) implementing additional surveys for bats, with a combination of passive acoustic surveys and mist-netting; and (2) building bat houses away from the Airfield Operations Area. Annual bat monitoring, along with regular acoustic surveys, could help natural resource managers better understand which species occur on the Installation, when and where they occur, and how their population numbers are changing through time. Mist-netting would allow properly trained wildlife biologists to not only definitively identify which species are present, but would also provide an opportunity to check for signs of white-nose syndrome in the local bat population. As bat surveys and monitoring continue, the NRM will keep VDGIF apprised on the list of confirmed species. If any listed bat species were documented at either NSN or CI, the NRM would coordinate with VDGIF and USFWS to ensure the protection of those species and their habitats.

- **Management action:** Erect bat houses in the West End of CI.
- **Project: 1 S NAVSTA/CI Threatened & Endangered Species Inventories. Sub-component: Bat surveys, with a combination of acoustic surveys and mist-netting** should be included in this inventory in order to determine whether the northern long-eared bat, gray bat, or little brown bat, occur, and to monitor the seasonal presence of the Rafinesque's eastern big-eared bat and the tri-colored bat.

3.8 HABITAT CONSERVATION AND RESTORATION

Extensively developed and built primarily on reclaimed landfill, NSN and CI have very few truly natural habitats to conserve, however biodiversity concepts can be applied to the NSN urban ecosystem while also adhering to BASH requirements for mitigating the presence of hazardous wildlife species (Savard, Clergeau, and Mennechez 2000). Due to the omnipotent need to consider BASH requirements, habitat conservation and restoration opportunities must be targeted and specialized areas away from the Airfield Operations Area, such as the "Environmental Area" in the southeastern corner of NSN, green corridors of planted trees or patches of unmowed grasses within the developed areas, riparian edge along Mason Creek, the nearshore areas, and wetlands located outside of the clear zone.

3.8.1 Beneficial Landscaping

Direction for grounds maintenance and urban forestry at NSN and CI comes from several sources. Foremost is EO 13148, *Greening the Government through Leadership in Environmental Management*. This EO requires federal agencies to incorporate the principles and practices of beneficial landscaping as specified in the Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds (60 FR40837). Specifically, federal projects are required, to the extent practicable, to implement the following guidelines:

- use regionally native plants, including plants that will attract pollinators;
- use construction practices that minimize adverse effects on the natural habitat;

- reduce fertilizer and pesticide use;
- use water-efficient practices; and
- create outdoor demonstrations to promote awareness of the environmental and economic benefits of beneficial landscaping.

The preferential use of regionally native plant species over nonnative species is particularly important as they are generally better suited for local site conditions and reduce the need for intensive maintenance and use of fertilizers and pesticides. Native plant species also are less likely to become invasive pests than nonnative species and can serve as better sources of food and cover for native wildlife. The overuse of nonnative species, such as Bradford pear (*Pyrus calleryana*) and crepe myrtle (*Lagerstroemia indica*), is not consistent with beneficial landscaping practices and should be avoided. These species offer few environmental benefits and, in the long run, increase maintenance costs because of pruning and care requirements. A list of native landscaping species suitable for the Tidewater region of Virginia is in Appendix G.

The specifications for planting, mowing, edging, mulching, weed control, use of fertilizers, pesticides, and herbicides, etc., are laid out in NSN's Grounds Maintenance Plan. As the Installation has expanded, it has been a priority to avoid development on soils that are classified as Class I or Class II; these are the few remaining undisturbed natural soils and are the most productive and economical for designation as "green areas" in support of the long-term goal of "no net green loss" (Environmental Management Commander, Naval Base Norfolk 1997). As described in Section 2.2, the only Class I soils on the Installation are in the Magazine District, and Class II soils are found in the Central Campus; according to the NSN *Master Plan*, the Open Space System planned for those districts coincides with the areas where those soils are located (NSN 2011). NSN recognizes the high risk of surface run-off contributing to non-point source pollution of the Chesapeake Bay watershed, and has accordingly made efforts to reduce chemical applications. Increasing the permeability of surfaces by converting asphalt to grass, mulch, or even artificial permeable surfaces would greatly reduce run-off, and would also help minimize the heat island effect of NSN.

Fescue (*Festuca* sp.) and Bermuda grass have long been the preferred grasses at NSN and CI, due to their hardiness, resistance to disease and drought, and lower growing height, requiring less frequent mowing. However, planting native, warm-season grasses in the open space areas currently maintained as fescue lawn would provide multiple ecological and economic benefits including: (1) increase the available grassland habitat for birds outside of the Airfield Operations Area; (2) decrease the amount of grounds maintenance required (e.g., reduced mowing costs); and (3) boost the ability of soils to absorb surface runoff. The area referred to as "Site 2" in the Magazine District—an old landfill that is capped and needs to be maintained as lawn—would be a particularly good site to plant warm season grasses. In addition, that area borders other early successional habitat and would create and an excellent continuation of breeding bird habitat (see photo below). To ensure that conflicts with the military mission are avoided, this project would be coordinated with the WS BASH Program.



NSN Site 2: lawn identified for planting warm season grasses

Another potential area suitable for the planting of warm-season grasses would be the area where the yellow-crowned night heron was observed (location marked on Figure 2-11). Currently this area serves as a storm surge basin and has a network of ditches bordered by grasses and shrubs (see photo below). Warm season grasses could be planted in this area to facilitate uptake of water and to reduce maintenance. Additionally, this project transitioning from non-native to native grass species could also be applied to the open, grassy areas at CI.



Grass habitat of the NSN storm surge basin

The conversion of grass lawn areas into breeding bird habitat would be a great example of applying biodiversity concepts to the urban ecosystem. Additional examples of landscaping management practices that would support biodiversity at NSN and CI include: the extension and consolidation of “green” vegetation corridors, linking parks when possible and making use of natural streams and rights of way; the identification of important areas for sensitive

species (e.g., birds and bats); increasing the volume and diversity (including structural diversity) of vegetation along streets and in industrial, recreational, and residential sectors; and planting conifers and fruit trees in targeted areas (i.e., away from the Airfield Operations Area) to provide cover and food for birds (Savard, Clergeau, and Mennechez 2000).

Vegetation surveys conducted at NSN in preparation for this INRMP found that wetland habitats at the Installation that could possibly provide habitat for state species of interest such as yellow-eyed grass (*Xyris* sp.), but frequent mowing limits plant growth in these areas (including the wet edge along Patrol Road). The wetland pond along Bellinger Boulevard could also potentially support more diverse wetland herbaceous species and amphibian species if mowed less frequently; many tree frogs (*Hyla* sp.) were observed in the few tall sedges that remained after mowing in September 2015. To the extent that these areas can be allowed to grow longer without increasing BASH concerns, the habitats and the species that utilize them would benefit.

In summary, the management measures pertaining to beneficial landscaping that are planned under this INRMP include:

- **Management action: Increase the permeability of surfaces by converting asphalt to grass, mulch, or even artificial permeable surfaces.**
- **Project: SIKES NAVSTA/CI-Establish & Maintain Warm Season Grass Areas**
- **Management action: Reduce mowing frequency of wetland edge habitats (where possible) to increase plant diversity and improve available amphibian habitat.**

3.8.2 Pollinators

Recently, the Navy has recognized the important ecological role played by pollinators, and has encouraged installations to foster pollinator habitats. As a group, pollinators are threatened worldwide by habitat loss and fragmentation, pesticides, disease, and parasites (USDA-NRCS n.d.). According to the USDA-NRCS, native pollinators are attracted to diverse, colorful floral sources that provide a succession of flowers; however, bees prefer to visit multiple flowers of the same type on one trip, so it is important to plant in clusters or with individuals of the same species nearby one another. Providing flowers of different shapes will attract pollinators with different body sizes and mouthparts. Use of native plants is preferable since these are usually adapted to Virginia's growing conditions and native pollinators evolved with these plants.

Small blocks of unmowed or mowed open green space at NSN and CI will be considered for establishing pollinator habitat. Plants will be selected based on their tolerance for the conditions present in a particular location. For example, swamp milkweed can grow well in damp, well-drained soil, such as may be found around drainage ditches.

- **Project: SIKES NAVSTA/CI-Establish & Maintain Pollinator Habitat Areas**

More information on habitat development for pollinators, including recommended plant species for the Mid-Atlantic Region, is available at <http://www.xerces.org/fact-sheets/>.

3.9 INVASIVE SPECIES AND PEST MANAGEMENT

The primary objective of invasive species and pest management at NSN and CI is to prevent interference with military operations and preparedness by protecting infrastructure, real property, and human health and safety. The Armed Forces Pest Management Board Technical Information Memorandum Number 37 assigns responsibility for human health and safety to the CO. Each installation should develop a CO-approved Integrated Pest Management Plan, which describes the requirements, resources, responsibilities, and procedures for pest management throughout the region. For this INRMP, pest management includes management of nuisance wildlife and invasive plant species.

The Armed Forces Pest Management Board has useful information about DOD pest management policy and issues on their website: <http://www.afpmb.org/>

In accordance with the Navy's Pest Management Programs (OPNAVINST 6250.4C), the Pest Management Plan will employ IPM principles to avoid and minimize use of pesticides. The objective of IPM is to use ecologically, economically, and socially sound strategies to keep pests at tolerable levels. In IPM the full range of pest control options (cultural, mechanical, biological, and chemical) may be employed after careful consideration of the pest's biology, the damage or infestation thresholds that require action, and the impacts each control alternative will have on the environment. A variety of biological, cultural, and mechanical pest management strategies used in IPM are included in the following discussions of the major types of pest issues occurring at NSN and CI. The NRM will seek training in these IPM methods for the oversight of the management of all types of pests (i.e., nuisance wildlife, invasive species, insects, etc.) by taking the DOD Integrated Pest Management Coordinator Course.

- ***Project: SIKES NAVSTA/CI – DOD Pesticide Applicator Certification***
- ***Project: SIKES NAVSTA/CI – Integrated Pest Management Coordinator Course***

3.9.1 Nuisance Wildlife

DOD's Armed Forces Pest Management Board defines nuisance wildlife as wildlife that, because of their feeding or nesting habits, interferes with the military mission or well-being of domestic animals, other wildlife, or humans (Armed Forces Pest Management Board 2012). Authority and responsibility for nuisance wildlife resides with the regional pest controller. Large trapping efforts are best handled initially by pest control with follow-up

maintenance trapping if needed. The Installation NRM or the appointed delegate maintains the permits necessary for controlling species protected by federal or state law. Potential nuisance wildlife problems at NSN and CI include feral animals, Canada geese (*Branta canadensis*), fox, and other waterfowl, and miscellaneous vertebrate species. Regardless of the type of nuisance animal that may occur at the Installation, the standard DOD-authorized IPM methods, in accordance with DODI 4150.07, should be employed to control the individual pest(s) and limit the population, for example: prohibiting feeding, enforcement, habitat modification, and population management.

Pursuant to 4 VAC 15-20-160 the following mammal and bird species are designated as nuisance species: house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), black rat (*Rattus rattus*), coyote (*Canis latrans*), feral hog (*Sus scrofa*), nutria (*Myocastor coypus*), woodchuck (*Marmota monax*), European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), and rock pigeon (*Columba livia*). Other nonnative species as defined in the Migratory Bird Treaty Reform Act of 2004 and regulated under 50 CFR 10.13 also are included as nuisance species.

VDGIF defines nuisance wildlife in 4 VAC 15-20-160, and lists those species that are considered by the State of Virginia as nuisance species; however, feral animals, Canada geese 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.*” NSN needs to remove wildlife species from the Installation when human-wildlife interactions pose a risk to human health and safety. To ensure compliance with this law, any nuisance wildlife removal or control activities performed by the environmental staff at NSN and CI will be coordinated with VDGIF as necessary, to make certain that methods employed do not violate Virginia State law.

- **Management action: Coordinate any removal or control of nuisance wildlife with VDGIF and the NAVFAC Regional Game Warden.**

Feral Animals

Pets that have been abandoned or left behind by owners often become serious pests on military installations, especially when they have not been neutered or spayed. Reproduction of these strays leads to exploding populations of feral animals, which are a health and safety risk for Installation personnel and threaten wildlife populations—especially migratory birds. Feral cats in particular are an ongoing management issue at NSN. While feeding of feral cats is against Navy policy, it also poses a BASH issue because the food attracts gulls, geese, foxes, vultures, raccoons, and other scavengers.

The CNO Policy Letter of January 2002 on Preventing Feral Cat and Dog Populations on Navy Property identifies the Navy policy on feral animals. In accordance with this policy, the Installation must adopt proactive pet management procedures that prevent the establishment of free-roaming cat and dog populations. Additionally, the Installation must ensure the humane capture and removal of feral cats and dogs, and every effort should be made to find

homes for adoptable animals. At NSN, captured feral animals are taken to the local animal control facility. A formal MOU was established in 2016 between the Norfolk Society for the Prevention of Cruelty to Animals (SPCA), NSN, and CNRMA, for the control of NSN's feral cat population. This pilot program enlists the assistance of trained and authorized volunteers of the Norfolk SPCA to coordinate the humane capture of feral cats on NSN, and to receive, transport, and house the animals until they may be transferred to the SPCA for treatment and ultimate placement in permanent homes. The involvement of such volunteers ensures that the SPCA will not be overburdened by an overwhelming influx of cats from NSN; however, close coordination with the receiving facility is important to ensure the continued success of this operation. If the collection of NSN's feral cats were found to be overly taxing on the SPCA, they could, alternatively, be humanely dispatched upon their capture.

NSN also controls feral cat populations by encouraging responsible pet ownership and limiting access to food and shelter for strays. Partners in this effort include Norfolk Animal Control, the SPCA, and NSN Pest Services. Vaccination, registration, and tags are required for every pet on the Installation. Spaying and neutering are promoted through educational programs, and all pets are required to be kept under strict supervision. The NRM provides pet and wildlife information to Installation personnel through the regional outreach specialist.

The feeding of strays is prohibited, and all dumpsters have to be secured. Feeding (intentional and accidental) further encourages feral cats to remain in areas frequented by people, and attracts additional nuisance wildlife species. On Sewells Point, where cats congregate around (illicit) feeding spots, they are a threat to the bird species of conservation concern, including the black skimmers that inhabit the beach adjacent to the area in the spring and early summer, and could possibly nest there. To abate this problem, the Installation has posted and maintains a number of signs around the waterfront area and Sewells Point; signs have been posted as well in the Willoughby residential neighborhood, where the feeding of feral animals is also a common problem. Nonetheless, signs posted are not effective at stopping sympathetic people from feeding the cats. Better education is needed about the danger the cats impose to rare migratory birds, and NSN needs to have an enforceable anti-feeding policy, with better enforcement as identified by Article 92 of the Uniform Code of Military Justice.

- ***Management action: Develop an enforceable policy to prohibit feeding of feral cats at NSN.***

Canada Geese

Resident Canada geese are a nuisance wildlife species at NSN and CI. High fecundity, low mortality, and desirable habitat have concentrated geese populations on the Installation. Geese graze on short grasses such as those found in parks, lawns, or golf courses and prefer feeding sites with open vistas and access to lakes and marshes. Large numbers of birds raise the potential for epizootic waterfowl diseases, pose a sanitation problem, and damage valuable turf. Additionally, this species poses a bird-aircraft strike hazard for Chambers Field and helicopter pads.

A combination of techniques is generally required to achieve optimal control of resident Canada geese populations, including erecting barriers, hazing, and habitat alteration. Specific tactics that may be used at NSN and CI include increasing vegetation height around lakes and ponds, hazing, oiling or addling eggs, and geese roundups. These activities are authorized under 50 CFR 21.49, the control order for resident Canada geese at airports and military airfields, when necessary to resolve or prevent threats to public safety from resident Canada geese. Authorized control and management activities include indirect and/or direct control strategies such as trapping and relocation, nest and egg destruction, gosling and adult trapping and culling programs, or other lethal and non-lethal control strategies. The Installation NRM or the appointed delegate maintains the required permits. The WS occasionally conducts Canada geese roundups in accordance with the BASH Plan (Appendix H) in the vicinity of Chambers Field to control their populations due to the potential for bird-aircraft strikes; these roundups are conducted via contract because the WS staff onboard NSN are not funded for this activity. Egg addling was previously used as a control measure for Canada geese, and was performed as recommended by the Humane Society of the United States (Humane Society of the United States 2009).

Feeding (intentional and accidental) further encourages resident Canada geese and other waterfowl to remain in areas frequented by people. To abate this problem, the Installation has posted signs in problem areas to discourage the feeding of waterfowl. These signs serve to educate residents and employees on the ecology and habits of waterfowl and the importance of not feeding the birds. Any measures used to control the population of resident Canada geese at NSN and CI will be conducted in accordance with the MBTA and Virginia State law and implementing regulations at 50 CFR 21.49.

- **Management action: Maintain required permits for management and control of the resident Canada goose population, and conduct activities in accordance with the MBTA, Virginia State law, and the regulations at 50 CFR 21.49.**
- **Management action: Maintain posted signs in problem areas to discourage the feeding of waterfowl.**
- **Project: SIKES NAVSTA/CI – Nuisance Wildlife Control**

The U.S. Department of Agriculture Animal and Plant Health Inspection Service website provides additional guidance on wildlife damage assessment, including management of nuisance wildlife at: http://www.aphis.usda.gov/wildlife_damage/index.shtml

Miscellaneous Vertebrates

Aside from feral cats and geese, the major vertebrate pests at NSN are fox, coyotes, pigeons, and starlings. A number of vertebrate species such as raccoon, squirrels, mice, rats, skunks, and opossums can also be considered nuisance pests in and around buildings at NSN. Capture and relocation of native wild mammal species is not allowed by Virginia state law (VA §29.1-521). Therefore lethal control methods will be used, but only if there is imminent danger to Installation personnel, or if the species present is damaging structures, disrupting

the military mission, causing a severe nuisance, or is otherwise intolerable. Animals that are attracted to open fields, or that have a wide roaming range, like foxes, are considered a wildlife hazard to the airfield and lethal controls (e.g., euthanization) must be used. To control the fox population, a collaborative effort between the WS Wildlife Biologist, Pest Management personnel, and Natural Resources personnel have had to resort to trapping and culling.

At CI, foxes pose a similar problem, and coyotes and muskrats are also nuisances. When reported present, these species must be eradicated from the area by trapping and euthanization. White-tailed deer may become a problem due to their increasing population (absent sufficient predators or population controls), and black bears have also been noted rarely as unwanted guests (Olexa 2015).

CNRMA INST 11015.3, Natural Resources Management for Fish and Wildlife, Feral Animals, Invasive Species, and Certain Pests, requires natural resources managers and all other personnel involved in lethal control activities to be properly trained and certified for all weapons employed in accordance with applicable regulations. It should also be noted that the use of pesticides (poisoned baits) to control vertebrate pests, other than mice and rats, is strictly prohibited. Any measures used to control the nuisance populations of vertebrate species at NSN and CI will be coordinated with VDGIF to ensure they are conducted in accordance with Virginia State law.

- **Management action: Coordinate any removal or control of nuisance wildlife with VDGIF and the NAVFAC Regional Game Warden.**
- **Project: SIKES NAVSTA/CI – Nuisance Wildlife Control**

3.9.2 Mosquitos

Mosquitos pose a public health risk because they are vectors for human disease, carrying major viruses such as West Nile Virus and Eastern Equine Encephalitis. Mosquitos are prevalent at CI, making them both a pest and a health hazard. CI participates in a coordinated DOD effort to control the mosquito population at the Fuel Terminal and the adjacent USACE Craney Island Dredged Material Management Area. The USACE conducts habitat reduction, mosquito surveillance, and control activities in accordance with DOD guidelines on reducing the risk of mosquito-borne diseases; these efforts reduce nuisance mosquito populations at Craney Island as well as the adjacent areas of Portsmouth, Virginia (USACE Norfolk District 2011). The USACE Norfolk District has multiple contracts to control mosquito populations at the Fuel Terminal and the Dredged Material Management Area, which include both surveillance activities, including adult mosquito traps and larval monitoring, and also control activities, including larvicides applied by hand, back-pack, and aerial application (USACE Norfolk District 2011). These contracts and activities are also supported by personnel from NSN Environmental Services and NAVFAC MIDLANT's Environmental Conservation Branch. The United States Air Force conducts aerial spraying targeting adult mosquitoes when regional mosquito populations on DOD bases and facilities warrant an aerial spray mission.

3.9.3 Invasive Plant Species

Many nonnative species of plants used in agriculture or erosion control, as ornamentals, or accidentally introduced have become problematic weed species. These nonnative species are considered one of the leading threats to natural ecosystems and biodiversity. Several statutes and EOs, including the Chesapeake Bay Preservation Act, EO 11987 *Exotic Organisms*, and EO 13112 *Invasive Species* address the control of invasive, nonnative species on federal facilities. EO 11987 specifically restricts the introduction of harmful exotic species onto native ecosystems, whereas EO 13112 requires federal facilities, to the extent practicable and permitted by law, to:

- prevent the introduction of invasive species;
- detect and control such species;
- accurately monitor invasive species populations;
- provide for restoration of native species and habitats that have been invaded;
- conduct research on invasive species to prevent their introduction and provide for environmentally sound control; and
- promote public education about invasive species.

EO 13148, *Greening the Government through Leadership in Environmental Management*, also requires federal agencies to use regionally native plants in landscaping, as specified in the Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds (60 FR 40837) (see also Section 3.8.1). A list of regional native landscaping species is included in Appendix G.

A number of nonnative and invasive plant species have been identified at NSN and CI, as summarized in Section 2.4 and detailed in Appendix F. Of these, the most predominant invasive species of concern is common reed, which thrives in the heavily disturbed environment available at both facilities. This aggressive grass species dominates the Monkey Bottom wetland mitigation area, and is also prevalent in other wetlands around the Installation, including the wetland edge along Patrol Road (Tetra Tech 2015d). Growing 8 to 16 ft. tall, common reed plagues the Installation by obstructing line of sight security and threatening the safety of the base perimeters and gates, as well as increasing the risk of airfield accidents. The Navy has developed a regional plan to control common reed on a number of installations in the Hampton Roads region of Virginia, including NSN and CI (Navy 2002a). The multi-faceted strategic management approach implemented starting in 2002 involved a combination of satellite mapping to identify problem areas, a fall aerial spray application of a glyphosate herbicide followed by controlled burning or mowing, and reintroduction of native plant seeds to limit common reed's growth and expansion. Monitoring was conducted annually to determine when additional treatments were needed to control common reed on the Installation. This project is no longer occurring at NSN and has not been funded for several years, but NSN would like to reinstate such an effort as an INRMP project.

A list of Virginia's invasive species, methods of control and fact sheets are available on the VDCR-DNH website: http://www.dcr.virginia.gov/natural_heritage/invspinfo.shtml

Other common invasive species, such as *Lespedeza* sp., and Japanese honeysuckle (*Lonicera japonica*), are widespread across the upland areas of NSN, occurring predominantly around the edges of forested parcels and roads. Kudzu (*Pueraria montana* var. *lobata*) had formerly been present (NAVFAC MIDLANT 1997), but it was not identified during the 2015 vegetation surveys; while this does not rule out the species' possible presence, at least it has not become dominant in the areas surveyed. Minimal dense invasion was observed within the interior of the forested parcels (Tetra Tech 2015d), indicating that the invasive plants and vines have not yet taken over these vegetative communities. The location of the invasive vegetation along the edges of roads and natural areas, and in isolated stands, would make it possible to control without a very intensive or extensive treatment effort.

Although highly disturbed, CI's vegetation communities are composed of predominantly native plant species. In the West End, pockets of urban forest—divided by roads, ditches, and mowed areas—are characterized by native species through the interior, and a sparse understory and shrub layer. Like NSN, most of the upland invasive species occur along the edges of forested parcels and roads. Only a handful of invasive species were identified in the nearshore area. It is important to keep the invasive species from spreading extensively at CI and forming a thick, dense understory, which would represent a significant fuel load and wildfire hazard in proximity of the fuel depot at the East End.

After the completion of a comprehensive flora survey including the identification of invasive species populations, an invasive species management plan will be developed, which will assist in protection and improvement of the natural resource conditions across the Installation. Priorities for controlling these species are based on ecological significance, the severity of infestation, and the likelihood of successful control with available resources.

General control methods that are used to combat invasive plant species infestations include mechanical methods such as cutting, mowing, and burning and chemical applications of herbicides. Herbicide applications are most effective with species that have a larger percentage of foliage in comparison to stems and roots, such as grasses and non-woody vines. For woody species a combination of practices that includes cutting the larger woody materials and treating re-sprouting vegetation with a foliar application of herbicides is frequently recommended. To ensure proper identification of species and use of appropriate control methods, natural resources personnel should periodically attend invasive species control workshops and training, including the DOD Pesticide Applicator Certification Course, as well as the IPM Coordinator Course mentioned above.

Herbicides may only be applied by licensed DOD employees or contractors in a manner consistent with all label instructions. The NSN and CI Pest Management Plan gives further guidance on herbicide application, storage, and protective measures. All herbicides used must be approved by the regional entomologists and must be on the authorized user list in

accordance with the Pest Management Plan. In addition, all outdoor pesticide use that is conducted in remote areas must be coordinated with the NRM to ensure wildlife, plants, or their habitats are not affected.

The projects proposed under this INRMP that will support the management and control of invasive species include:

- ***Project: EO 13112 NAVSTA/CI – Invasive Species Mapping, Inventory, and Control Plan***
- ***Project: EO 13112 NAVSTA/CI-Invasive Species Control Treatments***
- ***Project: SIKES NAVSTA/CI – DOD Pesticide Applicator Certification***
- ***Project: SIKES NAVSTA/CI – Integrated Pest Management Coordinator Course***

3.10 OUTDOOR RECREATION AND ENVIRONMENTAL AWARENESS

NSN and CI largely consists of developed land; however, the Installation does offer a number of outdoor recreation opportunities for active and retired military personnel, civilian employees, and their dependents. The objectives of outdoor recreation and environmental awareness management at NSN and CI are to:

- provide for outdoor recreation opportunities to the maximum extent possible within the constraints of the military mission and capability of the natural resources with the goal of improving the quality of life for Installation personnel, their dependents, and the military community; and
- foster understanding and awareness of the environment through educational conservation programs.

3.10.1 Outdoor Recreation

Outdoor recreation opportunities at the Installation include numerous sports fields throughout NSN, a three-hole golf course on-site and a full course just outside of NSN, recreational walking trails at both NSN and CI, fishing, picnicking, bird watching, and boating. Most of these activities are concentrated within designated recreational activities areas, and are administered by the MWR Department at NSN. Coordination and cooperation between MWR and natural resources staff is necessary for the protection and management of natural resources on MWR-administered facilities. Natural resources personnel cooperate with MWR staff on issues such as the prevention of nonpoint source pollution, nuisance wildlife control, urban tree management, and identification of specialized habitats that need to be fenced off for conservation.

Review of the NSN Master Plan indicates that expansion of recreation opportunities at NSN is a priority. Two training and recreation campuses are planned—one in the Waterfront District and the other in the Airfield Support District; new MWR facilities will be sited in concentrated locations (“Constellations”) designed for pedestrian access (NSN 2011).

Parks

Salt Marsh Park has facilities for picnics, volleyball and nature observation. Use of Salt Marsh Park is on a first-come, first-serve basis, seven days a week from dawn to dusk. Breezy Point Park is available by reservation. Both facilities offer facilities for picnics, softball, volleyball and horseshoes (NAVYMWR Naval Station Norfolk n.d.).

Naval Sailing Center and Marina

The Sailing Center offers various types of boating classes for adults and summer camps for children, as well as a wide array of rental boats including kayaks and stand-up paddleboards, power boats for fishing and water skiing, and a fleet of over 50 sailboats from dinghies to cruising keelboats (NAVYMWR Naval Station Norfolk n.d.). In addition, fishing gear and outdoor lawn games are available for rent. The Marina offers 200 deep water slips, conference rooms with waterfront views, a nearby fishing pier, boat launch ramp, complementary pump out service, marina store, and dinghy storage.

Fishing

Saltwater fishing is a popular recreational activity at NSN, allowed only at the pier at Sewells Point. Fishing from the quay walls, piers, bridges, or Navy vessels, however, is not permitted. Ice, bait, fishing supplies, and a fish cleaning station are available at the Sailing Center and Marina. Public fishing is prohibited on CI (Fleet and Industrial Supply Center 2008), however opportunistic fishing by CI employees is authorized when mission activities allow.

Hunting

Hunting is not permitted at NSN and CI; however, hunting opportunities for NSN and CI personnel are available locally at WPNSTA Yorktown, NAS Oceana, NAS Oceana Dam Neck, Naval Auxiliary Landing Field (NALF) Fentress, and Northwest Annex. Hunting seasons in these areas correspond to state hunting seasons, and a valid state hunting license and an Installation permit are required. If white-tailed deer become overpopulated at CI, a controlled management hunt may be conducted when deemed necessary.

Wildlife Observation

NSN offers opportunities for observation of shorebirds, waterfowl, and other migratory birds in Salt Marsh Park on Sewells' Point, and on Vista Point beach. The Monkey Bottom area attracts numerous wetlands bird species, and provides a dry observation deck for nature lovers. The Environmental Area in the Magazine District provides a canopied refuge with the highest concentration of song birds on the Installation.

3.10.2 Environmental Awareness

Environmental education and outreach efforts at NSN and CI are coordinated by the NRM. In addition to the efforts to educate the public about nuisance wildlife species described in Section 3.9.1, the outreach specialist coordinates annual events such as Arbor Day, Earth

Day, and Clean the Bay Day, which are important activities for promoting environmental awareness and appreciation for the natural resources at NSN and CI. Through such activities, Installation residents, employees, and volunteers have the opportunity to learn about environmental stewardship as well as contribute to the protection and enhancement of local ecosystems.

- **Project: Sponsor environmental awareness events such as Clean the Bay Day, Earth Day, Migratory Bird Day, and Arbor Day**, and implement educational programs regarding the importance of spaying/neutering pets, the problems posed by feral animals, human-wildlife/recreation interaction, and other topics.

If protected species are confirmed as occurring on the Installation, the NRM will evaluate the need for development of educational outreach materials such as informational handouts. These materials can be distributed to visitors and those living and working on the Installation to increase awareness about threatened and endangered species that occur on NSN and CI. The WS Wildlife Biologist and other personnel involved in monitoring and controlling wildlife on and around Chambers Airfield are among the most vital individuals to keep abreast of the protected species list so that the NRM can engender their support in recording and reporting any occurrences of these species.

Environmental awareness and education also must extend to planners and project managers throughout NAVFAC MIDLANT installations. Developing instructional materials to inform planners, project managers, and others of natural resources issues that need to be considered when developing project and construction plans would benefit the environment by ensuring that environmental concerns are addressed early in the planning stage, and would benefit planners by ensuring compliance with environmental legislation and avoiding possible litigation. NSN has pro-actively involved the NRM (as well as Cultural Resources staff) in the early stages of the Installation Development Plan so that pertinent issues are properly considered and factored into the plan.

3.11 CONSERVATION LAW ENFORCEMENT

The Sikes Act (16 U.S.C. 670a *et seq.*) as amended requires that natural resources law enforcement be provided on military lands (Benton et al. 2008). The DOD developed law enforcement guidance in DOD Instruction (DODI) 4715.03, which mandates that all DOD components must (1) ensure that sufficient numbers of professionally trained natural resources management personnel and natural resources law enforcement personnel are available and assigned responsibility to manage their installations' natural resources; and (2) coordinate with the appropriate agencies to support conservation law enforcement and enforce Federal and applicable State laws and regulations that pertain to the management and use of the natural resources under their jurisdiction. DODI 5525.17 (October 2013) establishes overall policy and provides guidance for the DOD Conservation Law Enforcement Program (CLEP), in accordance with Natural Resources Conservation Program Policy (DODI 4715.03) and the Cultural Resources Program Policy (DODI 4715.16). 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.

The implementation method(s) for each installation CLEP should be proportionate to the conservation law enforcement needed at the installation. The specific implementation methods at installations can range from dedicated conservation officers; to military police, security forces, master-at-arms, component civilian police, or other law enforcement personnel who are temporarily or seasonally assigned to the CLEP; to non-law enforcement personnel who may be assigned for case-specific investigations and educational awareness activities (DOD 2013).

Law enforcement at NSN and CI is generally provided by Security personnel; their purview includes appropriate natural resources regulations. NSN Security is responsible for ensuring that unauthorized individuals do not enter restricted areas, such as the airfield or the area around the Willoughby Oak. If any stranding of marine wildlife is discovered by security personnel along the coastline of NSN and CI, the stranding should be reported to the NRM immediately, who will follow the stranding protocol outlined in Section 3.1 of this INRMP. NSN Pest Management and Security personnel assist in the enforcement of Navy policies in accordance with Article 92 of the Uniform Code of Military Justice to discourage the feeding of feral animals and geese. Open and consistent communication between the NRM and the parties who enforce natural resources regulations is key to ensuring that one another's roles and responsibilities are mutually understood and supported.

4.0 NATURAL RESOURCES MANAGEMENT UNITS

For natural resources management purposes, land and water resources at NSN may be divided into seven management areas based on ecological and land use considerations as defined in this INRMP, rather than the geographical districts by which the Master Plan is organized. These natural resources – based areas are the NSN Nearshore Management Unit, NSN Airfield Operations Area Management Unit, NSN Developed Areas Management Unit, NSN Open Areas Management Unit (depicted on Figure 4-1); and the CI Nearshore Management Unit, CI East End Management Unit, and CI West End Management Unit (depicted on Figure 4-2).

The management procedures and actions described for each unit will help NSN and CI meet its management goals and objectives, maintain regulatory compliance, and ensure an ecosystem approach to natural resources management is implemented. Although management issues may be common to the different management units, practical management solutions and actions will be tailored to meet the specific constraints of each unit. Management actions that apply broadly across the entire installation (e.g., natural resources training, climate change preparedness, and INRMP revisions) are not repeated in this section to avoid redundancy. Natural resources projects for which NSN will seek funding, and which appear in the INRMP Projects Table (Appendix A), are called out in bold font.

4.1 NSN NEARSHORE AREA MANAGEMENT UNIT

The NSN Nearshore Management Unit covers the entire nearshore, marine environment surrounding NSN, from the Waterfront to Sewells Point, and along the entire crescent of Willoughby Bay, from the shoreline (i.e., mean high water mark) out 250 m. Note that this area is larger than the nearshore area, as defined in DODI 4715.03 and OPNAVINST 5090.1D, by which, for the purposes of natural resources management, the Navy’s nearshore areas include all submerged lands titled to the Navy and all other submerged lands that are adjacent to the Installation that extend from the mean high water level, offshore to the boundary of any secure areas that are controlled by the Navy. The Nearshore Area, in accordance with this definition, is depicted by a red-dashed line on Figure 4-1. However, NAVFAC MIDLANT has conducted nearshore surveys at NSN from the shore out 250 m for consistency across the board between all nearshore surveys conducted at NAVFAC MIDLANT installations, so that survey area has been designated as the NSN Nearshore Management Unit. (In addition to consistently defining the nearshore survey area across installations, the nearshore survey boundary of 250 m was chosen because not all installations have waters controlled by the CO, and because the difficulties of getting into the areas actually controlled by the CO and blocked off by floating security barriers would have been too burdensome on the installations’ Port Operations/Security staff.)

The management issues and concerns applicable to the NSN Nearshore Area Management Unit include Wetlands and Water Quality Protection, Invasive Species Control, Threatened and Endangered Species Protection, Fish and Wildlife Management, and Environmental

Awareness. The projects and management actions pertaining to this Management Unit for each of these issue areas are listed under the corresponding headings below.

Wetlands and Water Quality Protection

- Coordinate with VADEQ, USACE, VMRC, and LWB, as appropriate, to apply for permits as needed for any unavoidable impacts to wetlands and aquatic resources from future maintenance, construction, and development projects.
- **Through the implementation of this INRMP, NSN will seek to complete a jurisdictional wetland delineation of the entire area within the property boundary of NSN.**
- **Plant nearshore emergent and aquatic vegetation** in marine waters at 1–2 m depth. Follow VIMS SAV Transplantation Guidelines. Continue monitoring the health and distribution of vegetation to determine how successful these efforts are.
- **Restore oyster reefs in the nearshore area via Cooperative Service Agreements.**

Fish and Wildlife Management

- **Conduct migratory and breeding bird surveys.** NSN will participate in the National Audubon Society Christmas Bird Counts and Breeding Bird Counts in order to obtain a comprehensive inventory of the species that occur regularly and transiently at the Installation and the Fuel Terminal. In the NSN Nearshore Area Management Unit, the focus of the surveys would be on shorebirds (e.g., black skimmer, piping plover, roseate tern, red knot), seabirds (various gulls, loggerhead shrike, ducks), and other piscivorous birds (bald eagle, osprey).
- **Department of Defense Coordinated Bird Monitoring.** This project is part of the overall migratory bird conservation program at NSN, and is designed to help ensure that the ecosystems upon which the migratory birds depend are appropriately managed to support biodiversity and ecological integrity of the Installation. Additionally, this project will support MBTA permit compliance and integrate bird/wildlife aircraft strike data for a more comprehensive analysis of aircraft risk and hazardous species. Meeting these requirements along with providing a conservation management program supports the Navy mission of ensuring healthy lands for long-term use of installations for military training and readiness activities. The primary purpose of this monitoring study is to contribute to DOD Coordinated Bird Monitoring to develop a comprehensive list of observed bird species, checklist of potentially occurring bird species, and quantitative analysis of bird strike and migratory bird take data.
- Protect the small beach where the black skimmers were observed from feral cats. In case birds are found to use the beach for nesting, temporarily close the area to foot traffic.
- **Department of Defense PARC Herpetofauna and Microhabitat Inventory.** With this finalized INRMP in-place, NSN will be eligible to have a herpetofauna and microhabitat inventory completed via PARC. Once all the updated species lists are

completed, they will be entered into a database that will be stored on the Navy Environmental Portal (<https://eprportal.cnrc.navy.mil/eprwebnet/logon.aspx>). The database will provide accurate and up-to-date lists of amphibian and reptile species in support of future data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions. The NSN Nearshore Area Management Unit will be surveyed for marine and estuarine reptiles (e.g., snakes and turtles).

- **Conduct vertebrate species surveys.** Surveys may be conducted in-house or contracted out. They will primarily target mammals such as deer, fox, feral cats, nutria, and any other species that may be warranted.

Threatened and Endangered Species Protection

- **Conduct a threatened and endangered species inventory.** In the NSN Nearshore Area Management Unit, protected species with possible presence include the Atlantic sturgeon, West Indian manatee, and numerous sea turtles, in addition to the listed shorebird and seabird species named below under the migratory and breeding bird survey.

Invasive Species Control

- **Invasive species mapping, inventory, and control plan.** A small number of invasive species were identified in the NSN Nearshore Area Management Unit during the vegetation surveys conducted in 2015. The shoreline in the northwest of the Installation, along Willoughby Bay and Willoughby Spit, was not accessible, so the quantity and extent invasive species in those areas were not captured in the survey. A comprehensive inventory will fill information gaps vital to the planning of controls.
- **Invasive species control treatments.**

Environmental Awareness

- **Promote education and outreach, including Clean the Bay Day,** to give residents and personnel appreciation for the importance of coastal and marine natural resources, and the need to protect them.

4.2 NSN AIRFIELD OPERATIONS AREA MANAGEMENT UNIT

The NSN Airfield Operations Area includes the Mason Creek riparian area, clear zones around the airstrip, and the heliport. Vegetated areas that require special mowing heights for BASH reduction are included in this unit for distinction from the other open areas that may be left natural.

The management issues and concerns applicable to the NSN Airfield Operations Area Management Unit include Wetlands and Water Quality Protection; Urban Forestry, Soils, and Grounds Maintenance; Invasive Species Control; Threatened and Endangered Species Protection; and Fish and Wildlife Management. The projects and management actions

pertaining to this Management Unit for each of these issue areas are listed under the corresponding headings below.

Wetlands and Water Quality Protection

- Coordinate with VADEQ, USACE, VMRC, and LWB, as appropriate, to apply for permits as needed for any unavoidable impacts to wetlands and aquatic resources from future maintenance, construction, and development projects.
- **Complete a jurisdictional wetland delineation of the entire area within the property boundary of NSN.**
- Continue to maintain stormwater treatment basins in open areas around the airfield to achieve increased infiltration and the overall improvement of stormwater runoff quality.

Urban Forestry

- Conduct an **urban tree assessment**, which will result in the **mapping of urban forest resources, and the development of an Urban Tree Preservation Plan.** Vegetation management in the Airfield Operations Area, such as mowing frequency and maintenance heights of shrubs and trees, is mandated by the Airfield Clear Zone Management Plan for NSN Chambers Field, but the inventory of urban forestry resources, particularly those in the riparian buffer area along Mason Creek, is applicable to ecosystem-based planning at NSN.

Fish and Wildlife Management

- **Conduct migratory and breeding bird surveys.** NSN will participate in the National Audubon Society Christmas Bird Counts and Breeding Bird Counts in order to obtain a comprehensive inventory of the species that occur regularly and transiently at the Installation and the Fuel Terminal. The WS Wildlife Biologist regularly surveys the Airfield Operations Area Management Unit and records data on which bird species were present, dispersed, or removed; these should be combined with bird survey data for a comprehensive list of species that have been present over time.
- **Department of Defense Coordinated Bird Monitoring** (in coordination with the WS surveys conducted under the BASH Program). This project is part of the overall migratory bird conservation program at NSN, and is designed to help ensure that the ecosystems upon which the migratory birds depend are appropriately managed to support biodiversity and ecological integrity of the Installation. Additionally, this project will support MBTA permit compliance and integrate bird/wildlife aircraft strike data for a more comprehensive analysis of aircraft risk and hazardous species. Meeting these requirements along with providing a conservation management program supports the Navy mission of ensuring healthy lands for long-term use of installations for military training and readiness activities. The primary purpose of this monitoring study is to contribute to DOD Coordinated Bird Monitoring to develop a

comprehensive list of observed bird species, checklist of potentially occurring bird species, and quantitative analysis of bird strike and migratory bird take data.

- Retrofit light poles and other towers with anti-nesting devices.
- Attend quarterly BASH Working Group meetings in accordance with NAVSTANORVAINST 8020.1 to ensure coordination between the airfield manager, WS, PWD Norfolk, and the Norfolk Installation Environmental Program Director.
- **Department of Defense PARC Herpetofauna and Microhabitat Inventory.** With this finalized INRMP in-place, NSN will be eligible to have a herpetofauna and microhabitat inventory completed via PARC. Once all the updated species lists are completed, they will be entered into a database that will be stored on the Navy Environmental Portal (<https://eprportal.cnrc.navy.mil/eprwebnet/logon.aspx>). The database will provide accurate and up-to-date lists of amphibian and reptile species in support of future data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions. The Airfield Operations Area Management Unit will be surveyed for terrestrial and freshwater reptiles and amphibians.
- Coordinate with the WS and the NAVFAC Regional Game Warden whenever reduction efforts relate to wildlife population controls.
- Secure all environmental permits in cooperation with the Environmental Core Natural Resources office.
- Annually review the BASH Safety Program Plan, updating the plan every 5 years.
- Nuisance wildlife control in the Airfield Operations Area is the responsibility of the BASH Program, and not included in the INRMP project for that issue, but the removal of wildlife is carried out in coordination with the Natural Resources Program.

Threatened and Endangered Species Protection

- **Conduct a threatened and endangered species inventory. Bat surveys, with a combination of acoustic surveys and mist-netting** should be included in this inventory in order to determine whether the northern long-eared bat, gray bat, or little brown bat, occur, and to monitor the seasonal presence of the Rafinesque's eastern big-eared bat and the tri-colored bat.

Invasive Species Control

- **Invasive species mapping, inventory, and control plan.** In the NSN Airfield Operations Area Management Unit, regular mowing keeps native and invasive species alike from growing extensively. Common reed dominates many of the unmowed wetland areas adjacent to Chambers Field. The invasive species inventory will need to be coordinated to occur before fall (September) mowing to ensure that species can be properly identified.
- **Invasive species control treatments.**

4.3 NSN DEVELOPED AREAS MANAGEMENT UNIT

The Developed Areas Management Unit encompasses the areas indicated as urban/developed on the Land Cover map (Figure 2-7), including the Willoughby residential areas and photovoltaic impound lot to the northeast; the operations, administrative, and residential complex spanning the northern and central portions of campus; and the highly urban Waterfront on the west.

The management issues and concerns applicable to the NSN Developed Area Management Unit include Wetlands and Water Quality Protection; Urban Forestry, Soils, and Grounds Maintenance; Threatened and Endangered Species Protection; Fish and Wildlife Management; and Environmental Awareness. The projects and management actions pertaining to this Management Unit for each of these issue areas are listed under the corresponding headings below.

Wetlands and Water Quality Protection

- Utilize natural and pervious surfaces for future planned site improvements (as identified in the Master Plan) and replace impervious surfaces to the extent possible.
- Develop an Erosion and Sedimentation Control Plan for disturbed areas greater than 2,500 square feet (232 square meters), and submit the plan to VDCR.
- Register for coverage under the General Permit for Discharges of Stormwater from Construction Activities and develop a project-specific SWP3 for disturbed areas greater than 2,500 square feet (232 square meters).

Urban Forestry

- **Conduct an urban tree assessment, which will result in the mapping of urban forest resources, and the development of an Urban Tree Preservation Plan.**

Fish and Wildlife Management

- **Conduct migratory and breeding bird surveys.** NSN will participate in the National Audubon Society Christmas Bird Counts and Breeding Bird Counts in order to obtain a comprehensive inventory of the species that occur regularly and transiently at the Installation and the Fuel Terminal.
- **Department of Defense Coordinated Bird Monitoring** (in coordination with WS surveys conducted under BASH Program)
- Retrofit light poles and other towers with anti-nesting devices.
- Translocate nestling osprey from NSN under a MBTA permit and provide to Illinois DNR for hacking (resettlement) in support of osprey recovery.
- **Nuisance wildlife control.** In the NSN Developed Areas Management Unit, the main nuisance wildlife issue is the overwhelming population of feral cats. NSN will uphold the MOU with the SPCA to humanely trap, transfer, and transport strays from NSN to a local shelter and/or to a permanent new home. Signs are posted in problem areas

prohibiting the feeding of these animals. NSN will develop an enforceable anti-feeding policy. Additional public education and better enforcement of NSN policy is needed. Spaying and neutering are promoted through educational programs, and pet and wildlife information is disseminated to Installation personnel through the regional outreach specialist.

- Coordinate with VDGIF and the NAVFAC Regional Game Warden whenever reduction efforts relate to wildlife population controls.

Threatened and Endangered Species Protection

- **Conduct a threatened and endangered species inventory. Bat acoustic surveys** should be included in the inventories in order to determine whether the northern long-eared bat, gray bat, or little brown bat, occur, and to monitor the seasonal presence of the Rafinesque's eastern big-eared bat and the tri-colored bat. Due to the low number of bats likely to occur in areas with little vegetation, mist netting in the NSN Developed Areas Management Unit would not be cost-effective.

Environmental Awareness

- **Sponsor environmental awareness events such as Clean the Bay Day, Earth Day, and Arbor Day**, and implement educational programs regarding the importance of spaying/neutering pets, the problems posed by feral animals, wildlife/recreation interaction, and other topics.

4.4 NSN OPEN AREAS MANAGEMENT UNIT

The NSN Open Areas Management Unit comprises the natural/forested areas (including wetlands) and mowed/maintained green spaces that are not within the Airfield Operations Area, in addition to the vegetated portions of the shoreline above the mean high water mark; this component is concentrated on the eastern side of Willoughby Bay and the inlet by Monkey Bottom, where the shoreline has not been entirely hardened.

The management issues and concerns applicable to the NSN Open Areas Management Unit include Wetlands and Water Quality Protection; Urban Forestry, Soils, and Grounds Maintenance; Habitat Conservation and Restoration; Invasive Species Control; Threatened and Endangered Species Protection; Fish and Wildlife Management; and Environmental Awareness. The projects and management actions pertaining to this Management Unit for each of these issue areas are listed under the corresponding headings below.

Wetlands and Water Quality Protection

- Coordinate with VADEQ, USACE, VMRC, and LWB, as appropriate, to apply for permits as needed for any unavoidable impacts to wetlands and aquatic resources from future maintenance, construction, and development projects.
- **Complete a jurisdictional wetland delineation of the entire area within the property boundary of NSN.**

- **Establish living shoreline buffer areas to protect the shoreline from coastal erosion.** The Willoughby spit was originally created by a storm, and most of the Willoughby area was artificially constructed via soil fill; this inception has led to a lot of shoreline erosional issues. Other parts of NSN’s shoreline have been hardened with riprap, but the ecosystem would benefit if these were converted back to natural, vegetated shoreline; a hybrid approach may be applied. If possible, NSN will reserve a 25-foot no mow zone.
- Continue to maintain stormwater treatment basins in open space areas to achieve increased infiltration and the overall improvement of stormwater runoff quality.
- The Monkey Bottom wetlands mitigation area is dominated by common reed, which has caused loss of species diversity, habitat availability, and water quality; eradicating common reed to restore the area to native wetlands species would benefit native vegetation species, migratory birds, and the watershed.

Urban Forestry

- Continue to protect the historic Willoughby oak and encourage “offspring” to replace it.
- Conduct an **urban tree assessment**, which will result in the **mapping of urban forest resources, and the development of an Urban Tree Preservation Plan.**
- **Native tree planting and establishment:** NSN will establish at least two specific tree preservation/park project areas that would include the preservation and planting of a diverse assortment of native trees with educational plaques. The recommended locations for these areas are (1) near the designated green space at the Willoughby Oak, and (2) Admiral Taussig Boulevard. Tree planting will be followed by 2 years’ maintenance by Environmental/Natural Resources for successful establishment.
- **Native tree care to maintain the new planting displays of native species.** Once the plantings have been successfully established, long-term maintenance will be provided (along with general grounds maintenance) under Facilities funds.
- Maintain Tree City USA status with an annual forestry expenditure of at least \$2.00 per capita and through continual tree mitigation planting efforts.
- Develop a tree ordinance and management plan that focuses on the retention, care, mitigation, and improvement of existing forested areas, urban tree canopy, and significantly recognized trees.
- Achieve no net loss of tree canopy on the Installation in 5 years, and increase the overall tree canopy by 30% in future years.
- Establish a 2:1 mitigation ratio for tree removal and/or mortality associated with development.

Fish and Wildlife Management

- **Conduct migratory and breeding bird surveys.** NSN will participate in the National Audubon Society Christmas Bird Counts and Breeding Bird Counts in order to obtain a comprehensive inventory of the species that occur regularly and transiently at the Installation and the Fuel Terminal. The greatest diversity of bird species observed during the 2015 bird surveys were in the Environmental Area, where there is an edge habitat between forest and open field.
- **Department of Defense Coordinated Bird Monitoring.** This project is part of the overall migratory bird conservation program at NSN, and is designed to help ensure that the ecosystems upon which the migratory birds depend are appropriately managed to support biodiversity and ecological integrity of the Installation. Additionally, this project will support MBTA permit compliance and integrate bird/wildlife aircraft strike data for a more comprehensive analysis of aircraft risk and hazardous species. Meeting these requirements along with providing a conservation management program supports the Navy mission of ensuring healthy lands for long-term use of installations for military training and readiness activities. The primary purpose of this monitoring study is to contribute to DOD Coordinated Bird Monitoring to develop a comprehensive list of observed bird species, checklist of potentially occurring bird species, and quantitative analysis of bird strike and migratory bird take data.
- Consult with the College of William & Mary's Conservation Biology Department for the status of active nests, reviewing the Virginia Bald Eagle Nest Locator in the Center for Conservation Biology's online mapping portal; as well as ground-truth the locations of bald eagle and osprey nest surveys on the Installation and the Fuel Terminal with ground-based surveys.
- Try to retain the forested blocks on the southern portions of the Installation, such as the "Environmental Area."
- Maintain the old fields for early successional habitat for birds.
- Protect the storm surge basin (network of drainage ditches) in the open field in the northwest portion of the base where yellow crowned night herons were observed. Set back mowing an additional 5 + meters on each edge to allow native sedges and shrubs to grow, thus creating additional foraging habitat.
- Translocate nestling osprey from NSN under a MBTA permit and provide to Illinois DNR for hacking (resettlement) in support of osprey recovery.
- **Department of Defense PARC Herpetofauna and Microhabitat Inventory.** With this finalized INRMP in-place, NSN will be eligible to have a herpetofauna and microhabitat inventory completed via PARC. Once all the updated species lists are completed, they will be entered into a database that will be stored on the Navy Environmental Portal (<https://eprportal.cniv.navy.mil/eprwebnet/logon.aspx>). The database will provide accurate and up-to-date lists of amphibian and reptile species in

support of future data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions. The NSN Open Areas Management Unit will be surveyed for terrestrial and freshwater reptiles and amphibians.

- **Nuisance wildlife control:** Canada geese, fox, rock pigeons, and European starlings are the primary nuisance wildlife requiring control in the NSN Open Space Areas Management Unit. For health and safety reasons, depredation trapping is used to control the fox population. Other miscellaneous birds, rodents, and mammals may also be considered pests, but if they do not enter the Airfield Operations Area Management Unit or cause damage to Navy property, controls may not be applied. Rising animal populations around Mason Creek may be problematic for BASH due to the proximity to the airfield.
- Perform ongoing duties to coordinate BASH Program with WS, Chambers Airfield operations manager, and NAVFAC MIDLANT Regional Game Warden; secure permitting; conduct annual reviews; and update the BASH Safety Program Plan every 5 years.
- Maintain required permits for management and control of the resident Canada goose population, and conduct activities in accordance with the MBTA, Virginia State law, and the regulations at 50 CFR 21.49.
- Maintain posted signs in problem areas to discourage the feeding of waterfowl.

Threatened and Endangered Species Protection

- **Conduct a threatened and endangered species inventory. Bat surveys, with a combination of acoustic surveys and mist-netting** should be included in this inventory in order to determine whether the northern long-eared bat, gray bat, or little brown bat, occur, and to monitor the seasonal presence of the Rafinesque's eastern big-eared bat and the tri-colored bat.

Habitat Conservation and Restoration

- **Plant native, warm-season grasses in the open space areas currently maintained as lawn.**
- Increase the permeability of surfaces by converting asphalt to grass, mulch, or even artificial permeable surfaces.
- Reduce mowing frequency of wetland edge habitats (where possible) to increase plant diversity and improve available amphibian habitat.

Invasive Species Control

- **Invasive species mapping, inventory, and control plan.** In the NSN Open Areas Management Unit, common reed is prevalent in the disturbed wetland areas, including the Monkey Bottom wetlands mitigation area; the mapping effort will determine the extent of the current stands and provide an indication of how successful the past/current treatments have been. In the upland areas, numerous invasive species

such as Chinese lespedeza and Japanese honeysuckle are widespread, but occur predominantly around the edges of forested parcels and roads.

- **Invasive species control treatments.**

Environmental Awareness

- **Sponsor environmental awareness events such as Clean the Bay Day, Earth Day, and Arbor Day**, and implement educational programs regarding the importance of spaying/neutering pets, the problems posed by feral animals, wildlife/recreation interaction, and other topics.

4.5 CI NEARSHORE AREA MANAGEMENT UNIT

The CI Nearshore Management Unit covers the nearshore environment along both the East and West ends of CI, following the same definition as was applied to NSN (i.e., mean high water mark out to 250 m), so-as to allow consistent management and project implementation around the entire southern and eastern edges of the Fuel Terminal.

The management issues and concerns applicable to the CI Nearshore Area Management Unit include Wetlands and Water Quality Protection; Invasive Species Control; Threatened and Endangered Species Protection; and Fish and Wildlife Management. The projects and management actions pertaining to this Management Unit for each of these issue areas are listed under the corresponding headings below.

Wetlands and Water Quality Protection

- Coordinate with VADEQ, USACE, VMRC, and LWB, as appropriate, to apply for permits as needed for any unavoidable impacts to wetlands and aquatic resources from future maintenance, construction, and development projects.
- Restore oyster reefs in the nearshore area via Cooperative Service Agreements.
- **Promote education and outreach** to give personnel appreciation for the importance of coastal and marine natural resources, and the need to protect them.
- **Establish living shoreline buffer areas to protect the shoreline from coastal erosion.** Trees and shrubs could be planted along CI's eastern shoreline on the Elizabeth River to install a riparian buffer. On the southern shore along Craney Island Creek, estuarine and marine wetland vegetative species should be allowed to establish. If possible, NSN will reserve a 25-foot no mow zone.

Fish and Wildlife Management

- **Conduct migratory and breeding bird surveys.** NSN will participate in the National Audubon Society Christmas Bird Counts and Breeding Bird Counts in order to obtain a comprehensive inventory of the species that occur regularly and transiently at the Installation and the Fuel Terminal. In the CI Nearshore Area Management Unit, there are not likely to be shorebirds due to the lack of beach

habitat, so the focus of the surveys would be on seabirds, piscivorous birds, and species attracted to tidal wetlands.

- **Department of Defense PARC Herpetofauna and Microhabitat Inventory.** With this finalized INRMP in-place, NSN will be eligible to have a herpetofauna and microhabitat inventory completed via PARC. Once all the updated species lists are completed, they will be entered into a database that will be stored on the Navy Environmental Portal (<https://eprportal.cnrc.navy.mil/eprwebnet/logon.aspx>). The database will provide accurate and up-to-date lists of amphibian and reptile species in support of future data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions. The CI Nearshore Area Management Unit will be surveyed for marine and estuarine reptiles (e.g., snakes and turtles).

Threatened and Endangered Species Protection

- **Conduct a threatened and endangered species inventory. Bat surveys, with a combination of acoustic surveys and mist-netting** should be included in this inventory in order to determine whether the northern long-eared bat, gray bat, or Rafinesque's eastern big-eared bat, occur.

Invasive Species Control

- **Invasive species mapping, inventory, and control plan.** In the CI Nearshore Area Management Unit, only a handful of invasive species were identified during the 2015 vegetation surveys. The extent of invasive species, particularly of common reed, will be an important factor to determine what control methods are recommended.
- **Invasive species control treatments.**

INRMP/Installation-wide

- **SIKES CI-Nearshore habitat assessment and species inventory.** Seasonal nearshore surveys are planned to occur at CI, using the same methods as were employed at NSN. The survey area will extend from the shoreline out 250 m, consistent with nearshore surveys that have been conducted at other Navy Mid-Atlantic installations. The survey will characterize the identified nearshore environment by surveying benthic habitat, SAV, fish, threatened and endangered species, water quality, marine mammals, and intertidal areas.

4.6 CI EASTERN END MANAGEMENT UNIT

Craney Island was divided into CI Eastern End and CI Western End management units to help identify management issues and associated management recommendations (Figure 4-2). Midway Road is used to separate the two units. On the east end are 39 active aboveground storage tanks with an aggregate capacity of 46 million gallons, four fueling piers (A, B, C, and D), and one wharf (E).

The management issues and concerns applicable to the CI Eastern End Management Unit include Wetlands and Water Quality Protection; Threatened and Endangered Species Protection; Fish and Wildlife Management; and Environmental Awareness. The projects and management actions pertaining to this Management Unit for each of these issue areas are listed under the corresponding headings below.

Wetlands and Water Quality Protection

- Coordinate with VADEQ, USACE, VMRC, and LWB, as appropriate, to apply for permits as needed for any unavoidable impacts to wetlands and aquatic resources from future maintenance, construction, and development projects.

Fish and Wildlife Management

- **Conduct migratory and breeding bird surveys.** NSN will participate in the National Audubon Society Christmas Bird Counts and Breeding Bird Counts in order to obtain a comprehensive inventory of the species that occur regularly and transiently at the Installation and the Fuel Terminal. These inventories will supplement the avian data that was collected during spring and fall surveys at CI in preparation for this INRMP.
- **Department of Defense PARC Herpetofauna and Microhabitat Inventory.** With this finalized INRMP in-place, NSN will be eligible to have a herpetofauna and microhabitat inventory completed via PARC. Once all the updated species lists are completed, they will be entered into a database that will be stored on the Navy Environmental Portal (<https://eprportal.cnrc.navy.mil/eprwebnet/logon.aspx>). The database will provide accurate and up-to-date lists of amphibian and reptile species in support of future data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions. The CI Eastern End Management Unit will be surveyed for terrestrial and freshwater/wetland reptiles and amphibians.
- Maintain and enhance native natural habitats (e.g., plant native, warm-season grasses in the open space areas currently maintained as lawn; plant marsh grasses along unhardened sections of shoreline).

Threatened and Endangered Species Protection

- **Conduct threatened and endangered species inventories. Bat acoustic surveys** should be included in the inventories in order to determine whether the northern long-eared bat, gray bat, or little brown bat, occur, and to monitor the seasonal presence of the Rafinesque's eastern big-eared bat and the tri-colored bat. Due to the very low number of bats detected in this area during the 2015 surveys, mist netting in the CI Eastern End Management Unit would not be cost-effective.

Environmental Awareness

- **Sponsor environmental awareness events such as Clean the Bay Day and Migratory Bird Day.**

4.7 CI WESTERN END MANAGEMENT UNIT

The CI Western End Management Unit (i.e., the area of the Fuel Terminal that lies west of Midway Road) consists of planted loblolly pine stands, an old growth mixed pine hardwood stand, a cleared power line, and roads lined by drainage ditches. There are 35 bunkered tanks which are considered underground storage tanks. Most are inactive and are being reclaimed; those still active are being scheduled for retirement and reclamation.

The management issues and concerns applicable to the CI West End Management Unit include Wetlands and Water Quality Protection; Urban Forestry, Soils, and Grounds Maintenance; Habitat Conservation and Restoration; Invasive Species Control; Threatened and Endangered Species Protection; and Fish and Wildlife Management. The projects and management actions pertaining to this Management Unit for each of these issue areas are listed under the corresponding headings below.

Wetlands and Water Quality Protection

- Coordinate with VADEQ, USACE, VMRC, and LWB, as appropriate, to apply for permits as needed for any unavoidable impacts to wetlands and aquatic resources from future maintenance, construction, and development projects.

Urban Forestry

- The current grounds maintenance plan at CI's Western End, with fragmented forest parcels divided by roads and drainage ditches, has created a system of natural fire breaks that is beneficial from the standpoint of reducing the risk of wildfire in proximity of the Fuel Terminal. Clearing undergrowth annually will reduce the fuel load.

Fish and Wildlife Management

- **Conduct migratory and breeding bird surveys.** NSN will participate in the National Audubon Society Christmas Bird Counts and Breeding Bird Counts in order to obtain a comprehensive inventory of the species that occur regularly and transiently at the Installation and the Fuel Terminal. These inventories will supplement the avian data that was collected during spring and fall surveys at CI in preparation for this INRMP.
- Consider including CI in the next update of the BASH Plan.
- Consult with the College of William & Mary's Conservation Biology Department for the status of active nests, reviewing the Virginia Bald Eagle Nest Locator in the Center for Conservation Biology's online mapping portal; as well as ground-truth the locations of bald eagle and osprey nest surveys on the Fuel Terminal with ground-based surveys.
- **Department of Defense PARC Herpetofauna and Microhabitat Inventory.** With this finalized INRMP in-place, NSN will be eligible to have a herpetofauna and microhabitat inventory completed via PARC. Once all the updated species lists are

- completed, they will be entered into a database that will be stored on the Navy Environmental Portal (<https://eprportal.cnrc.navy.mil/eprwebnet/logon.aspx>). The database will provide accurate and up-to-date lists of amphibian and reptile species in support of future data calls, INRMP updates, and other relevant planning documents needed to support Navy projects and missions. The CI Western End Management Unit will be surveyed for terrestrial and freshwater/wetlands reptiles and amphibians.
- Maintain and enhance native natural habitats (e.g., plant native, warm-season grasses in the open space areas currently maintained as lawn; plant marsh grasses along unhardened sections of shoreline).
 - Maintain the open edge and forest floor habitats in the CI Western End Management Unit by taking action to control invasive species on a fine scale, applying targeted, species-specific control methods, before they spread extensively and form a dense understory (see Invasive Species Control projects above).
 - **Nuisance wildlife control.** Foxes, coyotes, and muskrats are nuisances that must be eradicated from the CI Western End Management Unit by trapping and euthanization. Depredation of coyotes has left the white-tailed deer population without natural predators, so they are a rising problem for which population controls will need to be applied. Controlling nuisance wildlife (e.g., fox, coyote, and muskrat) is also likely to help limit natural predation of bird species. Measures used to control the nuisance populations of vertebrate species will be coordinated with VDGIF and the NAVFAC Regional Game Warden.

Threatened and Endangered Species Protection

- **Conduct a threatened and endangered species inventory. Bat surveys, with a combination of acoustic surveys and mist-netting** should be included in this inventory in order to determine whether the northern long-eared bat, gray bat, or little brown bat, occur, and to monitor the seasonal presence of the Rafinesque's eastern big-eared bat and the tri-colored bat.
- Erect bat houses: In the 1990's, many bat houses were built at CI, but none were ever occupied; nevertheless, bat activity was very high during the 2015 surveys at the CI Western End Management Unit, and the results indicate that at least one protected species is present, and possibly more. Putting up bat houses would be a very low-cost way to increase bat hibernacula and benefit multiple species. In order to improve chances for success, the bat houses should be constructed or purchased in coordination with VDGIF.

Habitat Conservation and Restoration

- **Plant native, warm-season grasses in the open space areas currently maintained as lawn.**
- **Consider small blocks of unmowed or mowed open green space for establishing pollinator habitat.**

Invasive Species Control

- **Invasive species mapping, inventory, and control plan.** In the CI Western End Management Unit, most of the upland invasive species occur along the edges of forested parcels and roads, so it may be possible to apply targeted, species-specific control methods on a fine scale. It is advised to take action to control the invasives before they spread extensively and form a dense understory.
- **Invasive species control treatments.**

Environmental Awareness

- **Sponsor environmental awareness events such as Clean the Bay Day and Migratory Bird Day.**

5.0 INRMP IMPLEMENTATION

The Navy intends to implement this INRMP within the framework of regulatory compliance, mission obligations, anti-terrorism and force protection limitations, and funding constraints. Any requirement for the obligation of project funding in this INRMP shall be subject to availability of funds appropriated by Congress, and none of the proposed projects shall be interpreted to require obligation or payment of funds in violation of any applicable law, most notably the Anti-Integrated Natural Resources Management Plan Deficiency Act (31 U.S. Code [U.S.C.] 1341 *et seq.*). This INRMP is intended to help guide the natural resources management activities on the installation.

Implementation of this INRMP will follow an annual strategy that addresses legal requirements, DOD and Navy directive or policy requirements, funding, implementation responsibilities, technical assistance, labor resources, and technological enhancements. In order for this INRMP to be considered implemented, the following actions will need to be completed.

- Funding is secured for completion of all Environmental Readiness Level (ERL) 4 projects, as described in Section 5.5.
- Installation is staffed with a sufficient number of professionally trained natural resources management staff needed to perform the tasks required by the INRMP.
- Annual coordination with all cooperating offices is performed.
- Specific INRMP accomplishments that are undertaken are documented each year as part of the annual review.

The following sections provide an overview of natural resources consultation requirements, achieving no net loss, NEPA compliance, project development and classification, funding sources, commitment, and use of cooperative agreements. Appendix A provides information on the implementation schedule, prime legal driver and initiative, Navy assessment level, cost estimate, and potential funding source(s) for each of the projects proposed in this INRMP.

5.1 PROJECT IMPLEMENTATION SCHEDULE

For prioritization and budgeting purposes, actions or projects recommended in this INRMP are provided in Appendix A. The prime legal drivers, programming and budgeting classification, cost estimate, potential funding source, and completion schedule are identified for each project. Cost estimates may represent annual expenditures for the NSN and CI natural resources staff and other technical support for planning, coordinating, and implementing activities or the cost of materials, personnel, and/or contractors associated with a project. All projects submitted for O&MN environmental funding must be included in this INRMP or a clear justification for their omission must be provided. An INRMP annual increment addendum must be prepared annually to facilitate implementation of the INRMP. The annual increment addendum should provide concise detail and cost estimates of proposed work or projects planned for each FY.

Relevant legal drivers and initiatives that were identified for each management issue in this INRMP are also summarized in the project table provided in Appendix A. Primary statutes and regulations identified in the project table include the CWA, Sikes Act (as amended), ESA, NEPA, and MBTA; state conservation laws; Navy and DOD instructions and policies; and presidential EOs.

5.2 NATURAL RESOURCES CONSULTATION REQUIREMENTS

Section 7 of the ESA requires federal agencies to consult (formally or informally, depending on the level of effects to species from the proposed action) with USFWS (inland fish and wildlife) or NOAA NMFS (marine mammals, fish, or fisheries) when any proposed activity authorized, carried out, or conducted by that agency may affect a listed species or designated critical habitat. If adverse effects to listed species are anticipated as the result of proposed actions, formal consultation would be required. As a result of formal consultation, USFWS or NOAA NMFS would issue a biological opinion, which would include actions that the federal agency must complete in order to conduct the proposed activity. If proposed actions may affect, but are not likely to adversely affect listed species, Section 7 consultation can be done informally and without the need to conduct a comprehensive biological assessment. In this case a letter of concurrence would be provided by the interested agency.

If critical habitat is located on federal property and adequate protection and management of the critical habitat has been included in the installation INRMP, the ESA allows USFWS and or NOAA NMFS to preclude this habitat from the biological opinion. However, in order for the critical habitat to be excluded, the qualifying INRMP must address the maintenance and improvement of the primary constituent elements important to the species, and must manage for the long-term conservation of the species. The USFWS or NOAA NMFS may decline to designate critical habitat where there exists a plan that provides for the adequate management or protection for listed species. The USFWS uses the following three-point criteria to determine if an INRMP provides adequate management or benefit to species. For each criterion, an explanation of how the INRMP addresses the requirement is provided.

1. The plan provides a conservation benefit to the species. The cumulative benefits of management activities identified in a management plan, for the length of the plan, must maintain or provide for an increase in a species' population or the enhancement or restoration of its habitat within the area covered by the plan (i.e., those areas deemed essential for conservation of the species). A conservation benefit may result from reducing fragmentation of habitat, maintaining or increasing populations, insuring against catastrophic events, enhancing and restoring habitats, buffering protected areas, or testing and implementing new conservation strategies.

2. The plan provides certainty that the management plan will be implemented. Persons charged with plan implementation are capable of accomplishing the objectives of the management plan and have adequate funding for implementing the management plan. They have the authority to implement the plan and have obtained all the necessary authorizations or approvals. An implementation schedule (including completion dates) for conservation effort is provided in the plan.

3. The plan provides certainty that the conservation effort will be effective. The following criteria are considered when determining the effectiveness of the conservation effort. The plan includes: (1) biological goals (broad guiding principles for the program) and objectives (measurable targets for achieving the goals); (2) quantifiable, scientifically valid parameters that will demonstrate achievement of objectives, and standards for these parameters by which progress will be measured; (3) provisions for monitoring and, where appropriate, adaptive management; (4) provisions for reporting progress on implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the conservation effort; and (5) a duration sufficient to implement the plan and achieve the benefits of its goals and objectives.

In addition to USFWS consultation requirements for potential impacts to federally listed species, all project and plans, including INRMPs, must be submitted to USFWS via their online project review system to determine if there are federally listed species, critical habitat, or special status species concerns for the Installation. Submission of the INRMP for USFWS review using this process will ensure all species identified by USFWS as a concern for the Installation have been addressed.

The USFWS online project review process is available at:
http://www.fws.gov/northeast/virginiafield/endspecies/Project_Reviews_Introduction.html

5.3 ACHIEVING NO NET LOSS

Section 101(b)(1)(I) of the Sikes Act (16 U.S.C. 670a *et seq.*) as amended states that each INRMP shall, to the extent appropriate and applicable, and consistent with the use of the installation to ensure the preparedness of the Armed Forces, provide for “no net loss in the capability of military installation lands to support the military mission of the installation.” It is DOD policy that appropriate management objectives to protect mission capabilities of installation lands (from which annual projects are developed) be clearly articulated, and receive high priority in the INRMP planning process (Navy 2006).

The effectiveness of this INRMP in preventing “net loss” will be evaluated annually. Mission requirements and priorities identified in this INRMP will, where applicable, be integrated into other environmental programs and policies. It is not the intent that natural resources are to be consumed by mission requirements, but rather are sustained for the use of mission requirements. To achieve this, the goal of this INRMP is to conserve the environment for the purpose of the military mission. There may be instances where a “net loss” of mission capability may be unavoidable to fulfill regulatory requirements other than the Sikes Act, such as complying with a biological opinion under the provisions of the ESA, or from the protection of wetlands under the provisions of the CWA. However, both the USFWS and USACE are required to adhere to the Sikes Act provision of no net loss. Loss of mission capability in these instances will be identified in the annual update of the INRMP and will

include a discussion of measures being undertaken to recapture any net loss in mission capability.

5.4 NEPA COMPLIANCE

Prior to passage of Sikes Act legislation (16 U.S.C. 670a *et seq.*) as amended, the extent of natural resources management on military lands was largely discretionary. Although installations with applicable natural resources were required to prepare natural resources plans, it was not a legal requirement. The only legal natural resources requirements for installations were related to compliance with ESA, CWA, and other statutory requirements or DOD directives. Passage of the Sikes Act, as amended (16 U.S.C. 670a *et seq.*), brought into effect the requirement for “the Secretary of each military department to prepare and implement an INRMP for each military installation in the U.S. under the jurisdiction of the Secretary” (Navy 2006). The Council on Environmental Quality (CEQ) defines an INRMP as a major Federal action requiring NEPA analysis, and as a result the Navy Office of the Assistant General Counsel (Energy, Installations, and Environment) has established that implementation of an INRMP per Sikes Act requirements, necessitates the preparation of NEPA documentation prior to approval of the INRMP. The preparation of an EA is usually sufficient to satisfy the NEPA review requirement for most installation INRMPs; however, in cases where implementation of the INRMP will have significant impact on the environment, the preparation of an Environmental Impact Statement (EIS) is required. Annual updates and revisions are covered by the original NEPA documentation unless a major change in installation mission or program scope occurs.

Decisions that affect future land or resource use that are associated with an INRMP require NEPA analysis. The NRM should refer to Secretary of the Navy Instruction (SECNAVINST) 5090.6A, and Chapter 5 of OPNAVINST 5090.1D for basic guidance on the preparation of NEPA documents. CEQ’s “Regulations for Implementing NEPA” (available at: http://ceq.hss.doe.gov/nepa/regs/ceq/toc_ceq.htm) and “NEPA’s 40 Most Asked Questions” (available at: <http://ceq.hss.doe.gov/nepa/regs/40/40p3.htm>) provide further information. The INRMP and associated NEPA documentation should be prepared as individual documents to ensure that the viability, integrity, and intent of each are maintained. The intent of the INRMP is to outline projects that would fulfill Navy compliance and stewardship obligations, whereas the intent of the NEPA documentation is to analyze the impacts of the various program management options outlined within the INRMP. Although each of these documents are prepared as separate documents, they should be prepared simultaneously, as it is important for installation natural resources managers to coordinate the two documents at the earliest possible stage to ensure that decisions reflect current environmental values, and avoid potential conflicts.

Preparation of the NEPA documentation should be completed early in the planning process to involve Navy decision-makers in preparation of the document. If a comment period or public notice is required under NEPA, public notice and comment periods should be coordinated and integrated with development and review of the INRMP. A finding of no significant impact (FONSI) must be achieved before an INRMP may be approved. If a FONSI is not achievable, the NEPA process must proceed to development of an EIS. One of

the first steps in the NEPA process is to define the proposed action and explain its purpose and need. The proposed action is to develop and implement an INRMP that integrates natural resources management with the installation's military use in a manner that ensures military readiness and provides for sustainable multipurpose uses and conservation of natural resources (Navy 2006). The purpose and need for the INRMP is to meet statutory requirements imposed by the Sikes Act (16 U.S.C. 670a *et seq.*) as amended, as well as the requirements of various DOD and Navy instructions. The purpose and need section for the proposed action can be further clarified with a brief discussion of the required plan elements applicable to the installation.

The majority of the NEPA document should focus on the discussion of relevant environmental issues and reasonable alternatives. Alternatives that are not feasible because they are inconsistent with the Installation mission, unreasonably expensive, too technically or logistically complex should not be included in the analysis. Additionally, any alternative that is associated with significant environmental impacts cannot be analyzed in an EA (i.e., publication of a FONSI is not possible), and would require preparation of an EIS. The CEQ defines reasonable alternatives as those that are economically and technically feasible, and utilize common sense. Feasibility is a measure of whether the alternative makes sense and is achievable. The analysis should focus on the alternatives and methodologies proposed for accomplishing the management objectives for the program elements. Appendix E of the 2006 Navy INRMP Guidance document recommends that the NEPA analysis for INRMP documents adopt a "programmatic" approach that provides opportunities for the Installation to accommodate unforeseen projects that meet pre-established criteria for significance evaluation, as well as changes to the projects, as long as impacts are covered within the overall scope and analysis for the selected alternative (Navy 2006). Analysis in the NEPA document will focus on evaluation and comparison of alternative plans in association with four management objectives: forestry management, fish and wildlife management, land management, and management for outdoor recreation opportunities. Analysis should not focus on the individual projects or practices except in the cases of controversial projects, or projects considered outside the scope of, or a major deviation from a previously existing INRMP (Navy 2006). The projects and recommendations outlined in an INRMP should provide a framework for reviewing on-going activities, and will assist in reviewing changes for unforeseen projects or modifications in the future. It is important to distinguish that the NEPA analysis for evaluating plans/programs is different from the project level of analysis used for project specific actions.

The No Action alternative should always be included as an alternative to implementation of the INRMP. The No Action alternative describes impacts that would occur if the Installation did not implement the INRMP, and the Installation continued to operate without a plan or the existing plan if one is in place. The No Action alternative serves as a baseline to which all other alternatives are compared. Each alternative should describe the general geographical extent applicable to each of the management objectives and program elements. Each of the reasonable alternatives may only represent variable intensities of one or more of the management objectives and program elements; however, differences in funding levels for each alternative would not constitute a valid range of alternatives. For example, it is not acceptable for all required compliance projects to represent an alternative. A brief summary

and comparison of all alternatives considered for the INRMP should be included in the NEPA document to provide the agency and public reviewers with the range of management scenarios that were analyzed.

Although specific projects are not required to be analyzed in the NEPA document, a complete list of projects, including description, cost estimate, funding priority designations, and implementation schedule must be included to provide the basis of the proposed action. If agency stakeholders and the Navy determine that potential projects are controversial, sufficient project details must be provided in the INRMP so that a decision can be made regarding significance as part of the NEPA analysis. Additionally, controversial projects, or projects outside the scope or intent of the INRMP, may require a tiered or amended NEPA document for that specific project. All projects must be consistent with the methodologies analyzed in the NEPA document, and the Installation should ensure that the NEPA documentation for the INRMP is prepared such that it will accommodate for unforeseen projects, and changes to original projects. Reference Appendix E of the Navy INRMP Guidance document (Navy 2006) for more information on NEPA requirements associated with evaluation of INRMP documents.

5.5 PROJECT DEVELOPMENT AND CLASSIFICATION

This INRMP is a public document that requires the mutual agreement of the Installation, USFWS, and state fish and wildlife agencies. It is crucial therefore, that these entities reach a common understanding as to which projects are most likely to be funded through the sources identified in Section 5.6. An annual strategy must be adopted for INRMP funding that addresses the Installation's legal requirements. The Navy programming hierarchy is described in Section 5.5.1 and Project Classification is described in Section 5.5.2.

5.5.1 Programming Hierarchy

The Navy funding classification of recurring and non-recurring projects consists of four ERLs, as defined by M-5090.1. The ERLs, as defined below, are listed in order of funding priority, where ERL 4 is the absolute minimum requirement to achieve compliance and has the highest funding priority.

Environmental Readiness Level 4 (ERL 4) – Environmental Compliance:

- ERL 4 is for legal requirements derived from existing laws, regulations, EOs, or the Overseas Environmental Baseline Guidance Document, as applicable; and applies to Navy activities, platforms, and operations.

Environmental Readiness Level 3 (ERL 3) – Navy or DOD Policy Requirements or Proactive Initiatives:

- ERL 3 is for requirements derived from DOD policy and DON policy, or proactive initiatives that could enable future compliance or result in a positive return on Navy investments. They could also support critical readiness activities by decreasing encumbrances of statutory compliance requirements. These efforts are not mandated

by law or other Federal, State, or local requirements but would minimize current or future impacts (including costs) to the Navy mission.

Environmental Readiness Level 2 (ERL 2) – Pending Requirements for Future Compliance:

- ERL 2 is for requirements derived from pending Federal, State, or local legal requirements, laws, regulations, or EOs that could enable future compliance but result in less certain returns on investments and uncertain benefits to the Navy mission. These project efforts are not mandated by existing law or other Federal, State, or local requirements. Funding requirements should be based on best available scientific or commercial data; or on pending Federal, State, or local regulations under development (where publication is scheduled) under model State regulations or permit standards, if available.

Environmental Readiness Level 1 (ERL 1) – Navy Environmental Stewardship:

- ERL 1 is for investments in environmental leadership and general proactive environmental stewardship.

5.5.2 Project Classification

The list of projects described in this INRMP consist of both “must fund”, compliance-type projects and stewardship-type projects. “Must fund” compliance-type projects and activities are those projects and activities that are required to meet recurring natural and cultural resources conservation management requirements or current legal compliance needs, including EOs. These projects are designated ERL 4 or 3 in the Navy funding classification system, described in Section 5.5.1.

“Must fund” or ERL 4 or 3 projects could include:

- developing, updating, and revising INRMPs;
- salaries and annual training of professional personnel involved in the development and implementation of INRMPs, in accordance with Individual Development Plans;
- terms and conditions of Biological Opinions issued by USFWS or NMFS;
- baseline surveys needed to keep INRMPs current;
- biological surveys to determine population status of endangered, threatened and sensitive species;
- survey and monitoring programs to support MBTA and related permits;
- wetland surveys for planning, monitoring and/or permit applications;
- erosion control measures required to remain in compliance with natural resources protection regulations and to maintain land condition for realistic training operations;
- invasive species surveys, management plans, and control efforts;
- climate change vulnerability assessments and adaptation plans;

- support of leadership roles or executive agent responsibilities such as for the Coastal America, and Chesapeake Bay agreements; or
- Memorandums of Agreement/Understanding commitments.

This list is not meant to be all-inclusive, but is meant to provide an overview of the types of projects that could be classified as compliance or must-fund projects.

The Navy may also pursue funding for projects that go beyond current legal and policy drivers, in anticipation of requirements that may come about for future Navy actions or as a result of by pending legislation. These “future compliance” projects, which are not mandatory to fund or implement, are classified by the Navy as ERL 2, and could include:

- Installation-wide wetlands delineations for USACE Jurisdictional Determination of areas beyond the sites of current/proposed modification;
- surveys or habitat improvement for candidate species or species proposed for listing under the ESA;
- developing a stormwater management improvement strategy; and
- creating living shoreline buffer areas to address shoreline erosion.

In addition to compliance-oriented projects, INRMPs should include valid projects and programs that enhance an installation’s natural resources, promote proactive conservation measures, and support investments that demonstrate Navy environmental leadership and proactive environmental stewardship. These projects are considered “stewardship” projects and fall under ERL 1 in the Navy classification system. Examples of stewardship projects include, but are not limited to:

- community outreach activities, such as Earth Day and Migratory Bird Day activities;
- education and public awareness projects such as interpretive displays, oral histories, watchable wildlife areas, nature trails, wildlife checklists, and conservation teaching materials;
- biological surveys or habitat protection for non-listed species;
- management and execution of volunteer and partnership programs;
- demonstration plantings of native plant materials and trees;
- experimental conservation techniques;
- agricultural outlease improvements;
- forest stand improvements and other management efforts; and
- wildlife management efforts.

The ERLs that correspond to each of the projects proposed herein are included in the NSN and CI INRMP Projects Table, (Table A-1, Appendix A). All INRMP Projects must be entered into the environmental program requirements network (EPR-web) system and receive

approval up the chain of command prior to soliciting any signatures on the INRMP. CNO Environmental Readiness Division (N45) is the final authority for designating the appropriate ERL for a given INRMP Project.

5.6 FUNDING SOURCES

INRMP projects must be validated and entered into the EPR-web before ERL 3 and 4 projects can be programmed into the system for funding. ERL 1 and 2 projects are not usually funded through the EPR-web system, and alternate sources of funding should be sought for these projects. EPR-web project entries should include clear justification of funds being requested so that: (1) natural resource funds are distributed wisely, and (2) funding levels are not threatened by the use of funds in ways that are inconsistent with funding program rules (Navy 2006). The primary sources for funding Navy natural resources programs are: Operations and Maintenance, Navy (O&MN) Environmental Funds, Sikes Act Revenues, Legacy Resource Management Program (Legacy) Funds, Navy Forestry Revenues, Agricultural Outleases, Fish and Wildlife Fees, Recycling Funds, SERDP Funds, and other Non-DOD Funds.

5.6.1 O&MN Environmental Funds

A majority of natural resource projects are funded with O&MN environmental funds, and are primarily restricted to support “must-fund” environmental compliance projects (i.e., Navy ERL 4 projects). O&MN environmental funds are generally not allocated for ERL 1–3 projects. Other limitations for the use of O&MN environmental funds include the following.

- Only the initial procurement, construction, and modification of a facility or project are considered valid environmental funding requirements. The subsequent operation, modification due to mission requirements, maintenance, repair, and eventual replacement is considered a Real Property Maintenance funding requirement.
- When natural resource requirements are tied to a specific construction project or other action, funds for natural resource requirements should be included in project costs.

O&MN environmental funds are expected to be the primary source of funding for NSN and CI INRMP Environmental Compliance Projects.

5.6.2 Sikes Act Revenues

Sikes Act Revenues include funds received for hunting and fishing permits and fees that are primarily collected as part of installation hunting, fishing or trapping programs. These fees are deposited and used in accordance with the Sikes Act (16 U.S.C. 670a *et seq.*) as amended and DOD financial management regulations. The Sikes Act (16 U.S.C. 670a *et seq.*), as amended, specifies that user fees collected for hunting, fishing or trapping shall be used only on the installation where they are collected, and be used exclusively for fish and wildlife conservation and management at that installation. It is unlikely that NSN and CI would implement a hunting program; however, fees are collected as part of the fishing permits

issued for recreational fishing in the lakes and coastal areas. These fees may be used to support natural resource management projects.

5.6.3 The Legacy Resource Management Program

The Legacy Resource Management Program (Legacy) was part of a special Congressional mandated initiative for funding military conservation projects. Although Legacy was originally funded from 1991 to 1996 only, funds for new projects have continued to be available through this program (Navy 2006). Legacy funds can be used for a variety of conservation projects, such as regional ecosystem management initiatives, habitat preservation efforts, archaeological investigations, invasive species control, monitoring and predicting migratory patterns of birds and animals, and national partnerships and initiatives, such as National Public Lands Day. Requests for Legacy funds should consider the following:

- The availability of Legacy funds is generally uncertain early in the year.
- Pre-proposals for Legacy projects are due in March and submitted using the Legacy Tracker Website.
- Project proposals are reviewed by the Navy chain of command before being submitted to the DOD Legacy Resource Management Office for final project selection.
- The Legacy Website provides further guidance on the proposal process and types of projects requested.

Legacy funds should be considered a potential funding source for NSN and CI INRMP Projects.

5.6.4 Navy Forestry Revenues

Forestry Revenues originate from the sale of forest products on Navy lands, and can be used to fund forestry and potentially other natural resources management programs. Forestry revenues are given preference for funding the Annual Navy Forestry Funds and the DOD Forestry Reserve Account. Annual Navy Forestry Funds are used to support commercial forestry operations at installations. Forestry revenues are first used to reimburse commercial forestry expenses, then, as directed by DOD Financial Management Regulation 7000.14-R Volume 11A, 40% of net proceeds for the FY for a given installation are distributed to the state in which the installation resides. The state usually uses these funds to support road systems and schools. Once the commercial forestry expenses are reimbursed, and proceeds are distributed among the state counties, any remaining amount is transferred to a holding account known as the DOD Forestry Reserve Account.

Forestry Revenues can also be used to fund the improvement of forested lands; fund unanticipated contingencies associated with administration of forested lands and production of forest products, for which other sources of funds are not available; and natural resources management for implementation of approved plans and agreements. In order for a natural

resources project to be eligible for funding from Forestry Revenues it must be specifically included in an approved management plan, such as an INRMP; and must provide for:

- fish and wildlife habitat improvements or modifications;
- range rehabilitation where necessary for support of wildlife;
- control of off-road vehicle traffic;
- specific habitat improvement projects and related activities; and
- adequate protection for species of fish, wildlife, and plants considered threatened or endangered.

The amount of funds available through Forestry Revenues varies from year to year. It is important to note that the amount of funds remaining for natural resources management is relatively small, and although installations are not required to have a timber harvesting plan to be eligible for funds from the DOD Forestry Reserve Account, Reserve Account funds cannot be used for “must fund” environmental compliance projects. DOD Forestry Reserve Account funds are a potential source of funding for NSN and CI INRMP Projects that are not classified as environmental compliance projects.

5.6.5 Agricultural Outleases

Agricultural Outleasing funds are collected through the leasing of Navy-owned property for agricultural use. This money is directed back into the natural resources program and reallocated throughout the Navy by NAVFAC Headquarters. Agricultural Outleasing funds are primarily allocated for agricultural outlease improvements, but may also potentially be used for natural resources management and stewardship projects once the primary objective is met. In addition to projects related to agricultural outleasing, these funds can be used for implementation of INRMP Stewardship Projects. Although funds available through Agricultural Outleasing varies from year to year, this funding source is one of the more consistent sources for implementing INRMP projects that do not have Level 1 requirements. Agricultural Outleasing funds should be considered as a potential funding source for NSN and CI INRMP Projects that are not classified as environmental compliance projects.

5.6.6 Recycling Funds

Installations that have a Qualified Recycling Program (QRP) may use their proceeds for some types of natural resource projects. Any proceeds collected as part of the installation QRP must first be used to cover QRP costs, and then up to 50% of the net proceeds can be for pollution abatement, pollution prevention, composting, alternative fueled vehicle infrastructure support, vehicle conversion, energy conversion, or occupational safety and health projects, with first consideration given to projects included in the installation’s pollution-prevention plans. Remaining funds may be transferred to the non-appropriated MWR account for approved programs, or retained to cover anticipated future program costs. NSN and CI does not currently include a QRP so Recycling Funds are not expected to be used to support any of the natural resource project recommended in this INRMP.

5.6.7 Strategic Environmental Research and Development (SERDP) Funds

SERDP is DOD's corporate environmental research and development program, planned and executing in full partnership with the Department of Energy and EPA, with participation by numerous other Federal and non-Federal organizations (Navy 2006). SERDP funds are allocated for environmental and conservation project through a competitive process. The focus of SERDP is on Cleanup, Compliance, Conservation, and Pollution Preventions technologies. Due to the competitive process involved with allocation of SERDP Funds, NSN is not expected to receive funds through this source.

5.6.8 Non-DOD Funds

Non-DOD Funds, such as those received from grant programs, are available to fund natural resources management projects, such as watershed management and restoration, habitat restoration, and wetland and riparian area restoration. Federally funded grant programs typically require non-Federal matching funds, however, installations can partner with other groups for preparing proposals for eligible projects. NSN and CI should consider grant funding and partnerships as a potential funding source for INRMP natural resources projects.

5.7 COMMITMENT

This INRMP will require formal adoption by the Regional Commander or Installation CO to ensure commitment for pursuing funding, and to execute all ERL 4 Projects, subject to the availability of funding. Funding of ERL 4 Projects should be pursued within the specific timeframes identified in Appendix A of this INRMP.

5.8 USE OF COOPERATIVE AGREEMENTS

A cooperative agreement is used to acquire goods or services, or stimulate an activity that will be implemented for the public good. The Sikes Act (16 U.S.C. 670a *et seq.*), as amended, provides the authority to enter into cooperative agreements with state and local governments, nongovernmental organizations, and individuals to provide for the maintenance and improvement of natural resources on, or to benefit natural and historic research on, DOD installations. In addition to a standard cooperative agreement, examples of other agreements include MOU, and Cooperative Assistance Agreement. Funds appropriated for multiyear agreements during a FY may be obligated to cover the cost of goods and services provided under a cooperative agreement entered into or through an agency agreement under Section 1535 of Title 31 during any 18-month period beginning in that FY, without regard to whether the agreement crosses FYs. Cooperative agreements entered into are subject to the availability of funds.

EO 13352, *Facilitation of Cooperative Conservation*, directs that the Secretaries of the Interior, Agriculture, Commerce, and Defense and the Administrator of the EPA shall, to the extent permitted by law and subject to the availability of appropriations and in coordination with each other as appropriate: carry out the programs, projects, and activities of the agency that they respectively head that implement laws relating to the environment and natural

resources in a manner that facilitates cooperative conservation; take appropriate account of and respects the interests of persons with ownership or other legally recognized interests in land and other natural resources; properly accommodate local participation in Federal decision making; and provides that the programs, projects, and activities are consistent with protecting public health and safety.

This page intentionally left blank

6.0 REFERENCES

- Armed Forces Pest Management Board. 2012. Technical Guide No. 37: Integrated Management of Stray Animals on Military Installations. Available at: <http://www.afpmb.org/sites/default/files/pubs/techguides/tg37.pdf>. Last accessed on 01 November 2013. 16 pp.
- ASMFC. 2007. Species Profile: Atlantic Croaker, Amendment Seeks to Maintain Healthy Mid-Atlantic Stock Component. Excerpted from *ASMFC Fisheries* Vol. 16, Issue 3, April.
- Atlantic States Marine Fisheries Commission (ASMFC). 2009. Species Profile: Black Sea Bass, Joint Management Yields Rebuilt Status for Popular Mid-Atlantic Fish. Excerpted from *ASMFC Fisheries* Vol. 18, Issue 6, August.
- Austin, T. 2016. Comment on March 2016 Draft Integrated Natural Resources Management Plan for Naval Station Norfolk and Craney Island Fuel Depot. Comment Response Matrix, dated 29 April.
- Benton, N., J.D. Ripley, and F. Powledge, Eds. 2008. *Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers*. ISBN 0-9711053-8-3. Arlington, VA: NatureServe. Available at: <http://www.DODbiodiversity.org>.
- Binohlan, C. B. 2015. *Anchoa mitchilli*, Bay Anchovy. R. B. Reyes (Ed.). Available at <http://www.fishbase.org/summary/545>, accessed on 18 December 2015.
- Blakenship, K. 2015. Little things turn out to be big deals in Bay predator diets: Analysis finds invertebrates, tiny anchovies are critical in Chesapeake food web. *Bay Journal Online*. Available at http://www.bayjournal.com/article/little_things_turn_out_to_be_big_deals_in_bay_predators_diets, accessed on 07 December 2015.
- Boesch, D. F., R. B. Brinsfield, and R. E. Magnien. 2001. Chesapeake Bay Eutrophication: Scientific Understanding, Ecosystem Restoration, and Challenges for Agriculture. *Journal of Environmental Quality* 30:303–320.
- Bonzek, C.F., J. Gartland, and R. J. Latour. 2011. Data collection and analysis in support of single and multispecies stock assessments in Chesapeake Bay: The Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP). Project # F-130-R-6. Annual Progress Report to the Virginia Marine Resources Commission, and the United States Fish and Wildlife Service. Virginia Institute of Marine Science, Gloucester Point, VA. 160 pages.
- Bullard, John K. 2016. Letter on behalf of National Oceanic and Atmospheric Administration (NOAA) Greater Atlantic Regional Office to Assistant Secretary of the Navy for Environment, Karnig Ohannessian, regarding proposed critical habitat for three Distinct Population Segments (DPSs) of Atlantic sturgeon. 12 October. 5 pp.

References

- Buranen, Margaret. 2010. The Navy and Stormwater: As the government adopts new LID practices, one branch of the service charges ahead. *Stormwater*, January–February issue. Available at http://www.biaw.com/documents/LID/BMPs/navy_and_stormwater.pdf, accessed 01 December 2015.
- Center for Coastal Resources Management. 2015. Living Shorelines Legislative Initiative Items within Virginia Senate Bill 964. Available at http://ccrm.vims.edu/livingshorelines/policy_legislation/index.html, accessed on 24 February 2016.
- City of Norfolk. 2015. *plaNorfolk 2030*. December 2015 update. Department of City Planning. Norfolk, Virginia: 231 pp. Available at <http://www.norfolk.gov/index.aspx?nid=1376>, accessed on 21 February 2016.
- CH2M HILL. 2014. Final Site Management Plan, Fiscal Year 2014, Naval Station Norfolk, Norfolk Virginia. Prepared for Department of the Navy, Navy Facilities Engineering Command, Mid-Atlantic. Virginia Beach, Virginia. 66 pp.
- Chesapeake Bay Program. 2015. Chesapeake Bay's underwater grass abundance rises 27 percent in 2014. *Chesapeake Bay News*, 30 July online edition. Available at http://www.chesapeakebay.net/blog/post/chesapeake_bays_underwater_grass_abundance_rises_27_percent_in_2014, accessed on 28 February 2016.
- Chesapeake Bay Program Partners. 2014. Chesapeake Watershed Agreement. 20 pp.
- Chesapeake Bay Program Sediment Workgroup. 2007. An Introduction to Sedimentsheds: Sediment and Its Relationship to Chesapeake Bay Water Clarity, Final Report. CBP-TRS-286-07. May 2007.
- Clark, R. E. 2014. Naval Station Norfolk Environmental Policy. Document No. 5090-N00. 07 March 2014.
- College of William and Mary, Department of Geology. n.d. Coastal Plain Province, The Geology of Virginia. Available at: http://web.wm.edu/geology/virginia/provinces/coastalplain/coastal_plain.html?svr=www, accessed on 16 December 2015.
- Connell, J. H. 1961. The influence of intra-specific competition and other factors on the distribution of the barnacle *Chthamalus stellatus*. *Ecology* 42:710–723.
- CNIC (Commander, Navy Installations Command). n.d. Naval Station Norfolk History. [Web site]. https://www.cnic.navy.mil/regions/cnrma/installations/ns_norfolk/about/history.html, accessed on 20 February 2016.
- CNRMA (Commander, Navy Region Mid-Atlantic). 2011. Consolidated Regional Facility Response Plan, Oil & Hazardous Substance Contingency Plan for VA-FRP-073 (Naval Station Norfolk), VA-FRP-083 (Oceana Naval Air Station), and VA-FRP-110 (Joint Expeditionary Base Little Creek). 15 December. 1374 pp.

References

- Denny, M., and D. Wethey. 2001. Physical processes that generate patterns in marine communities. In M. D. Bertness, S. D. Gaines, and M. E. Hay (Eds.), *Marine Community Ecology*, pp. 3–37. Sinauer Associates, Sunderland.
- DOD (U.S. Department of Defense). 2011a. Adaptation Planning for Climate Change in Integrated Natural Resources Management. December 2011. Available online at: http://www.dodnaturalresources.net/files/DoD_CC_INRMP_Fact_Sheet_01-16-12.pdf, accessed on 18 February 2013.
- DOD (U.S. Department of Defense). 2011b. Department of Defense Chesapeake Bay Strategic Action Plan. 2011 Update.
- DOD (U.S. Department of Defense). 2013. Conservation Law Enforcement Program (CLEP). Department of Defense Instruction Number 5525.17, dated 17 October.
- Doering, P. H., C. A. Oviatt, B. L. Nowicki, E. G. Klos, and L. W. Reed. 1995. Phosphorus and nitrogen limitation of primary production in a simulated estuarine gradient. *Marine Ecology Progress Series* 124:271–287.
- Duhring, Karen. 2014. Living Shorelines in Virginia: What’s happened since the 2006 Living Shorelines Summit? Virginia Institute of Marine Science, Center for Coastal Resources Management. Available online at http://crm.vims.edu/education/workshops_events/spring2014/1_Duhring_May22_PDF.pdf, accessed 26 July 2016.
- Environmental Management Commander, Naval Base Norfolk. 1997. Integrated Natural Resources Management Plan, Naval Base Norfolk, Norfolk, Virginia. Incomplete, unpublished Draft.
- EPA (U.S. Environmental Protection Agency). 2010. Chesapeake Bay TMDL Executive Summary. 29 December revision. 14 pp.
- EPA (U.S. Environmental Protection Agency). 2015. Data from the National Aquatic Resource Surveys. <http://www2.epa.gov/national-aquatic-resource-surveys/data-national-aquatic-resource-surveys>, accessed on 19 November 2015. Last updated 14 November 2015.
- ESRI. n.d. Agricultural Capability of United States Soils. Land Capability Class. [Web site]. Available at <http://resources.arcgis.com/en/communities/soils/02ms00000005000000.htm>, accessed 07 September 2016.
- Fleet and Industrial Supply Center. 2008. Craney Island Fuel Terminal Port Guide. CRANEYISLANDFUELDINST 4027.1B 700, issued 01 October 2008.
- Fleming, G. P., K. D. Patterson, K. Taverna, and P. P. Coulling. 2013. The natural communities of Virginia: classification of ecological community groups. Second approximation. Version 2.6. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Available at:

References

- http://www.dcr.virginia.gov/natural_heritage/natural_communities/ncintro.shtml, accessed 17 December 2015.
- Fugro Atlantic. 2012. City-wide Coastal Flooding Study, Norfolk, Virginia. Contract Job Number 04.81110022. Prepared for City of Norfolk, Virginia. Available at <http://www.norfolk.gov/DocumentCenter/View/1737>, accessed on 16 December 2015.
- Geo-Marine, Inc. 2000. Wetland Delineation of Naval Station Norfolk, Virginia. Prepared for Naval Facilities Engineering Command, Atlantic Division.
- Geo-Marine, Inc. 2011. Airfield Clear Zone Management Plan for Naval Station Norfolk Chambers Field, Virginia. Final (June Revision). Hampton, Virginia: 128 pp.
- Geo-Marine, Inc. 2012. Environmental Assessment for Implementation of an Airfield Obstructions Management Plan at Naval Station Norfolk, Chambers Field Virginia. FINAL. Prepared for Naval Facilities Engineering Command Mid-Atlantic.
- Hager, C. 2015. Telemetry Tracking of Atlantic Sturgeon in the Lower Chesapeake Bay: Annual Progress Report for 2014. Submitted to Naval Facilities Engineering Command (NAVFAC) Atlantic, Norfolk, Virginia, under Contract No. N62470-10-3011, Task Order XE19, issued to HDR Inc., Norfolk, Virginia. Submitted by Chesapeake Scientific, LLC, Hampton Roads, Virginia. 1 June 2015.
- Hankerson, Mechelle. 2016. Shadow spotted in Rudee Inlet turns out to be manatee swimming in Virginia Beach. *The Virginian-Pilot*. 29 July. Available at http://pilotonline.com/news/local/shadow-spotted-in-rudee-inlet-turns-out-to-be-manatee/article_b1ac7b1b-a24b-5eac-ab42-ac3219f81acc.html, accessed on 26 March 2017.
- Illinois Department of Natural Resources. 2012. 2012 IDNR Recovery Outline for the Osprey (*Pandion haliaetus*) in Illinois. Final. 28 August.
- Irani, F. 2013. Map: Average 2000–2010 Stream Health in the Chesapeake Bay Sub-watersheds. Created 29 May 2013. Available at: http://www.chesapeakebay.net/maps/map/average_2000_2010_stream_health_in_the_chesapeake_bay_sub_watersheds, accessed on 4 January 2016.
- Lenntech. 2015. Nitrogen (N) and Water. [Web site.] Available at: <http://www.lenntech.com/periodic/water/nitrogen/nitrogen-and-water.htm>, accessed on 7 December 2015.
- Lutcavage, M. and J.A. Musick. 1985. Aspects of the Biology of Sea Turtles in Virginia. *Copeia* 1985:449–456.

References

- Markwood, Mark. 2016. Naval Station Norfolk Public Works Department Planning review of Pre-final Integrated Natural Resources Management Plan for Naval Station Norfolk and Craney Island Fuel Terminal. [Comment Response Matrix.] 11 October.
- McCaffrey, B. [Ed.] 2011a. CNO Environmental Awards Recognize Exceptional Stewardship. *Currents*, summer: 16–29. Available at: http://greenfleet.dodlive.mil/files/2011/08/Currents_Summer_2011.pdf, accessed on 01 December 2015.
- McCaffrey, B. [Ed.] 2011b. Commander, Navy Region Mid-Atlantic Installs its First Green Roof at Naval Station Norfolk. *Currents*, summer: 52–53. Available at: http://greenfleet.dodlive.mil/files/2011/08/Currents_Summer_2011.pdf, accessed on 01 December 2015.
- Menge, B. A., and J. P. Sutherland. 1976. Species diversity gradients: Synthesis of the roles of predation, competition, and temporal heterogeneity. *American Naturalist* 110: 351–369.
- Murray-Brown, Mark. 2016. Agency response letter re: Review of Pre-Final Integrated Natural Resource Management Plan (INRMP). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, Protected Resources Division. 07 December. 3 pp.
- Naval Supply Systems Command, Fleet Logistics Center, Norfolk. 2016. Defense Supply Point Craney Island Fuel Terminal Oil & Hazardous Substance Facility Response Plan. February. 313 pp.
- NAVFAC Atlantic (Naval Facilities Engineering Command Atlantic Division). 2005. Environmental Assessment for Modernization of the Norfolk Magnetic Silencing Facility. Norfolk, VA. September.
- NAVFAC Environmental (Naval Facilities Engineering Command Environmental Program). 2014. U.S. Navy Afloat Environmental Compliance Training. [Web site]. Available at http://www.navfac.navy.mil/products_and_services/ev/products_and_services/marine_resources/afloat_training.html, accessed on 11 September 2016.
- NAVFAC MIDLANT (Naval Facilities Engineering Command Mid-Atlantic). n.d. Oil Spill Response. [Web site]. http://www.navfac.navy.mil/navfac_worldwide/atlantic/fecs/mid-atlantic/about_us/environmental_norfolk/services_types/oil_recovery/spill_response.html, accessed on 22 February 2016.
- NAVFAC MIDLANT (Naval Facilities Engineering Command Mid-Atlantic). 2012. Environmental Assessment for Implementation of an Airfield Obstruction Management Plan at Naval Station Norfolk, Chambers Field Virginia. Prepared for Mid-Atlantic Division, Naval Facilities Engineering Command by Geo-Marine, Inc., Norfolk, Virginia.

References

- NAVFAC MIDLANT (Naval Facilities Engineering Command Mid-Atlantic). 2013. NAVFAC Mid-Atlantic Herpetofauna Database.
- Navy (U.S. Department of the Navy). 2014a. OPNAV Instruction 5090.1D (OPNAVINST 5090.1). Environmental Readiness Program. Dated 10 January. Chief of Naval Operations, Office of the Chief of Naval Operations, Washington, District of Columbia. Available at: <http://doni.daps.dla.mil/Directives/05000%20General%20Management%20Security%20and%20Safety%20Services/05-00%20General%20Admin%20and%20Management%20Support/5090.1D.pdf>. Accessed 04 February 2017. 3 pp.
- Navy (U.S. Department of the Navy). 2014b. OPNAV Manual 5090.1 (OPNAV M-5090.1). Environmental Readiness Program Manual. Chief of Naval Operations, Office of the Chief of Naval Operations, Washington, District of Columbia. January 10. Available at: <http://doni.daps.dla.mil/SECNAV%20Manuals1/5090.1.pdf>. Accessed 18 November 2016. 996 pp.
- NAVYMWR Naval Station Norfolk. n.d. Recreation. [Web site]. Available at <http://www.navymwrnavalstationnorfolk.com/recreation>, accessed 16 September 2016.
- New Hampshire Fish and Game. 2015. Windowpane. [Web site]. <http://www.wildlife.state.nh.us/fishing/profiles/windowpane-flounder.html>, accessed on 16 November 2015.
- NOAA (National Oceanographic Atmospheric Administration). 2007. River Herring (Alewife & Blueback Herring). Species of Concern. NOAA National Marine Fisheries Service. Available at http://www.nmfs.noaa.gov/pr/pdfs/species/riverherring_highlights.pdf, accessed on 31 December 2015.
- NOAA (National Oceanographic Atmospheric Administration). 2014. Tides and Currents at Sewells Point. Norfolk, VA. Available at <http://tidesandcurrents.noaa.gov/noaatidepredictions/NOAATidesFacade.jsp?Stationid=8638610>, accessed on 11 September 2016.
- NOAA (National Oceanographic Atmospheric Administration). 2015a. Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*). [Web page.] Available at <http://www.fisheries.noaa.gov/pr/species/fish/atlantic-sturgeon.html>, accessed on 14 January 2016. Last updated 15 January 2015.
- NOAA (National Oceanographic Atmospheric Administration). 2015b. Bottlenose Dolphin (*Tursiops truncatus*). [Online Factsheet]. Available at <http://www.fisheries.noaa.gov/pr/species/mammals/dolphins/bottlenose-dolphin.html>, accessed on 31 December 2015. Last updated 15 January 2015.

References

- NOAA (National Oceanographic Atmospheric Administration). 2015c. Commercial Fisheries Statistics. <http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/landings-by-gear/index>, accessed on 3 December 2015.
- NOAA (National Oceanographic Atmospheric Administration). 2015d. NOAA Nautical Chart On-Line Viewer, Atlantic. Available at <http://www.charts.noaa.gov/OnLineViewer/AtlanticCoastViewerTable.shtml>, accessed on 11 December 2015.
- NOAA (National Oceanic and Atmospheric Administration). 2016a. Endangered and Threatened Species; Designation of Critical Habitat for the Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments of Atlantic Sturgeon. [Proposed Rule]. *Federal Register* 81, 107: 35701–35732. NOAA National Marine Fisheries Service (NMFS). Available at https://www.greateratlantic.fisheries.noaa.gov/protected/atlsturgeon/docs/2016-12743_fr_notice.pdf, accessed on 11 September 2016.
- NOAA (National Oceanic and Atmospheric Administration). 2016b. Environmental Sensitivity Index (ESI) Maps. Available at <http://response.restoration.noaa.gov/esi>, accessed on 22 February 2016.
- NOAA (National Oceanic and Atmospheric Administration) Fisheries. n.d. Atlantic Sturgeon Chesapeake Bay Distinct Population Segment: Endangered. [Online Factsheet.] Available at http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticsturgeon_chesapeakebay_dps.pdf, accessed on 14 January 2016.
- NOAA (National Oceanic and Atmospheric Administration) Greater Atlantic Regional Fisheries Office. 2016. Proposed Critical Habitat for Atlantic Sturgeon. The Gulf of Maine, New York Bight, and Chesapeake Bay Distinct Population Segments. [Information Meeting Presentation.] 14 July. 48 pp.
- NSN (Naval Station Norfolk). 2003. Environmental Management System (EMS). Flyer. Available at http://cnic.navy.mil/regions/cnrma/installations/ns_norfolk/om/enviromental_support.html, accessed on 13 July 2015.
- NSN (Naval Station Norfolk). 2011. Naval Station Norfolk Master Plan. Prepared by ERG and Urban Design Associates for Naval Station Norfolk Public Works Division. May. 35 pp.
- Olexa, T. 2015. Personal communication to S. Buchanan re NAVSTA Norfolk INRMP Updated Project List. [Email]. 29 December.
- Packer, D. B., S. J. Griesbach, P. L. Berrien, C. A. Zetlin, D. L. Johnson, and W. W. Morse. 1999. Essential Fish Habitat Source Document: Summer Flounder, *Paralichthys*

References

- dentatus*, Life History and Habitat Characteristics. NOAA Technical Memorandum NMFS-NE-151. Available at <http://www.nefsc.noaa.gov/nefsc/publications/tm/tm151/tm151.pdf>, accessed on 6 January 2015.
- Paine, R. T. 1994. Marine rocky shores and community ecology: An experimentalist's perspective. Ecology Institute, Oldendorf/Luhe, Germany.
- Robinette, H. R. 1983. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Gulf of Mexico)—Bay Anchovy and Striped Anchovy. Biological Report 82(11.14), TR EL-82-4.
- Salonen, Arne V. 2016. Naval Station Norfolk Public Works Department AICP review of Pre-final Integrated Natural Resources Management Plan for Naval Station Norfolk and Craney Island Fuel Terminal. [Comment Response Matrix.] 11 October.
- Savard, J-P. L., P. Clergeau, and G. Mennechez. 2000. Biodiversity concepts and urban ecosystems. *Landscape and Urban Planning* 48(2000):131–142. Available online at http://www.cabnr.unr.edu/weisberg/NRES675/Savard_2000.pdf, accessed 11 September 2016.
- Sebens, K. 1982. Competition for Space: Growth Rate, Reproductive Output, and Escape in Size. *American Naturalist* 120:189–197.
- SERDP (Strategic Environmental Research and Development Program). 2013. Assessing Impacts of Climate Change on Coastal Military Installations: Policy Implications. <http://www.serdp.org/Featured-Initiatives/Climate-Change-and-Impacts-of-Sea-Level-Rise>, accessed on 21 February 2013.
- Smith, B. S. and G. E. Harlow, Jr. 2002. Conceptual Hydrogeologic Framework of the Shallow Aquifer System at Virginia Beach, Virginia. Water-Resources Investigations Report 01-4262. U.S. Department of the Interior, U.S. Geological Survey, and City of Virginia Beach, Department of Public Utilities, Richmond, Virginia.
- Southeast Regional Climate Center. 2012a. Norfolk WSO Airport, Virginia. Monthly Average Temperature (Degrees Fahrenheit). <http://www.sercc.com/cgi-bin/sercc/cliMAIN.pl?va6139>, accessed on 16 February 2016.
- Southeast Regional Climate Center. 2012b. Norfolk WSO Airport, Virginia. Period of Record Monthly Climate Summary. <http://www.sercc.com/cgi-bin/sercc/cliMAIN.pl?va6139>, accessed on 16 February 2016.
- Stanford University Sea Urchin Embryology (SUE). 2015. Mineral Makeup of Seawater. <https://web.stanford.edu/group/Urchin/mineral.html>, accessed on 7 December 2015.
- Taylor, L. A., B. W. Eakins, K. S. Carignan, R. R. Warnken, T. Sazonova, D. C. Schoolcraft, and G. F. Sharman. 2008. Digital Elevation Model of Virginia Beach, Virginia:

References

- Procedures, Data Sources and Analysis. NOAA Technical Memorandum NESDIS NGDC-7. National Geophysical Data Center. Boulder, Colorado: 34 pp.
- Tetra Tech, Inc. 2013. Revised Request for Preliminary Jurisdictional Determination for Craney Island Fuel Depot, Portsmouth, Virginia. Submitted on behalf of Naval Facilities Engineering Command Mid-Atlantic to Lynette R. Rhodes, United State Army Corps of Engineers. 10 December.
- Tetra Tech, Inc. 2014. Survey Plan for Nearshore Surveys at Naval Station (NAVSTA) Norfolk. Revision-1. Task Order N62470-13-D-8016-WE08. Prepared For Naval Facilities Engineering Command Mid-Atlantic. October 2014.
- Tetra Tech, Inc. 2015a. Naval Station Norfolk and Craney Island Fall Avian Survey Memo. Summary of methods, results, and combined species list from May, July, and September 2015 visits. Prepared by C. Parrish.
- Tetra Tech, Inc. 2015b. Naval Station Norfolk and Craney Island Spring Avian Survey Memo. Summary of methods, results, and species list from July 2015 visit. Prepared by C. Parrish.
- Tetra Tech, Inc. 2015c. Naval Station Norfolk and Craney Island Summer Avian Survey Memo. Summary of methods, results, and species list from May 2015 visit. Prepared by C. Parrish.
- Tetra Tech, Inc. 2015d. Naval Station Norfolk and Craney Island Vegetation Survey Results and Summary. Description of ecological communities, areas and species of interest, and combined species list from May and September 2015 visits. Prepared by K. Metcalf.
- Tetra Tech, Inc. 2016. Nearshore Surveys at Naval Station (NAVSTA) Norfolk. Draft Report. Task Order N62470-13-D-8016-WE08. Prepared For Naval Facilities Engineering Command Mid-Atlantic. January.
- Tomanek, L., and B. Helmuth. 2002. Physiological ecology of rocky intertidal organisms: a synergy of concepts. *Integrative and Comparative Biology*, 42:771–775.
- U.S. Army Engineer Research and Development Center. 2014. Risk Quantification for Sustaining Coastal Military Installation Asset and Mission Capabilities (RC-1701). Final Report. Submitted to The Strategic Environmental Research and Development Program (SERDP). Vicksburg, Missouri. 364 pp.
- USDA-NRCS (U.S. Department of Agriculture – Natural Resources Conservation Service). n.d. Insects & Pollinators. [Web site]. <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate/>, accessed 20 February 2013.

References

- USDA-NRCS (U.S. Department of Agriculture – Natural Resources Conservation Service). 2010. USDA Soils Data Received by Tetra Tech, Inc. from U.S. Department of the Navy, 2015.
- USDA-NRCS (U.S. Department of Agriculture – Natural Resources Conservation Service). 2013. Web Soil Survey, Tidewater Cities Area, Virginia. Available at: <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>, accessed 15 December 2015.
- U.S. Department of the Army and the Navy. 1976. Planting Design. Technical Manual 5-830-1/NAVFAC Manual P-904. June 1976. https://portal.navy.mil/portal/page/portal/docs/doc_store_pub/p904.pdf, accessed 18 January 2013.
- USFWS (U.S. Fish and Wildlife Service). 2003. National Wetlands Inventory, Virginia Beach Quadrangle.
- USFWS (U.S. Fish and Wildlife Service). 2015. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-eared Bat with 4(d) Rule. Final rule, and interim rule with request for comments. *Federal Register*, 8(63): 17974–18033. 02 April. Available at: <http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinalListing02April2015.pdf>. Accessed 22 January 2016.
- USFWS (U.S. Fish and Wildlife Service). 2016. Information for Planning and Conservation (IPaC) Trust Resources Report: Naval Station Norfolk & Craney Island INRMP. [Online project planning tool]. Available at: <https://ecos.fws.gov/ipac/project/UWGVFBELANFUND22THPTBMXEXA/resources.pdf>, accessed 15 November 2016.
- U.S. Global Change Research Program. 2009. Second National Climate Assessment – Regional Climate Impacts: Southeast. Washington, DC. <http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/regional-climate-change-impacts/southeast>, accessed 20 February 2013.
- U.S. Navy (U.S. Department of the Navy). 1987. Real Estate Operations and Natural Resources Management Procedural Manual. NAVFAC P-73, Volume II. https://portal.navy.mil/portal/page/portal/docs/doc_store_pub/p-73%20vol%20ii.pdf, accessed 18 January 2013.
- U.S. Navy (Department of the Navy). 1999. Integrated Natural Resources Management Plan, Pre-Final, Fleet and Industrial Supply Center (FISC) Installations at Cheatham Annex, Craney Island Fuel Terminal, and Yorktown Fuel Depot, Virginia. March.
- U.S. Navy (Department of the Navy). 2006. Integrated Natural Resources Management Plan Guidance for Navy Installations. How to Prepare, Implement, and Revise Integrated Natural Resource Management Plans (INRMP). April 2006.

References

- U.S. Navy (U.S. Department of the Navy). 2014a. OPNAV Instruction 5090.1D (OPNAVINST 5090.1). Environmental Readiness Program. Dated 10 January. Chief of Naval Operations, Office of the Chief of Naval Operations, Washington DC. Available at: <http://doni.daps.dla.mil/Directives/05000%20General%20Management%20Security%20and%20Safety%20Services/05-00%20General%20Admin%20and%20Management%20Support/5090.1D.pdf>, accessed 04 February 2013. 3 pp.
- U.S. Navy (U.S. Department of the Navy). 2014b. OPNAV Manual 5090.1 (OPNAV M-5090.1). Environmental Readiness Program Manual. Dated January 10, 2014. Chief of Naval Operations, Office of the Chief of Naval Operations, Washington DC. Available at: <http://doni.daps.dla.mil/SECNAV%20Manuals1/5090.1.pdf>. Last accessed 18 November 2013. 996 pp.
- U.S. Navy (Department of the Navy). 2014c. Naval Station Norfolk Environmental Policy. Memorandum from R.E. Clark, Commanding Officer, Naval Station Norfolk, dated 07 March.
- VADEQ (Virginia Department of Environmental Quality). n.d. Virginia CZM Program Oyster Restoration Efforts. [Web site]. Available at <http://www.deq.virginia.gov/Programs/CoastalZoneManagement/CZMIssuesInitiatives/Oysters.aspx>, accessed 26 February 2016.
- VADEQ (Virginia Department of Environmental Quality). 2012. Status of Virginia's Water Resources: A Report on Virginia's Water Resources Management Activities. Available at www.deq.state.va.us/Portals/0/DEQ/Water/WaterSupplyPlanning/2012WaterResourcesReport.pdf, accessed 16 December 2013.
- VADEQ (Virginia Department of Environmental Quality). 2014. VWP General Permit Authorization Number WP4-14-1071, Chambers Field Airfield Obstruction Management, Norfolk. Addressed to Elizabeth Nashold, Department of the Navy.
- VADEQ (Virginia Department of Environmental Quality). 2016. Living Shorelines...The Natural Approach to Controlling Shoreline Erosion. [Factsheet]. Available online at <http://www.deq.virginia.gov/Portals/0/DEQ/CoastalZoneManagement/lfactsheet.pdf>, accessed 26 June 2016.
- VDCR (Virginia Department of Conservation and Recreation). 1992. Stormwater Management. Erosion and Sediment Control Handbook. Third Edition, 1992. http://www.dcr.virginia.gov/stormwater_management/e_and_s-ftp.shtml. Accessed 21 January 2013.
- VDCR (Virginia Department of Conservation and Recreation). 2012. Memorandum from R. Rhur, Environmental Impact Review Coordinator, regarding DEQ 12-007F, DOD, DON – Air Field Clear Zone Management Plan, Naval Station Norfolk.

References

- VDCR (Virginia Department of Conservation and Recreation). 2014. Natural Heritage Data Explorer. [Online searchable database.] Available at <https://vanhde.org/species-search>, accessed 07 November 2014.
- VDGIF (Virginia Department of Game and Inland Fisheries). 1998. Personal communication [letter] from J. B. Trollinger to G. A. Janek in response to request for information on threatened and endangered species in the vicinity of the Fleet Industrial Centers (FISC). 05 February. Enclosure in 1999 Pre-final INRMP for FISC Installations.
- VDGIF (Virginia Department of Game and Inland Fisheries). 2012. White-Nose Syndrome Continues to Decimate Bat Population in Virginia. *White Nose Syndrome in Virginia*. [Web site]. Available at <http://www.dgif.virginia.gov/wildlife/bats/white-nose-syndrome/>, accessed on 15 September 2016. Article posted 29 March.
- VDGIF (Virginia Department of Game and Inland Fisheries). 2016a. Virginia Fish and Wildlife Information Service (VaFWIS) Search Report: Known or likely to occur within a 3 mile radius around point Craney Island Portsmouth City (at 36.9420278 - 76.2983611). [Online searchable database.] Available at [http://vafwis.org/fwis/?Title=VaFWIS+GeographicSelect+Options&poi=36,53,32.5 - 76,21,33.8&dist=4828.032&report=V&placeName=Craney%20Island%20%28Island%29%3B%20Portsmouth%20%28city%29&lastMenu=Home.__By+Place+Name&dt=September+07,+2016+2:27:24PM&pf=1](http://vafwis.org/fwis/?Title=VaFWIS+GeographicSelect+Options&poi=36,53,32.5-76,21,33.8&dist=4828.032&report=V&placeName=Craney%20Island%20%28Island%29%3B%20Portsmouth%20%28city%29&lastMenu=Home.__By+Place+Name&dt=September+07,+2016+2:27:24PM&pf=1), accessed on 07 September 2016.
- VDGIF (Virginia Department of Game and Inland Fisheries). 2016b. Virginia Fish and Wildlife Information Service (VaFWIS) Search Report: Known or likely to occur within a 3 mile radius around point Naval Station Norfolk Military Norfolk city (at 36,56,31.3 -76,17,54.1). [Online searchable database.] Available at [http://vafwis.org/fwis/?Title=VaFWIS+GeographicSelect+Options&poi=36,56,31.3 - 76,17,54.1&dist=4828.032&report=V&placeName=Naval%20Station%20Norfolk%20%28Military%29%3B%20Norfolk%20%28city%29&lastMenu=Home.__By+Place+Name&dt=February+15,+2016+4:10:08PM](http://vafwis.org/fwis/?Title=VaFWIS+GeographicSelect+Options&poi=36,56,31.3-76,17,54.1&dist=4828.032&report=V&placeName=Naval%20Station%20Norfolk%20%28Military%29%3B%20Norfolk%20%28city%29&lastMenu=Home.__By+Place+Name&dt=February+15,+2016+4:10:08PM), accessed on 07 September 2016.
- VIMS (Virginia Institute of Marine Science). 2010. Virginia Oyster Reef Restoration Map Atlas. Box 23: Elizabeth and Lafayette Rivers. Available at <http://web.vims.edu/mollusc/oyrestatlas/orasites/orabox23.htm>, accessed 01 February 2016.
- VIMS (Virginia Institute of Marine Science) Center for Coastal Resources Management. 2014. City of Norfolk, Virginia, Shoreline Inventory Report. Special report in Applied Marine Sciences and Ocean Engineering No. 443 of the Virginia Institute of Marine Science. Available at http://ccrm.vims.edu/gis_data_maps/shorelineinventories/virginia/norfolk/CityofNorfolkSIR2014.pdf, accessed 11 September 2016.
- VIMS (Virginia Institute of Marine Science) Multispecies Research Group. 2016. ChesMMAP. Available at http://www.vims.edu/research/departments/fisheries/programs/multispecies_fisheries_research/chesmmap/index.php, accessed 04 January 2016.

References

- Virginia Department of Transportation (VDOT). 2012. 1-64 Hampton Roads Bridge-Tunnel Draft Environmental Impact Statement and Draft Section 4(f) Evaluation. VDOT Project Number: 0064-965-004, P101; UPC 99037.
- Virginia Geospatial Extension Program. 2011. Urban Tree Canopy Analysis of Virginia Localities. [Web site]. Available at http://gep.frec.vt.edu/va_utc.html, accessed on 12 September 2016.
- Virginia Marine Science Museum. 2013. Sea Turtles in Virginia. [Web site.] <http://www.vmsm.org/sea-turtles-in-virginia/>, accessed 17 February 2016.
- Virginia Tech. 2016. Virginia Big Tree Database. Available at: http://bigtree.cnre.vt.edu/bigtree_detail.cfm?AutofieldforPrimaryKey=791, accessed 15 February 2016.
- VMRC (Virginia Marine Resources Commission). 2016a. Virginia Marine Resources Commission. [Home Page]. Agency News. Postdated 08 December 2015. Available at <http://www.deq.virginia.gov/Programs/CoastalZoneManagement/CZMIssuesInitiatives/Oysters.aspx>, accessed 01 February 2016. Last updated 27 January.
- VMRC (Virginia Marine Resources Commission). 2016b. Regulation: Pertaining To Living Shoreline Group 1 General Permit for Certain Living Shoreline Treatments Involving Tidal Wetlands. Available at: <http://mrc.virginia.gov/regulations/fr1300.shtm>, accessed 24 February 2016.
- VMRC (Virginia Marine Resources Commission). 2016c. Regulation: Chapter 337, Submerged Aquatic Vegetation (SAV) Transplantation Guidelines. Available at: <http://www.mrc.state.va.us/regulations/fr337.shtm>, accessed 24 February 2016.
- Weinberg, H. 2015a. Map: Benthic Habitat (Index of Biological Integrity) (2014), Annual Average Score by Sampling Station. Created 2 July 2015. Available at http://www.chesapeakebay.net/maps/map/benthic_habitat_index_of_biological_integrity_2014_annual_average_score_by, accessed 04 January 2016.
- Weinberg, H. 2015b. Map: Chesapeake Bay Waters Meeting WQ Goals for the Shallow Water Bay Grasses Designated Use 2011-2013. Created 2 July 2015. Available at http://www.chesapeakebay.net/maps/map/chesapeake_bay_waters_meeting_wq_goals_for_the_shallow_water_bay_grass2, accessed 04 January 2016.
- Weinberg, H. 2014. Map: Bay Grasses (SAV) Restoration Goal Achievement: Single Best Year 2011-2013. Created 3 April 2014. Available at http://www.chesapeakebay.net/maps/map/bay_grasses_sav_restoration_goal_achievement_single_best_year_2011_2013, accessed 04 January 2016.

References

- Weinberg, H. 2013. Map: Chemical Contaminants (2012). Created 18 October 2013. Available at http://www.chesapeakebay.net/maps/map/chemical_contaminants_2012, accessed 4 January 2016.
- Weinberg, H. 2008a. Map: Chesapeake Bay Mean Surface Salinity – Fall (1985-2006). Created 13 February 2008. Available at http://www.chesapeakebay.net/maps/map/chesapeake_bay_mean_surface_salinity_fall_1985_2006, accessed 4 January 2016.
- Weinberg, H. 2008b. Map: Chesapeake Bay Mean Surface Salinity – Spring (1985-2006). Created 13 February 2008. Available at http://www.chesapeakebay.net/maps/map/chesapeake_bay_mean_surface_salinity_spring_1985_2006, accessed 04 January 2016.
- Woods Hole Oceanographic Institution (WHOI). 2015. Speciation of Dissolved Organic Phosphorus in Seawater. <http://www.whoi.edu/page.do?pid=131276>, accessed on 07 December 2015. Last updated 11 February 2014.
- WS (U.S. Department of Agriculture – Wildlife Services). 2015. Annual Monitoring Report for the Wildlife Hazard Assessment for Naval Station Norfolk – Chambers Field. October 2014 – September 2015. Prepared by Adam Coe, Wildlife Biologist. Moseley, Virginia. 50 pp.

Appendix A

Naval Station Norfolk and Craney Island INRMP Projects Table

This page intentionally left blank.

Table A-1: Naval Station Norfolk and Craney Island INRMP Projects.

Project #	Project Description	INRMP Section Ref.	Implementation Schedule ¹ (FY)	Legal Driver/ Initiative ²	Navy ERL ³	Cost Estimate	Funding Sources ⁴	Date Project Completed
Natural Resources Training								
1	SIKES NAVSTA/CI-Airport Biologist Certification	1.12, 3.62	Annual	A, B, C, E	ERL3	\$2,500	O&MN	
2	SIKES NAVSTA/CI- National Military Fish & Wildlife Training	1.12	Annual	A, B, C, E	ERL3	\$2,500	O&MN	
3	SIKES NAVSTA/CI- DoD Pesticide Applicator Certification	1.12, 3.9, 3.93	Annual	A, B, C, E	ERL3	\$2,500	O&MN	
4	SIKES NAVSTA/CI-Integrated Pest Management Coordinator Course	1.12, 3.9, 3.93	Annual	A, B, C, E	ERL3	\$2,500	O&MN	
5	SIKES NAVSTA/CI-Wildlife Biologist Certification	1.12	Annual	A, B, C, E	ERL3	\$2,500	O&MN	
Wetlands/Water Quality Protection								
6	CWA NAVSTA Jurisdictional Wetland Delineation Survey	3.3.1	Annual	A, B, C, G, H, I, K, O	ERL2	\$75,000	O&MN	
7	SIKES NAVSTA/CI Nearshore Oyster Reef Restoration (Cooperative Service Agreements)	3.3.3	Annual	A, B, C, E, G, H, I, O	ERL1	\$50,000	O&MN	
8	1 CP Living Shoreline Buffer Areas	3.2.2, 3.3.3	Annual	A, B, C, G, H, I, O	ERL2	\$250,000	O&MN	
9	SIKES NAVSTA/CI Plant Nearshore Emergent and Aquatic Vegetation	3.3.3	Recurring	A, B, C, E, G, H, I, O	ERL2	\$3,500	O&MN, LP	

Appendices

Project #	Project Description	INRMP Section Ref.	Implementation Schedule ¹ (FY)	Legal Driver/ Initiative ²	Navy ERL ³	Cost Estimate	Funding Sources ⁴	Date Project Completed
Urban Forestry								
10	CBPA NAVSTA/CI-Urban Tree Assessment, Mapping, & Preservation Plan	3.3.3, 3.5	Annual	A, B, C, J, N, O, R	ERL1	\$75,000	O&MN, FOR	
11	CBPA NAVSTA/CI-Native Tree Planting and Establishment	3.3.3, 3.3.4, 3.5	Recurring	A, B, C, J, N, O, R	ERL1	\$10,000	O&MN, FOR	
12	CBPA NAVSTA/CI-Native Tree Care	3.3.3, 3.5	Recurring	A, B, C, J, N, O, R	ERL1	\$50,000	O&MN, FOR	
Fish and Wildlife Management								
13	MBTA NAVSTA/CI-Migratory & Breeding Bird Surveys	3.6.1	Ongoing	D	ERL1	\$75,000	O&MN	
14	Department of Defense Coordinated Bird Monitoring	3.6.1, 3.6.2	Annual	A, B, C, D, E, F	ERL 1	\$55,000	O&MN	
15	SIKES NAVSTA/CI-Vertebrate Species Surveys	3.6.4	Ongoing	A, B, C, E	ERL1	\$35,000	O&MN	
16	Herpetofauna and Microhabitat Inventory	3.6.4	Annual	A, B, C, E	ERL1	\$64,000	O&MN	
17	SIKES NAVSTA/CI-Nuisance Wildlife Control	3.6.2, 3.9.1	Ongoing	E, P	ERL1	\$11,000	O&MN	
Threatened and Endangered Species Protection								
18	1 S NAVSTA/CI Threatened & Endangered Species Inventories (Various Species)	3.7	Annual	A, B, C, D, J	ERL4	\$65,000	O&MN	
Habitat Conservation and Restoration								
19	SIKES NAVSTA/CI-Establish & Maintain Pollinator Habitat Areas	3.8.2	Recurring	A, B, C, E, G, I, P, O, Q	ERL1	\$3,500	LP O&MN	
20	SIKES NAVSTA/CI-Establish and Maintain Warm Season Grass Areas	3.8.1	Recurring	A, B, C, E, G, I, N, O, Q	ERL1	\$3,500	LP	

Appendices

Project #	Project Description	INRMP Section Ref.	Implementation Schedule ¹ (FY)	Legal Driver/ Initiative ²	Navy ERL ³	Cost Estimate	Funding Sources ⁴	Date Project Completed
Invasive Species Control								
21	EO 13112 NAVSTA/CI-Invasive Species Mapping Inventory and Control Plan	3.6.2, 3.9.3	Annual	A, B, C, E, M, O	ERL3	\$35,000	O&MN	
22	EO 13112 NAVSTA/CI-Invasive Species Control Treatments	3.6.2, 3.9.3	Recurring	A, B, C, E, M, O	ERL3	\$55,000	O&MN, LP	
Environmental Awareness								
23	SIKES ACT NAVSTA/CI-Sponsor Clean the Bay Day, Earth Day, Arbor Day, etc.	3.10.2	Recurring	A, B, C, E, O	ERL1	\$3,500	O&MN/SAR	
INRMP/Installation-wide								
24	SIKES NAVSTA/CI-INRMP Update	Plan Updates	Every 5 years	A, B, C, E, J	ERL4	\$50,000	O&MN	
25	Climate Change Vulnerability Assessment & Adaptation Plan	3.2.1	Annual	A, B, C, H, L	ERL4	\$250,000	O&MN	
26	SIKES CI-Nearshore habitat assessment and species inventory	3.2	Recurring	A, E, F, H, O	ERL3	\$100,000	O&MN	

¹Implementation/Completion Project Frequency: Annual=1 day/year; Recurring=2–20 days/year, usually one season; Ongoing=every year, multi season activity

²Legal Drivers and Initiatives:

- | | | | |
|---|--|---|---|
| A | Chief of Naval Operations (OPNAV) Manual M-5090.1 | K | Executive Order 11990, <i>Protection of Wetlands</i> |
| B | DODI 4715.03, Natural Resources Conservation Program | L | Executive Order 11988, <i>Floodplain Management</i> |
| C | 32 CFR 190, Natural Resources Management Program | M | Executive Order 13112, <i>Invasive Species</i> |
| D | Migratory Birds Treaty Act (MBTA) | N | Executive Order 13148, <i>Greening the Government through Leadership in Environmental Management</i> |
| E | Sikes Act Amendment Act | O | Chesapeake Bay Agreements |
| F | Endangered Species Act (ESA) | P | CNO Guidance on Feral Cats and Dogs |
| G | Clean Water Act (CWA) | Q | Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds |
| H | Coastal Zone Management Act (CZMA) | R | Regional Tree Preservation and Replacement Instruction |
| I | Soil and Water Conservation Act | | |
| J | National Environmental Policy Act (NEPA) | | |

³Navy ERL: ERL4 Environmental Compliance Requirement; ERL3 Navy or DoD Policy Requirement; ERL2 Pending Requirements for Future Compliance; ERL1 Navy Environmental Stewardship

⁴Funding Sources: O&MN=Operations and Maintenance, Navy; SAR=Sikes Act Revenues; FOR=Navy Forestry; FR=DoD Forestry Reserve; AG=Agricultural Outlease, LP=Legacy Program, MWR=Morale, Welfare & Recreation (includes Fish and Wildlife fees), NWCF=Navy Working Capital Fund, DERA=Defense Environmental Restoration Account, SERDP=Strategic Environmental Research and Development Program Funds, Non-DOD=Other Non-DOD funds, NA = Not Applicable

This page intentionally left blank.

Appendix B

Agency Correspondence and Mutual Agreement Letters

This page intentionally left blank.

Appendix C

NAVFAC Project Planning Environmental Checklist

This page intentionally left blank.

Appendix D

Tables

Index of Tables

- Table 1-1. Stakeholders of Naval Station Norfolk (NSN) and Craney Island Fuel Terminal (CI) Natural Resources.
- Table 1-2. Natural Resources Training Opportunities.
- Table 2-1. Weather Data Recorded at Norfolk International Airport, 1946–2012.
- Table 2-2. General Characteristics of Naval Station Norfolk (NSN) and Craney Island Fuel Terminal (CI) Soils.
- Table 2-3. Waterbodies Summary for Craney Island, Portsmouth, Virginia.
- Table 2-4. Wetland Feature Summary for Craney Island, Portsmouth, Virginia.
- Table 3-1. Essential Fish Habitat Designations for Fish Collected during Seasonal Nearshore Surveys of Naval Station Norfolk.

Table 1-1. Stakeholders of Naval Station Norfolk (NSN) and Craney Island Fuel Terminal (CI) Natural Resources.

Navy	
Naval Facilities Engineering Command (NAVFAC), Mid-Atlantic	NSN Commanding Officer
NAVFAC Environmental Services	NSN Port Operations
NAVFAC Atlantic	NSN Air Operations
NSN Morale, Welfare, and Recreation	NSN Public Works
NSN Environmental Office	NSN Facility Planner
Naval Supply Systems Command Fleet Logistics Center Norfolk	NSN Public Affairs
Navy Tenant Commands and Personnel	NSN Special Operations
NSN Security	
Federal, State and Local Agencies	
U.S. Fish and Wildlife Service	Virginia Department of Game and Inland Fisheries
U.S. Department of Agriculture Wildlife Services	Virginia Marine Resources Commission
National Marine Fisheries Service	Virginia Department of Conservation and Recreation
U.S. Army Corps of Engineers, Norfolk District	Virginia Department of Environmental Quality
U.S. Department of Agriculture, Natural Resources Conservation Service	Virginia Cooperative Extension
U.S. Geological Survey	City of Norfolk
U.S. Environmental Protection Agency	City of Portsmouth
Department of Defense Partners In Flight	Hampton Roads Sanitation District
Department of Defense Partners in Amphibian and Reptile Conservation	
Non-governmental Organizations and Individuals	
Virginia Aquarium and Marine Science Center	Virginia Native Plant Society
Virginia Institute of Marine Science	The Nature Conservancy of Virginia
National Audubon Society	Dependents of Navy Personnel
Chesapeake Bay Program Office	Military Retirees
Norfolk Master Gardeners	

Table 1-2. Natural Resources Training Opportunities.

U.S. Government, DOD
<p>Defense Environmental Network and Information Exchange (DENIX) Training and Education Website: https://www.denix.osd.mil/conferences/</p>
<p>Navy Civil Engineer Corps Officers School Environmental Training Program 3502 Goodspeed Street, Suite 1 Port Hueneme, CA 93043-4336 Tel: 805-982-2895 DSN: 551-2895 Fax: 805-982-2918 Website: https://www.netc.navy.mil/centers/csfe/cecos/</p>
<p>Armed Forces Pest Management Board Training and Certification Website: http://www.afpmb.org/pubs/courses/courses.htm</p>
<p>U.S. Army Corps of Engineers (USACE) Professional Development Support Center 550 Sparkman Drive Huntsville, AL 35816 Tel: 256-895-7401 Fax: 256-895-7465 Website: http://pdsc.usace.army.mil/</p>
U.S. Government, non-DOD
<p>U.S. Fish and Wildlife Service (USFWS) National Conservation Training Center Route 1, Box 166 Shepherdstown, WV 25440 Division of Training Tel: 304-876-7472 Aquatic Resources Tel: 304-876-7445 Environmental Conservation Tel: 304-876-7475 Wildlife Tel: 304-876-7434 Technical (e.g., geographic information system) Tel: 304-876-7456 Website: http://training.fws.gov/</p>
NGOs
<p>Wetland Training Institute, Inc. P.O. Box 31 Glenwood, NM 88039 Tel and Fax: 877-792-6482 Website: http://www.wetlandtraining.com/</p>

NGOs (continued)

The Shipley Group

P.O. Box 908
Farmington, UT 84025
Tel: 888-270-2157
Website: <http://www.shipleygroup.com>

Graduate and Professional Schools and Universities

Colorado State University Online

2545 Research Blvd.
Fort Collins, CO 80526
Tel: 877-491-4336
Website: <http://online.colostate.edu>

Duke University

Nicholas School of the Environment and Earth Sciences Continuing Education Program
P.O. Box 90328
Durham, NC 27708-0328
Tel: 919-613-8082
Fax: 919-684-8741
Website: <http://www.nicholas.duke.edu/people/alumni/duke-environmental-leadership-program-continuing-and-executive-education>

Virginia Cooperative Extension

101 Hutcheson Hall
Virginia Tech (0402)
250 Drillfield Drive
Blacksburg, VA 24061
Tel: 540-231-5299
Website: <http://www.ext.vt.edu/>

Virginia Institute of Marine Science

P.O. Box 1346
1375 Greate Road
Gloucester Point, VA 23062-1346
Tel: 804-684-7000
Website: <http://www.vims.edu>

Virginia Tech

College of Natural Resources and Environment
Virginia Cooperative Fish and Wildlife Research Unit
Fish and Wildlife Conservation (0321)
Cheatham Hall, Room 106
310 West Campus Drive
Blacksburg, VA 24061
Contact: W. Mark Ford, wmford@vt.edu
Tel: 540-231-5927
Website: <https://cnre.vt.edu/college/research-centers/departmental/virginia-coop-fishwild/index.html>

Table 2-1. Weather Data Recorded at Norfolk International Airport, 1946–2012.

	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Average Max Temp (°F)	48.9	51.0	58.3	68.2	75.9	83.6	87.4	85.6	80.0	70.3	61.4	52.4	68.6
Average Min Temp (°F)	32.6	33.5	40.2	48.5	57.6	66.2	70.9	70.1	64.8	53.6	43.8	35.7	51.5
Mean Average Temp (°F)	40.8	42.3	49.2	58.4	66.7	74.9	79.1	77.9	72.4	62.0	52.6	44.0	60.0
Average Precip. (in.)	3.49	3.14	3.65	3.12	3.62	3.88	5.37	5.48	4.49	3.24	3.06	3.14	45.68

Source: Southeast Regional Climate Center 2012a and 2012b.

Note: Data for 2012 included in the averages is limited to data available through 30 April 2012.

Table 2-2. General Characteristics of Naval Station Norfolk (NSN) and Craney Island Fuel Terminal (CI) Soils.

Soil Series	Map Unit	Acres		General Description	Hydric	Hydric Inclusions	Drainage Class	Erosion Potential
		NSN	CI					
Altavista-Urban land complex, 0–3% slopes	1	162.3	52.9	On marine terraces on coastal plains. The parent material consists of loamy fluviomarine deposits.	No	Yes	Moderately-well drained	Slight
Altavista-Urban land complex, 0–2% slopes	2	13.7	115	On stream terraces on coastal plains. The parent material consists of loamy fluviomarine deposits.	No	Yes	Somewhat poorly drained	Slight
Bohicket muck, 0–1% slopes	6	32.6	22.8	On tidal marshes on coastal plains. Very frequently flooded, and continually saturated.	Yes	Yes	Very poorly drained	Slight
Duckston fine sand, 0–2% slopes	11	0.4	n/a	Deep, nearly level in shallow depressions between dunes and on low flats between dunes and marshes; low fertility, low available water, very rapid permeability, slow surface runoff and frequently flooded	Yes	Yes	Poorly drained	Slight
Johnston Silt Loam, 0–2% slopes	12	n/a	1.3	On flood plains and tidal marshes on coastal plains. The parent material consists of Loamy alluvium.	Yes	Yes	Very poorly drained	Slight
Lawnes loam, 0–1% slopes	13	n/a	8	On tidal marshes on coastal plains. The parent material consists of Herbaceous organic materials over loamy alluvial sediments. Soil is slightly saline in upper 30 inches.	Yes	Yes	Very poorly drained	Slight

Appendices

Soil Series	Map Unit	Acres		General Description	Hydric	Hydric Inclusions	Drainage Class	Erosion Potential
		NSN	CI					
Seabrook-Urban land complex, 0–2% slopes	20	0.9	n/a	On marine terraces on coastal plains. The parent material consists of Sandy alluvial sediments.	No	Yes	Moderately well drained	Slight
State-Urban land complex, 0–3% slopes	22	58.4	4.6	On stream terraces on coastal plains. State soils and areas covered by parking lots, buildings, and other structures on broad ridges and side slopes.	No	No	Well drained	Slight
Tomotley-Urban land complex, 0–2% slopes	24	26.9	n/a	On stream terraces on coastal plains. The parent material consists of Loamy alluvial sediments.	Yes	Yes	Poorly drained	Slight
Udorthents-Dumps complex	26	1,570.1	503.1	Areas where natural soils have been disturbed by grading, excavation or filling. Permeability and internal drainage are generally slow.	No	Yes	Needs site determination	Needs site determination
Urban Land, 0–2% slopes	27	1,590.2	n/a	More than 80% of the surface covered by parking lots, buildings, and other impermeable surfaces; Udorthents are included in this unit.	No	Yes	Needs site determination	Needs site determination

Source: USDA-NRCS 2010, 2013.

Table 2-3. Waterbodies Summary for Craney Island, Portsmouth, Virginia.

Stream Label	Direction of Flow	Length (ft.)	Comments
S01	E	176.26	Stream fed by outflow pipe draining parking lot. Ties into W42 at S01-03.
JD01	SE	2617.23	Man-made ditch with average width of 10 feet (3 feet in upper reach). Collects runoff from utility right-of-way. Ties into culvert north of W09.
JD02	SW	423.17	Man-made ditch with average width of 8 feet. Ties into W41 at W41-13.
JD03	S	63.2	Man-made ditch flowing from the landfill just north of the base. Average width 8 feet. Ties into W47 at W47-11.
JD04	W/SW/S	1283.34	Man-made ditch with average width of 8 feet. Ties into W49 and JD09.
JD05	E	1925.93	Man-made ditch with an average width of 15 feet. Ties into W54, JD07, and JD08.
JD06	NW	89.96	Man-made ditch connecting W53 and W54. Also connected to W57. Average width is 5 feet.
JD07	N	167.92	Man-made ditch draining the SWMU and connecting to JD05. Average width is 5 feet.
JD08	N	203.16	Man-made ditch draining the SWMU and connecting to JD05. Average width is 5 feet.
JD09	SE	234.11	Man-made ditch connecting to JD04 and W58. Average width is 7 feet.
JD10	SE	78.56	Man-made ditch connecting to W58. Average width is 6 feet.
JD11	S	174.24	Man-made ditch connecting to W59. Average width is 8 feet.

Appendices

Stream Label	Direction of Flow	Length (ft.)	Comments
JD12	E	612.40	Man-made concrete-lined ditch connecting to JD01. Wetlands W31, W32, W33, and W34 fringe the ditch. Average width is 8 feet.
JD13	SE	544.12	Man-made concrete-lined ditch connecting to JD01. Connects W35, W46, and W01. Average width is 8 feet.
JD14	SW	301.30	Man-made concrete-lined ditch connecting to JD01. Connects W05 to JD01. Average width is 8 feet.
JD15	SE	3811.43	Man-made concrete-lined ditch connecting JD01 to W27. Wetlands W24, W25, W26, and W28 fringe JD15. Average width is 10 feet.
JD16	S	683.50	Man-made concrete-lined ditch connecting to JD15. Wetland W37 is connected by overland flow to JD16. Average width is 8 feet.
JD17	S	94.98	Grass-lined ditch connecting W41 to JD15. Average width is 6 feet.
JD18	S	231.90	Man-made concrete-lined ditch connecting JD15 to W04. Average width is 8 feet.
JD19	S	101.75	Grass-lined ditch connecting to W43. Average width is 6 feet.
JD20	SW	175.02	Drainage ditch connecting W60 to JD09. Average width is 5 feet.
Non-jurisdictional overland flow	SE	281.46	Non-jurisdictional overland flow connecting W37 to JD16.

Table 2-4. Wetland Feature Summary for Craney Island, Portsmouth, Virginia.

Wetland Label	Field Wetland Class ¹	On Base Area (acre)	Comments
W01	PEM/PFO	0.18	Small wetland fringing JD01 and JD13. Dominated by common reed, sweet gum, and greenbriar.
W02	PEM	0.02	Very small wetland at the toe of a slope; near JD01 (does not extend all the way to ditch). Dominated by common reed.
W03	PEM	0.02	Very small wetland near JD01 (does not extend all the way to ditch). Dominated by common reed and lizard tail.
W04	E2EM	46.17	Large marsh fringing Craney Island Creek along the southern edge of property and dominated by smooth cordgrass, saltmeadow cordgrass, salt bush, and common reed. Connected to W06 (wetland flows beneath Cedar Lane bridge), W09 (wetland flows beneath South Perimeter Rd. bridge), W27 (flows through a culvert beneath Main Rd.), W47 (wetland flows through a culvert beneath Main Rd.), and JD18 (flows through a culvert beneath Main Rd).
W05	PFO	0.23	Forested wetland connected to JD14. Area very disturbed; soil filled with oil from an old oil spill. Dominated by red maple, sweet gum, and Japanese stiltgrass.
W06	E2EM	0.88	Large salt marsh in the southwest corner of the property. Culvert at flag W06-04 connects W06 to W07. W06 connected to W04 (wetland flows beneath Cedar Lane bridge). Dominated by smooth cordgrass, saltmarsh cordgrass, and common reed.
W07	PFO/PSS	0.17	Wetland connected to W06 at flag W07-01 (via culvert). Culvert present at flag W07-08 (wetland receiving runoff). Dominated by black willow, red maple, and common reed.
W08	PFO/PEM	0.005	Small forested wetland dominated by netted chain fern, red maple, and sweet gum. Culvert present at flag W08-01 that goes under the road.
W09	E2EM/PEM	2.51	Large tidally influenced estuarine wetland dominated by smooth cordgrass and common reed. Connected to W04 (wetland flows beneath South Perimeter Rd. bridge). Connected to W11 and JD01 via culvert at flag W09-14.
W10	PFO	0.06	Small sparsely vegetated depressional forested wetland. Dominated by red maple and sweet gum. Standing water and dark, mucky soil present.
W11	PFO/PEM	0.33	Wetland formed by a drainage feature that follows old road bed. Dominated by common reed, soft rush, sweet gum, and red maple. Connected to W09 via culvert at flag W11-01 and connected to W12 via culvert at flag W11-09.
W12	PFO/PEM	0.004	Very small depressional wetland dominated by red maple, black willow, and common reed. Connected to W11 via culvert at flag W12-01. Culvert also present west of W12 (but not connected to culvert).

Appendices

Wetland Label	Field Wetland Class ₁	On Base Area (acre)	Comments
W16	E2EM1P	0.11	Small wetland fringe along Craney Island Creek between upland and riprap. Dominated by smooth cordgrass.
W17	PFO	0.12	Highly disturbed sparsely vegetated forested wetland with drainage patterns present. Dominated by red maple, false nettle, and Japanese stiltgrass.
W18	PFO/PEM	0.02	Small depressional wetland potentially fed by runoff from adjacent Truck Rack Rd. Dark, stained surface dominated by smartweed, creeping primrose-willow and black
W19	PFO	0.40	Depressional wetland dominated by loblolly pine, sweet gum, sphagnum moss. Near W20.
W20	PFO	0.04	Small forested wetland adjacent to W19 and dominated by loblolly pine, sweet gum, and water oak.
W21	PFO	0.013	Small forested depressional wetland dominated by loblolly pine, sweet gum, slender woodoats, and smartweed.
W22	PSS	0.01	Small depressional wetland in a disturbed area. Dominated by common reed and Japanese stiltgrass.
W23	PFO	0.11	Depressional wetland dominated by loblolly pine, buttonweed, and soft rush.
W24	PFO/PEM	0.74	Large common reed-dominated marsh on the south side of JD15.
W25	PFO/PEM	2.07	Large common reed-dominated marsh fringing woods on the south side of JD15 (just east of W24). Wetland topography driven; extends into woods dominated by red maple and loblolly pine.
W26	PSS	0.44	Common reed-dominated wetland on the south side of JD15 (just east of W25). Also dominated by salt bush and red maple.
W27	PUB/PEM	0.12	Small pond with a fringing PEM wetland that is fed by culvert from W43. Dominated by common reed (very sparsely vegetated).
W28	PEM	1.82	Large common reed-dominated wetland on north side of JD15 (opposite side of ditch from W24, W25, and W26). Topography driven boundary; wetland fed by drainage ditch that drains into JD15.
W29	PSS/PEM	0.05	Small fringing wetland on eastern side of JD01. Dominated by giant cane, salt bush, and Japanese stiltgrass.
W30	PEM/PFO	0.11	Depressional wetland south of North Perimeter Road. Dominated by common reed, buttonweed, and loblolly pine. Hydrology comes from pipe coming from off site that runs north-south under North Perimeter Road.

Appendices

Wetland Label	Field Wetland Class	On Base Area (acre)	Comments
W31	PEM	0.03	Small fringing wetland on north side of concrete ditch and west of the powerline right of way (disturbed area). Continues west beyond property line. Dominated by common reed and Japanese stiltgrass.
W32	PEM	0.023	Small fringing wetland in the powerline right of way on the north side of JD12 (disturbed area). Dominated by common reed and cattail.
W33	PEM	0.21	Fringing wetland on south side of JD12 that begins west of utility right-of-way and extends east of utility right-of-way (disturbed area). Continues west beyond property line. Dominated by common reed and Japanese stiltgrass.
W34	PEM	0.13	Fringing wetland on north side of JD12 and east of utility right-of-way. Dominated by common reed and sensitive fern.
W35	PFO/PEM	0.35	Bottomland hardwood wetland that extends beyond property line. Portions of wetland are inundated. Dominated by giant cane, lizard tail, red maple, and sweet gum. East side of wetland is connected to W46 and W01 through JD13 (culvert beneath Main St).
W36	PFO/PEM	0.09	Small fringing wetland on east side of JD01. Dominated by black willow, privet, goldenrod, and common reed.
W37	PFO/PEM	0.07	Wetland fed by a small roadside ditch (just north of Jet Field Rd.) Dominated by common reed, loblolly pine, and soft rush.
W38	PEM/PSS	0.16	Depressional wetland in a highly disturbed area. Contains 24 inches of ponded water. Dominated by soft rush, salt bush, and smartweed.
W39	PEM	0.16	Wetland located along northern boundary fence on north side of North Perimeter Rd. Fed by drainage feature in landfill on the other side of the fence. Dominated by flatsedges, common reed, and climbing hempvine.
W40	PEM	0.13	Depressional wetland located in mowed right of way just south of North Perimeter Rd. Saturated soil/ponded water present. Dominated by sedges, creeping primrose-willow, and buttonweed.
W41	PEM/PFO	3.02	Large common reed -dominated marsh fed by a ditch flowing north-south through wetland and a ditch flowing west-east from W42 into W41. Connected to W42 by culvert beneath dirt road at flag W41-36. Connected to W25 by JD17 through a culvert (could not see culvert) between flags W41-17 and 18. Connected to JD02 on east side of W41 at flag W41-13.
W42	PFO	0.04	Fringing wetland on banks of S01. Dominated by sweet gum, red maple, and Japanese stiltgrass. Connected to W41 through a culvert beneath the dirt road at W42-05.

Appendices

Wetland Label	Field Wetland Class	On Base Area (acre)	Comments
W43	PEM	3.07	Large common reed – dominated marsh fed by water flowing north-south from JD19 (through a culvert at W43-20). A secondary channel drains the western portion of the wetland and connects to the main drainage channel (forms a Y). There is a large upland ridge area containing fill located between the two channels. W43 is connected to W27 through a culvert at W43-14.
W44	PEM	0.10	Small depressional wetland in the mowed right-of-way between North Perimeter Rd and pipeline. Dominated by buttonweed and flatsedges.
W45	PEM	0.06	Small depressional wetland north of Main Rd. and east of Group Rd. fed by culvert running beneath Group Rd. Located in mowed and maintained grassy area. Dominated by buttonweed and flatsedges.
W46	PEM	0.15	Small fringing wetland on south side of JD13, just east of Main St. W46 is connected to W35 through a culvert near W46-01.
W47	PEM	0.35	Wetland fringing a tidally-influenced man-made ditch dominated by common reed. Ditch flows north-south and also flows south-north in the southern portion of the wetland (tidal). W47 is connected to W04 through a culvert at W47-01 and to JD03 at W47-11.
W48	PSS/PEM	1.39	Scrub/shrub wetland just north of Main St. and just west of West Motor Pool Rd. Wetland dominated by cattail, callery pear, common reed, and salt bush. Fed by flow coming in from the NW corner (unknown water source), seepage from W04, and from a culvert in the SE corner of the wetland (coming out of JD04).
W49	PEM	0.02	Small depressional wetland at the western end of JD04. Dominated by sedges and spikerushes. Connected to JD04.
W50	POW/PEM	7.13	Wetland fringing a large man-made retention pond in a highly disturbed area. Wetland dominated by common reed and lady's thumb knotweed.
W51	PEM	0.06	Wetland located in a low spot adjacent to the road that receives drainage. Dominated by common reed and sedges. In a highly disturbed area.
W52	PEM	0.06	Small depressional wetland located in a mowed right-of-way. Dominated by sedges, lady's thumb knotweed, and buttonweed.
W53	PEM	0.13	Man-made wetland located partially in the Solid Waste Management Unit (SWMU). Dominated by common reed and lady's thumb knotweed. Connected to JD06 at W53-09.
W54	PEM	0.45	Wetland located in a man-made ditch (and fringing the ditch). Wetland dominated by common reed and lady's thumb knotweed. Connected to JD06 at W54-01.

Appendices

Wetland Label	Field Wetland Class	On Base Area (acre)	Comments
W55	PEM	0.02	Small depressional wetland dominated by fragrant flatsedge and lady's thumb knotweed.
W56	PEM	0.05	Wetland located in a man-made ditch (and fringing ditch). Dominated by common reed and lady's thumb knotweed.
W57	PEM	0.008	Small, man-made channelized wetland that connects to JD-06. Dominated by common reed and lady's thumb knotweed.
W58	PEM	0.25	Wetland dominated by common reed and swamp smartweed. Connected to JD-09 and JD-10. Upland ridge between W58 and W60.
W59	PEM	0.39	Wetland dominated by common reed, cattail, soft rush, lady's thumb, and swamp smartweed. Located adjacent to a road side ditch. Connected to JD-11.
W60	PEM	0.93	Large wetland dominated by common reed. Fed by drainage channel running through the wetland and by surrounding upland areas. JD20 comes out of wetland at W60-16 and connects to JD09. Upland ridge between W58 and W60.
W61	PEM	0.64	Wetland formed by a low spot and fed by man-made ditch adjacent to road. Dominated by cattail, common reed, and lady's thumb knotweed.
W62	PEM	0.09	Small depressional wetland in a mowed right-of-way. Dominated by creeping primrose-willow, and sedges. Cracked soil present.
W63	E2EM	1.25	Large, fringing tidal salt marsh dominated by common reed, smooth cordgrass, and salt bush. Very disturbed area containing fill and large amounts of debris. Drift deposits present.
W64	PEM	0.125	Small emergent wetland located in the utility right-of-way. Dominated by soft rush. Connected to JD01.

Notes: P = palustrine; E2 = estuarine, intertidal; EM = emergent; SS = scrub-shrub; OW = open water.

Table 3-1. Essential Fish Habitat Designations for Fish Collected during Seasonal Nearshore Surveys of NSN.

Common Name	Eggs	Larvae	Juveniles	Adults
Black seabass			X	X
Summer flounder		X	X	X
Windowpane				X

Appendix E

Fish and Wildlife Species of NSN and CI

- **E-1. Endangered, Threatened, and Special Concern Species of Fish and Wildlife with Potential to Occur at Naval Station Norfolk**
- **E-2. Endangered, Threatened, and Special Concern Species of Fish and Wildlife with Potential to Occur at Craney Island Fuel Terminal**
- **E-3. Fauna Species Known or Likely to Occur at Naval Station Norfolk (NSN) and Craney Island Fuel Terminal (CI)**

This page intentionally left blank.

Table E-1: Endangered, Threatened, and Special Concern Species of Fish and Wildlife with Potential to Occur at Naval Station Norfolk

BOVA Code	Status*	Tier**	Common Name	Scientific Name
030074	FESE	Ia	Turtle, Kemp's ridley sea	<i>Lepidochelys kempii</i>
010032	FESE	Ib	Sturgeon, Atlantic	<i>Acipenser oxyrinchus</i>
030075	FESE	Ic	Turtle, leatherback sea	<i>Dermochelys coriacea</i>
120030	FESE	IVb	Manatee, West Indian	<i>Trichechus manatus</i>
030073	FESE		Turtle, hawksbill sea	<i>Eretmochelys imbricata</i>
040183	FESE		Tern, roseate	<i>Sterna dougallii dougallii</i>
030071	FTST	Ia	Turtle, loggerhead sea	<i>Caretta caretta</i>
040144	FTST	Ia	Knot, red	<i>Calidris canutus rufa</i>
050022	FTST	Ia	Bat, northern long-eared	<i>Myotis septentrionalis</i>
030072	FTST	Ib	Turtle, green sea	<i>Chelonia mydas</i>
040120	FTST	IIa	Plover, piping	<i>Charadrius melodus</i>
030064	SE	Ia	Turtle, eastern chicken	<i>Deirochelys reticularia reticularia</i>
040118	SE	Ia	Plover, Wilson's	<i>Charadrius wilsonia</i>
040110	SE	Ia	Rail, black	<i>Laterallus jamaicensis</i>
050020	SE	Ia	Bat, little brown	<i>Myotis lucifugus lucifugus</i>
050034	SE	Ia	Bat, Rafinesque's eastern big-eared	<i>Corynorhinus rafinesquii macrotis</i>
050027	SE	Ia	Bat, tri-colored	<i>Perimyotis subflavus</i>
030013	SE	IIa	Rattlesnake, canebrake	<i>Crotalus horridus</i>
040096	ST	Ia	Falcon, peregrine	<i>Falco peregrinus</i>
040293	ST	Ia	Shrike, loggerhead	<i>Lanius ludovicianus</i>
040179	ST	Ia	Tern, gull-billed	<i>Sterna nilotica</i>
020044	ST	IIa	Salamander, Mabee's	<i>Ambystoma mabeei</i>
020002	ST	IIa	Treefrog, barking	<i>Hyla gratiosa</i>
040292	ST		Shrike, migrant loggerhead	<i>Lanius ludovicianus migrans</i>
030067	CC	IIa	Terrapin, northern diamond-backed	<i>Malaclemys terrapin terrapin</i>
030063	CC	IIIa	Turtle, spotted	<i>Clemmys guttata</i>
040040		Ia	Ibis, glossy	<i>Plegadis falcinellus</i>
040306		Ia	Warbler, golden-winged	<i>Vermivora chrysoptera</i>
040213		Ic	Owl, northern saw-whet	<i>Aegolius acadicus</i>
020063		IIa	Toad, oak	<i>Anaxyrus quercicus</i>

Appendices

BOVA Code	Status*	Tier**	Common Name	Scientific Name
040052		IIa	Duck, American black	<i>Anas rubripes</i>
040033		IIa	Egret, snowy	<i>Egretta thula</i>
040029		IIa	Heron, little blue	<i>Egretta caerulea caerulea</i>
040036		IIa	Night-heron, yellow-crowned	<i>Nyctanassa violacea violacea</i>
040114		IIa	Oystercatcher, American	<i>Haematopus palliatus</i>
040192		IIa	Skimmer, black	<i>Rynchops niger</i>
040181		IIa	Tern, common	<i>Sterna hirundo</i>
040320		IIa	Warbler, cerulean	<i>Setophaga cerulea</i>
040140		IIa	Woodcock, American	<i>Scolopax minor</i>
040203		IIb	Cuckoo, black-billed	<i>Coccyzus erythrophthalmus</i>
040105		IIb	Rail, king	<i>Rallus elegans</i>
040304		IIc	Warbler, Swainson's	<i>Limnothlypis swainsonii</i>
110353		IIc	Spider, funnel-web	<i>Barronopsis jeffersi</i>

Notes: BOVA = Biota of Virginia;

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FC=Federal Candidate; 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

Virginia Wildlife Action Plan Conservation Opportunity Ranking:

a On the ground management strategies/actions exist and can be feasibly implemented;

b On the ground actions or research needs have been identified but cannot feasibly be implemented at this time;

c No on the ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.

Source: Virginia Department of Game and Inland Fisheries, Virginia Fish and Wildlife Service (VaFWIS) Search Report "Known or likely to occur within a 3 mile radius around point Naval Station Norfolk..." compiled on 7 September 2016, available at http://vafwis.org/fwis/?Menu=Home.__By+Place+Name.

Table E-2: Endangered, Threatened, and Special Concern Species of Fish and Wildlife with Potential to Occur at Craney Island Fuel Terminal

BOVA Code	Status*	Tier**	Common Name	Scientific Name
030074	FESE	Ia	Turtle, Kemp's ridley sea	<i>Lepidochelys kempii</i>
040228	FESE	Ia	Woodpecker, red-cockaded	<i>Picoides borealis</i>
010032	FESE	Ib	Sturgeon, Atlantic	<i>Acipenser oxyrinchus</i>
030075	FESE	Ic	Turtle, leatherback sea	<i>Dermochelys coriacea</i>
120030	FESE	IVb	Manatee, West Indian	<i>Trichechus manatus</i>
030073	FESE		Turtle, hawksbill sea	<i>Eretmochelys imbricata</i>
030071	FTST	Ia	Turtle, loggerhead sea	<i>Caretta caretta</i>
040144	FTST	Ia	Knot, red	<i>Calidris canutus rufa</i>
050022	FTST	Ia	Bat, northern long-eared	<i>Myotis septentrionalis</i>
030072	FTST	Ib	Turtle, green sea	<i>Chelonia mydas</i>
040120	FTST	IIa	Plover, piping	<i>Charadrius melodus</i>
040118	SE	Ia	Plover, Wilson's	<i>Charadrius wilsonia</i>
040110	SE	Ia	Rail, black	<i>Laterallus jamaicensis</i>
050034	SE	Ia	Bat, Rafinesque's eastern big-eared	<i>Corynorhinus rafinesquii macrotis</i>
050027	SE	Ia	Bat, tri-colored	<i>Perimyotis subflavus</i>
030013	SE	IIa	Rattlesnake, canebrake	<i>Crotalus horridus</i>
040096	ST	Ia	Falcon, peregrine	<i>Falco peregrinus</i>
040293	ST	Ia	Shrike, loggerhead	<i>Lanius ludovicianus</i>
040179	ST	Ia	Tern, gull-billed	<i>Sterna nilotica</i>
020044	ST	IIa	Salamander, Mabee's	<i>Ambystoma mabeei</i>
040292	ST		Shrike, migrant loggerhead	<i>Lanius ludovicianus migrans</i>
030067	CC	IIa	Terrapin, northern diamond-backed	<i>Malaclemys terrapin terrapin</i>
030063	CC	IIIa	Turtle, spotted	<i>Clemmys guttata</i>
040040		Ia	Ibis, glossy	<i>Plegadis falcinellus</i>
040422		Ic	Warbler, Wayne's	<i>Dendroica virens waynei</i>
070131		Ic	Isopod, Phreatic	<i>Caecidotea phreatica</i>
100176		Ic	Skipper, Arogos	<i>Atrytone arogos arogos</i>
020063		IIa	Toad, oak	<i>Anaxyrus quercicus</i>
040052		IIa	Duck, American black	<i>Anas rubripes</i>
040033		IIa	Egret, snowy	<i>Egretta thula</i>
040029		IIa	Heron, little blue	<i>Egretta caerulea caerulea</i>

Appendices

BOVA Code	Status*	Tier**	Common Name	Scientific Name
040036		IIa	Night-heron, yellow-crowned	<i>Nyctanassa violacea violacea</i>
040192		IIa	Skimmer, black	<i>Rynchops niger</i>
040181		IIa	Tern, common	<i>Sterna hirundo</i>
040320		IIa	Warbler, cerulean	<i>Setophaga cerulea</i>
040140		IIa	Woodcock, American	<i>Scolopax minor</i>
040203		IIb	Cuckoo, black-billed	<i>Coccyzus erythrophthalmus</i>
040105		IIb	Rail, king	<i>Rallus elegans</i>
040304		IIc	Warbler, Swainson's	<i>Limnothlypis swainsonii</i>

Notes: BOVA = Biota of Virginia;

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FC= Federal Candidate; 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

Virginia Wildlife Action Plan Conservation Opportunity Ranking:

a On the ground management strategies/actions exist and can be feasibly implemented;

b On the ground actions or research needs have been identified but cannot feasibly be implemented at this time;c No on the ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.

Source: Virginia Department of Game and Inland Fisheries, Virginia Fish and Wildlife Service (VaFWIS) Search Report "Known or likely to occur within a 3 mile radius around point Craney Island Fuel Depot..." compiled on 7 September 2016, available at http://vafwis.org/fwis/?Menu=Home.__By+Place+Name.

Table E-3: Fauna Species Known or Likely to Occur at Naval Station Norfolk (NSN) and Craney Island Fuel Terminal (CI).

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
AMPHIBIANS					
<i>Acris gryllus</i>	Frog, southern cricket				
<i>Ambystoma mabeei</i>	Salamander, Mabee's	ST	Ia		
<i>Ambystoma opacum</i>	Salamander, marbled				
<i>Amphiuma means</i>	Amphiuma, two-toed				
<i>Anaxyrus fowleri</i>	Toad, Fowler's				
<i>Anaxyrus quercicus</i>	Toad, oak		Ia		
<i>Anaxyrus terrestris</i>	Toad, southern				
<i>Desmognathus auriculatus</i>	Salamander, southern dusky				
<i>Desmognathus fuscus</i>	Salamander, northern dusky				
<i>Eurycea cirrigera</i>	Salamander, southern two-lined				
<i>Eurycea guttolineata</i>	Salamander, three-lined				
<i>Gastrophryne carolinensis</i>	Toad, eastern narrow-mouthed				
<i>Hemidactylium scutatum</i>	Salamander, four-toed				
<i>Hyla chrysoscelis</i>	Treefrog, Cope's gray				
<i>Hyla cinerea</i>	Treefrog, green				
<i>Hyla femoralis</i>	Treefrog, pine woods				
<i>Hyla gratiosa</i>	Treefrog, barking	ST	Ia		
<i>Hyla squirella</i>	Treefrog, squirrel				
<i>Lithobates catesbeianus</i>	Bullfrog, American				
<i>Lithobates clamitans</i>	Frog, green				
<i>Lithobates palustris</i>	Frog, pickerel				
<i>Lithobates sphenoccephalus utricularius</i>	Frog, southern leopard				
<i>Lithobates virgatipes</i>	Frog, carpenter		IIIa		
<i>Notophthalmus viridescens viridescens</i>	Newt, red-spotted				
<i>Plethodon chlorobryonis</i>	Salamander, Atlantic Coast Slimy				
<i>Plethodon cinereus</i>	Salamander, eastern red-backed				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Pseudacris brimleyi</i>	Frog, Brimley's chorus				
<i>Pseudacris crucifer</i>	Peeper, spring				
<i>Pseudacris feriarum</i>	Frog, upland chorus				
<i>Pseudacris ocularis</i>	Frog, little grass		IVa		
<i>Pseudotriton montanus montanus</i>	Salamander, eastern mud		IVa		
<i>Scaphiopus holbrookii</i>	Spadefoot, eastern		IVc		
<i>Siren intermedia intermedia</i>	Siren, eastern lesser		IIIa		
<i>Siren lacertina</i>	Siren, greater		IVa		
<i>Stereochilus marginatus</i>	Salamander, many-lined		IVa		
BIRDS					
<i>Accipiter cooperii</i>	Hawk, Cooper's			X	
<i>Accipiter striatus velox</i>	Hawk, sharp-shinned			X	
<i>Actitis macularia</i>	Sandpiper, spotted			X	
<i>Aegolius acadicus</i>	Owl, northern saw-whet		Ic		
<i>Agelaius phoeniceus</i>	Blackbird, red-winged			X	X
<i>Aix sponsa</i>	Duck, wood				
<i>Ammodramus caudacutus</i>	Sparrow, saltmarsh		IIIa		
<i>Ammodramus maritimus</i>	Sparrow, seaside		IVa		
<i>Ammodramus nelsoni</i>	Sparrow, Nelson's		IIIa		
<i>Ammodramus savannarum pratensis</i>	Sparrow, grasshopper		IVa		
<i>Amphispiza bilineata</i>	Sparrow, black-throated				
<i>Anas acuta acuta</i>	Pintail, northern		IVa		
<i>Anas americana</i>	Wigeon, American			X	
<i>Anas clypeata</i>	Shoveler, northern				
<i>Anas crecca carolinensis</i>	Teal, green-winged				
<i>Anas discors orphna</i>	Teal, blue-winged				
<i>Anas penelope</i>	Wigeon, Eurasian				
<i>Anas platyrhynchos</i>	Mallard			X	X
<i>Anas rubripes</i>	Duck, American black		IIa	X	
<i>Anas strepera</i>	Gadwall				
<i>Anthus rubescens</i>	Pipit, American				
<i>Antrostomus carolinensis</i>	Chuck-will's-widow				
<i>Antrostomus vociferus</i>	Whip-poor-will, Eastern		IIIa		X
<i>Archilochus colubris</i>	Hummingbird, ruby-throated				
<i>Ardea alba egretta</i>	Egret, great			X	X
<i>Ardea herodias herodias</i>	Heron, great blue			X	X

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Arenaria interpres morinella</i>	Turnstone, ruddy				
<i>Asio flammeus</i>	Owl, short-eared				
<i>Aythya affinis</i>	Scaup, lesser				
<i>Aythya americana</i>	Redhead				
<i>Aythya collaris</i>	Duck, ring-necked			X	
<i>Aythya marila</i>	Scaup, greater		IVa		
<i>Aythya valisineria</i>	Canvasback				
<i>Baeolophus bicolor</i>	Titmouse, tufted				X
<i>Bartramia longicauda</i>	Sandpiper, upland				
<i>Bombycilla cedrorum</i>	Waxwing, cedar			X	
<i>Botaurus lentiginosus</i>	Bittern, American				X
<i>Branta bernicla brota</i>	Brant		IIIa	X	
<i>Branta canadensis</i>	Goose, Canada			X	
<i>Bubo scandiacus</i>	Owl, snowy				
<i>Bubo virginianus</i>	Owl, great horned				
<i>Bubulcus ibis</i>	Egret, cattle				
<i>Bucephala albeola</i>	Bufflehead			X	
<i>Bucephala clangula americana</i>	Goldeneye, common				
<i>Buteo jamaicensis</i>	Hawk, red-tailed			X	
<i>Buteo lagopus johannis</i>	Hawk, rough-legged				
<i>Buteo lineatus lineatus</i>	Hawk, red-shouldered				
<i>Buteo platypterus</i>	Hawk, broad-winged				X
<i>Butorides virescens</i>	Heron, green		IVb		
<i>Calcarius lapponicus</i>	Longspur, Lapland				
<i>Calidris alba</i>	Sanderling		IVa		
<i>Calidris alpina hudsonia</i>	Dunlin		IVa		
<i>Calidris canutus rufa</i>	Knot, red	FTST	Ia		
<i>Calidris maritima</i>	Sandpiper, purple		IVc		
<i>Calidris mauri</i>	Sandpiper, western				
<i>Calidris minutilla</i>	Sandpiper, least				
<i>Calidris pusilla</i>	Sandpiper, semipalmated				
<i>Cardellina canadensis</i>	Warbler, Canada		IVb		
<i>Cardellina pusilla</i>	Warbler, Wilson's				
<i>Cardinalis cardinalis</i>	Cardinal, northern			X	X
<i>Cathartes aura</i>	Vulture, turkey			X	
<i>Catharus bicknelli</i>	Thrush, Bicknell's		IVa		
<i>Catharus fuscescens</i>	Veery				
<i>Catharus guttatus</i>	Thrush, hermit			X	

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Catharus minimus</i>	Thrush, gray-cheeked				
<i>Catharus ustulatus</i>	Thrush, Swainson's			X	
<i>Catoptrophorus semipalmatus semipalmatus</i>	Willet		IIIa		
<i>Certhia americana</i>	Creeper, brown				
<i>Ceryle alcyon</i>	Kingfisher, belted		IIIb	X	
<i>Chaetura pelagica</i>	Swift, chimney		IVb	X	
<i>Charadrius melodus</i>	Plover, piping	FTST	IIa		
<i>Charadrius semipalmatus</i>	Plover, semipalmated			X	
<i>Charadrius vociferus</i>	Killdeer			X	X
<i>Charadrius wilsonia</i>	Plover, Wilson's	SE	Ia	X	
<i>Chen caerulescens</i>	Goose, snow				
<i>Chen caerulescens caerulescens</i>	Goose, lesser snow				
<i>Chlidonias niger</i>	Tern, black				
<i>Chordeiles minor</i>	Nighthawk, common				X
<i>Chroicocephalus philadelphia</i>	Gull, Bonaparte's			X	X
<i>Circus cyaneus</i>	Harrier, northern		IIIa		
<i>Cistothorus palustris</i>	Wren, marsh		IVa		
<i>Cistothorus platensis</i>	Wren, sedge				
<i>Clangula hyemalis</i>	Duck, long-tailed				
<i>Coccythraustes vespertinus</i>	Grosbeak, evening				
<i>Coccyzus americanus</i>	Cuckoo, yellow-billed		IIIa	X	
<i>Coccyzus erythrophthalmus</i>	Cuckoo, black-billed		IIb		
<i>Colaptes auratus</i>	Flicker, northern		IVb	X	X
<i>Colinus virginianus</i>	Bobwhite, northern		IIIa		
<i>Columba livia</i>	Pigeon, rock			X	
<i>Columbina passerina</i>	Dove, common ground			X	
<i>Contopus virens</i>	Pewee, eastern wood		IVb		
<i>Coragyps atratus</i>	Vulture, black			X	
<i>Corvus brachyrhynchos</i>	Crow, American			X	X
<i>Corvus ossifragus</i>	Crow, fish				
<i>Coturnicops noveboracensis</i>	Rail, yellow				
<i>Cyanocitta cristata</i>	Jay, blue			X	X
<i>Cygnus columbianus columbianus</i>	Swan, tundra				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Cygnus olor</i>	Swan, mute				
<i>Dolichonyx oryzivorus</i>	Bobolink				
<i>Dryocopus pileatus</i>	Woodpecker, pileated				
<i>Dumetella carolinensis</i>	Catbird, gray		IVa	X	X
<i>Egretta caerulea caerulea</i>	Heron, little blue		IIa		
<i>Egretta rufescens rufescens</i>	Egret, reddish				
<i>Egretta thula</i>	Egret, snowy		IIa		
<i>Egretta tricolor</i>	Heron, tricolored				
<i>Empidonax traillii</i>	Flycatcher, willow				
<i>Empidonax virescens</i>	Flycatcher, Acadian				
<i>Eremophila alpestris</i>	Lark, horned				
<i>Eudocimus albus</i>	Ibis, white				
<i>Euphagus carolinus</i>	Blackbird, rusty		IVb		
<i>Falco columbarius</i>	Merlin				
<i>Falco peregrinus</i>	Falcon, peregrine	ST	Ia	X	
<i>Falco sparverius sparverius</i>	Kestrel, American			X	
<i>Fulica americana</i>	Coot, American				
<i>Gallinago delicata</i>	Snipe, Wilson's				
<i>Gallinula chloropus cachinnans</i>	Moorhen, common				
<i>Gavia immer</i>	Loon, common				
<i>Gavia stellata</i>	Loon, red-throated		IVa		
<i>Geothlypis formosa</i>	Warbler, Kentucky		IIIa		
<i>Geothlypis philadelphia</i>	Warbler, mourning				
<i>Geothlypis trichas</i>	Yellowthroat, common			X	X
<i>Guiraca caerulea caerulea</i> (a.k.a. <i>Passerina caerulea</i>)	Grosbeak, blue			X	X
<i>Haematopus palliatus</i>	Oystercatcher, American		IIa	X	
<i>Haemorhous mexicanus</i>	Finch, house			X	
<i>Haemorhous purpureus</i>	Finch, purple				
<i>Haliaeetus leucocephalus</i>	Eagle, bald			X	

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Helmitheros vermivorus</i>	Warbler, worm-eating				
<i>Himantopus mexicanus</i>	Stilt, black-necked				
<i>Hirundo rustica</i>	Swallow, barn			X	X
<i>Histrionicus histrionicus</i>	Duck, Harlequin				
<i>Hydrocoloeus minutus</i>	Gull, little				
<i>Hylocichla mustelina</i>	Thrush, wood		IVb		
<i>Icteria virens virens</i>	Chat, yellow-breasted		IVa	X	
<i>Icterus galbula</i>	Oriole, Baltimore			X	
<i>Icterus spurius</i>	Oriole, orchard				
<i>Ixobrychus exilis exilis</i>	Bittern, least		IIIa		
<i>Junco hyemalis</i>	Junco, dark-eyed			X	X
<i>Lanius ludovicianus</i>	Shrike, loggerhead	ST	Ia		
<i>Lanius ludovicianus migrans</i>	Shrike, migrant loggerhead	ST			
<i>Larus argentatus</i>	Gull, herring			X	X
<i>Larus delawarensis</i>	Gull, ring-billed			X	X
<i>Larus glaucoides</i>	Gull, Iceland				
<i>Larus marinus</i>	Gull, great black-backed			X	
<i>Laterallus jamaicensis</i>	Rail, black	SE	Ia		
<i>Leucophaeus atricilla</i>	Gull, laughing		IVa	X	X
<i>Leucophaeus pipixcan</i>	Gull, Franklin's			X	
<i>Limnodromus griseus</i>	Dowitcher, short-billed		IVa		
<i>Limnodromus scolopaceus</i>	Dowitcher, long-billed				
<i>Limnothlypis swainsonii</i>	Warbler, Swainson's		IIc		
<i>Limosa fedoa</i>	Godwit, marbled		IVa		
<i>Limosa haemastica</i>	Godwit, Hudsonian				
<i>Lophodytes cucullatus</i>	Merganser, hooded			X	
<i>Loxia leucoptera</i>	Crossbill, white-winged				
<i>Megascops asio</i>	Screech-owl, eastern				
<i>Melanerpes carolinus</i>	Woodpecker, red-bellied				
<i>Melanerpes erythrocephalus</i>	Woodpecker, red-headed				X
<i>Melanitta fusca deglandi</i>	Scoter, white-winged				
<i>Melanitta nigra americana</i>	Scoter, black				
<i>Melanitta perspicillata</i>	Scoter, surf				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Meleagris gallopavo silvestris</i>	Turkey, wild			X	
<i>Melospiza georgiana</i>	Sparrow, swamp			X	
<i>Melospiza lincolni</i>	Sparrow, Lincoln's				
<i>Melospiza melodia</i>	Sparrow, song			X	X
<i>Mergus merganser americanus</i>	Merganser, common			X	
<i>Mergus serrator serrator</i>	Merganser, red-breasted				
<i>Mimus polyglottos</i>	Mockingbird, northern			X	X
<i>Mniotilta varia</i>	Warbler, black-and-white		IVa	X	
<i>Molothrus ater</i>	Cowbird, brown-headed			X	X
<i>Morus bassanus</i>	Gannet, northern		IVa	X	
<i>Mycteria americana</i>	Stork, wood				
<i>Myiarchus crinitus</i>	Flycatcher, great crested			X	
<i>Numenius phaeopus</i>	Whimbrel		IVa		
<i>Nyctanassa violacea violacea</i>	Night-heron, yellow-crowned		IIa	X	
<i>Nycticorax nycticorax hoactii</i>	Night-heron, black-crowned		IIIa	X	
<i>Oceanites oceanicus</i>	Storm-petrel, Wilson's				
<i>Oporornis agilis</i>	Warbler, Connecticut				
<i>Oreothlypis celata</i>	Warbler, orange-crowned				
<i>Oreothlypis peregrina</i>	Warbler, Tennessee				
<i>Oreothlypis ruficapilla</i>	Warbler, Nashville				
<i>Oxyura jamaicensis</i>	Duck, ruddy			X	
<i>Pandion haliaetus carolinensis</i>	Osprey			X	X
<i>Parkesia motacilla</i>	Waterthrush, Louisiana				
<i>Parkesia noveboracensis</i>	Waterthrush, northern				
<i>Passer domesticus</i>	Sparrow, house				
<i>Passerculus sandwichensis</i>	Sparrow, savannah			X	X
<i>Passerella iliaca</i>	Sparrow, fox				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Passerina amoena</i>	Bunting, Lazuli				
<i>Passerina cyanea</i>	Bunting, indigo			X	X
<i>Pelecanus occidentalis carolinensis</i>	Pelican, brown			X	
<i>Phalacrocorax auritus</i>	Cormorant, double-crested			X	
<i>Phalacrocorax carbo</i>	Cormorant, great				
<i>Phalaropus tricolor</i>	Phalarope, Wilson's				
<i>Pheucticus ludovicianus</i>	Grosbeak, rose-breasted				
<i>Pheucticus melanocephalus</i>	Grosbeak, black-headed				
<i>Picoides pubescens medianus</i>	Woodpecker, downy			X	
<i>Picoides villosus</i>	Woodpecker, hairy			X	
<i>Pipilo erythrophthalmus</i>	Towhee, eastern		IVa		X
<i>Piranga ludoviciana</i>	Tanager, western				
<i>Piranga olivacea</i>	Tanager, scarlet				
<i>Piranga rubra</i>	Tanager, summer				
<i>Plectrophenax nivalis nivalis</i>	Bunting, snow				
<i>Plegadis falcinellus</i>	Ibis, glossy		Ia		
<i>Pluvialis squatarola</i>	Plover, black-bellied		IVa		
<i>Podiceps auritus</i>	Grebe, horned				
<i>Podiceps grisegena</i>	Grebe, red-necked				
<i>Podiceps nigricollis</i>	Grebe, eared				
<i>Podilymbus podiceps</i>	Grebe, pied-billed			X	
<i>Poecile atricapillus</i>	Chickadee, black-capped			X	X
<i>Poecile carolinensis</i>	Chickadee, Carolina			X	X
<i>Polioptila caerulea</i>	Gnatcatcher, blue-gray				
<i>Pooecetes gramineus</i>	Sparrow, vesper				
<i>Porzana carolina</i>	Sora			X	X
<i>Progne subis</i>	Martin, purple				
<i>Protonotaria citrea</i>	Warbler, prothonotary				
<i>Quiscalus major</i>	Grackle, boat-tailed				
<i>Quiscalus quiscula</i>	Grackle, common			X	X
<i>Rallus crepitans</i>	Rail, clapper		IVa	X	
<i>Rallus elegans</i>	Rail, king		IIB		

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Rallus limicola</i>	Rail, Virginia		IVa		
<i>Recurvirostra americana</i>	Avocet, American				
<i>Regulus calendula</i>	Kinglet, ruby-crowned				
<i>Regulus satrapa</i>	Kinglet, golden-crowned				
<i>Rissa tridactyla</i>	Kittiwake, black-legged				
<i>Rynchops niger</i>	Skimmer, black		IIa	X	
<i>Sayornis phoebe</i>	Phoebe, eastern				
<i>Scolopax minor</i>	Woodcock, American		IIa	X	
<i>Seiurus aurocapilla</i>	Ovenbird			X	X
<i>Setophaga americana</i>	Parula, northern				
<i>Setophaga caerulescens</i>	Warbler, black-throated blue				
<i>Setophaga castanea</i>	Warbler, bay-breasted				
<i>Setophaga cerulea</i>	Warbler, cerulean		IIa		
<i>Setophaga citrina</i>	Warbler, hooded				
<i>Setophaga coronata</i>	Warbler, yellow-rumped				
<i>Setophaga discolor</i>	Warbler, prairie			X	
<i>Setophaga magnolia</i>	Warbler, magnolia				
<i>Setophaga palmarum</i>	Warbler, palm			X	
<i>Setophaga pensylvanica</i>	Warbler, chestnut-sided			X	X
<i>Setophaga petechia</i>	Warbler, yellow			X	
<i>Setophaga pinus</i> (formerly <i>Dendroica pinus</i>)	Warbler, pine			X	X
<i>Setophaga ruticilla</i>	Redstart, American			X	X
<i>Setophaga striata</i>	Warbler, blackpoll			X	
<i>Setophaga virens</i>	Warbler, black-throated green				
<i>Sialia sialis</i>	Bluebird, eastern				
<i>Sitta canadensis</i>	Nuthatch, red-breasted				
<i>Sitta carolinensis</i>	Nuthatch, white-breasted				
<i>Sitta pusilla</i>	Nuthatch, brown-headed				
<i>Somateria mollissima</i>	Eider, common				
<i>Somateria spectabilis</i>	Eider, king				
<i>Sphyrapicus varius</i>	Sapsucker, yellow-bellied				
<i>Spinus pinus</i>	Siskin, pine				
<i>Spinus tristis</i>	Goldfinch, American			X	X
<i>Spiza americana</i>	Dickcissel				
<i>Spizella arborea</i>	Sparrow, American tree			X	
<i>Spizella passerina</i>	Sparrow, chipping			X	X
<i>Spizella pusilla</i>	Sparrow, field		IVa		

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Stelgidopteryx serripennis</i>	Swallow, northern rough-winged		IVc		
<i>Stercorarius parasiticus</i>	Jaeger, parasitic				
<i>Stercorarius pomarinus</i>	Jaeger, pomarine				
<i>Sterna antillarum</i>	Tern, least		IIIa	X	
<i>Sterna caspia</i>	Tern, Caspian			X	
<i>Sterna dougallii dougallii</i>	Tern, roseate	FESE			
<i>Sterna forsteri</i>	Tern, Forster's		IIIa	X	
<i>Sterna fuscata</i>	Tern, sooty				
<i>Sterna hirundo</i>	Tern, common		IIa	X	
<i>Sterna maxima maximus</i>	Tern, royal		IVa	X	
<i>Sterna nilotica</i>	Tern, gull-billed	ST	Ia		
<i>Sterna sandvicensis acufavidus</i>	Tern, sandwich				
<i>Streptopelia decaocto</i>	Collared-dove, Eurasian			X	
<i>Strix varia</i>	Owl, barred				X
<i>Sturnella magna</i>	Meadowlark, eastern		IVa	X	
<i>Sturnus vulgaris</i>	Starling, European			X	X
<i>Tachycineta bicolor</i>	Swallow, tree			X	
<i>Thryothorus ludovicianus</i>	Wren, Carolina			X	
<i>Toxostoma rufum</i>	Thrasher, brown		IVa	X	X
<i>Tringa flavipes</i>	Yellowlegs, lesser				
<i>Tringa melanoleuca</i>	Yellowlegs, greater				
<i>Tringa solitaria</i>	Sandpiper, solitary				
<i>Troglodytes aedon</i>	Wren, house				
<i>Troglodytes troglodytes</i>	Wren, winter				
<i>Turdus migratorius</i>	Robin, American			X	X
<i>Tyrannus tyrannus</i>	Kingbird, eastern		IVa	X	X
<i>Tyto alba pratincola</i>	Owl, barn		IIIa		
<i>Vermivora chrysoptera</i>	Warbler, golden-winged		Ia		
<i>Vermivora cyanoptera</i>	Warbler, blue-winged				
<i>Vireo flavifrons</i>	Vireo, yellow-throated				
<i>Vireo gilvus gilvus</i>	Vireo, warbling				
<i>Vireo griseus</i>	Vireo, white-eyed				
<i>Vireo olivaceus</i>	Vireo, red-eyed			X	
<i>Vireo philadelphicus</i>	Vireo, Philadelphia				
<i>Vireo solitarius</i>	Vireo, blue-headed			X	
<i>Zenaida macroura carolinensis</i>	Dove, mourning			X	X
<i>Zonotrichia albicollis</i>	Sparrow, white-throated			X	

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Zonotrichia leucophrys</i>	Sparrow, white-crowned				
FISH					
<i>Acipenser oxyrinchus</i>	Sturgeon, Atlantic	FESE	Ib	X	
<i>Alosa aestivalis</i>	Herring, blueback		IVa	X	
<i>Alosa mediocris</i>	Shad, hickory			X	
<i>Alosa pseudoharengus</i>	Herring, alewife		IVa	X	
<i>Alosa sapidissima</i>	Shad, American		IVa	X	
<i>Ameiurus catus</i>	Catfish, white				
<i>Ameiurus natalis</i>	Bullhead, yellow				
<i>Ameiurus nebulosus</i>	Bullhead, brown				
<i>Anchoa hepsetus</i>	Anchovy, striped			X	
<i>Anchoa mitchilli</i>	Anchovy, bay			X	
<i>Anguilla rostrata</i>	Eel, American		IIIa		
<i>Bairdiella chrysoura</i>	Perch, silver			X	
<i>Brevoortia tyrannus</i>	Menhaden, Atlantic			X	
<i>Clinostomus funduloides</i>	Dace, rosyside				
<i>Clupea</i> sp.	Herring			X	
<i>Cynoscion nebulosus</i>	Seatrout, spotted				
<i>Cynoscion regalis</i>	Weakfish			X	
<i>Cyprinodon variegatus</i>	Minnow, sheepshead				
<i>Cyprinus carpio</i>	Carp, common				
<i>Dasyatis sabina</i>	Stingray, Atlantic				
<i>Dorosoma cepedianum</i>	Shad, gizzard				
<i>Doryteuthis pealeii</i>	Squid, longfin			X	
<i>Esox niger</i>	Pickrel, chain				
<i>Etropus microstomus</i>	Flounder, smallmouth			X	
Family Sciaenidae	Sciaenid, juvenile			X	
<i>Fundulus confluentus</i>	Killifish, marsh				
<i>Fundulus diaphanus</i>	Killifish, banded				
<i>Fundulus heteroclitus</i>	Mummichog				
<i>Fundulus luciae</i>	Killifish, spotfin				
<i>Fundulus majalis</i>	Killifish, striped				
<i>Gambusia holbrooki</i>	Mosquitofish, eastern				
<i>Gobiosox strumosus</i>	Skilletfish			X	
<i>Gobiosoma bosc</i>	Naked goby			X	
<i>Gobiosoma ginsburgi</i>	Seaboard goby			X	
<i>Hippocampus erectus</i>	Lined seahorse			X	
<i>Hybognathus regius</i>	Minnow, eastern silvery				
<i>Hypsoblennius hentz</i>	Feather blenny			X	

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Ictalurus punctatus</i>	Catfish, channel				
<i>Larimus fasciatus</i>	Banded drum			X	
<i>Leiostomus xanthurus</i>	Spot			X	
<i>Lepomis gibbosus</i>	Pumpkinseed				
<i>Lepomis gulosus</i>	Warmouth				
<i>Lepomis macrochirus</i>	Bluegill				
<i>Lepomis microlophus</i>	Sunfish, redear				
<i>Lucania parva</i>	Killifish, rainwater				
<i>Menidia beryllina</i>	Silverside, inland				
<i>Menidia menidia</i>	Silverside, Atlantic			X	
<i>Menticirrhus americanus</i>	Kingfish, southern			X	
<i>Merluccius</i> sp.	Hake, silver or offshore			X	
<i>Micropogonias undulatus</i>	Croaker, Atlantic			X	
<i>Micropterus punctulatus</i>	Bass, spotted				
<i>Micropterus salmoides</i>	Bass, largemouth				
<i>Morone americana</i>	Perch, white				
<i>Morone saxatilis</i>	Bass, striped			X	
<i>Notemigonus crysoleucas</i>	Shiner, golden				
<i>Opsanus tau</i>	Oyster toadfish			X	
<i>Orthopristis chrysoptera</i>	Pigfish			X	
<i>Paralichthys dentatus</i>	Summer flounder			X	
<i>Peprilus paru</i>	Harvestfish			X	
<i>Perca flavescens</i>	Perch, yellow				
<i>Petromyzon marinus</i>	Lamprey, sea				
<i>Pogonias cromis</i>	Black drum			X	
<i>Pomoxis nigromaculatus</i>	Crappie, black				
<i>Prionotus carolinus</i>	Northern searobin			X	
<i>Prionotus evolans</i>	Striped searobin			X	
<i>Raja eglanteria</i>	Clearnose skate			X	
<i>Rhinoptera bonasus</i>	Cownose ray			X	
<i>Sander vitreus vitreus</i>	Walleye				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Scophthalmus aquosus</i>	Windowpane			X	
<i>Selene setapinnis</i>	Atlantic moonfish			X	
<i>Selene vomer</i>	Lookdown			X	
<i>Sphoeroides maculatus</i>	Northern puffer			X	
<i>Sphyraena borealis</i>	Sennet			X	
<i>Symphurus plagiusa</i>	Blackcheek tonguefish			X	
<i>Syngnathus fuscus</i>	Northern pipefish			X	
<i>Trichiurus lepturus</i>	Atlantic cutlassfish			X	
<i>Trinectes maculatus</i>	Hogchoker			X	
<i>Urophycis regia</i>	Spotted hake			X	
INVERTEBRATES					
<i>Achalarus lyciades</i>	Butterfly, hoary edge				
<i>Agraulis vanillae nigrior</i>	Butterfly, gulf fritillary				
<i>Alpheus heterochaelis</i>	Shrimp, big-clawed snapping				
<i>Amblyomma americanum</i>	Tick, lone star				
<i>Amblyscirtes aesculapius</i>	Butterfly, lace-winged road-skipper				
<i>Amblyscirtes carolina</i>	Butterfly, Carolina road-skipper				
<i>Amblyscirtes reversa</i>	Butterfly, reversed road-skipper				
<i>Anatrytone logan</i>	Butterfly, Delaware skipper				
<i>Ancyloxypha numitor</i>	Butterfly, least skipper				
<i>Anisota virginiensis</i>	Moth, pinkstriped oakworm				
<i>Atalopedes campestris</i>	Butterfly, sachem				
<i>Atlides halesus</i>	Butterfly, great purple hairstreak				
<i>Barronopsis jeffersi</i>	Spider, funnel-web		IIc		
<i>Battus philenor</i>	Butterfly, pipevine swallowtail				
<i>Callophrys augustinus</i>	Butterfly, brown elfin				
<i>Calpododes ethlius</i>	Butterfly, Brazilian skipper				
<i>Calycopis cecrops</i>	Butterfly, red-banded hairstreak				
<i>Cambarus acuminatus</i>	Crayfish, no common name				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Cambarus diogenes diogenes</i>	Crayfish, devil				
<i>Celastrina ladon</i>	Butterfly, spring azure				
<i>Cercyonis pegala</i>	Butterfly, common wood-nymph				
<i>Chrysops vittatus vittatus</i>	Deerfly				
<i>Colias eurytheme</i>	Butterfly, orange sulphur				
<i>Colias philodice</i>	Butterfly, clouded sulphur				
<i>Cydia pomonella</i>	Moth, codling				
<i>Cyloopsis gemma</i>	Butterfly, gemmed satyr				
<i>Danaus plexippus</i>	Butterfly, monarch		IIIa		
<i>Dermacentor albipictus</i>	Tick, winter				
<i>Dermacentor variabilis</i>	Tick, American dog				
<i>Elliptio complanata</i>	Mussel, eastern elliptio				
<i>Epargyreus clarus</i>	Butterfly, silver-spotted skipper				
<i>Erynnis brizo</i>	Butterfly, sleepy duskywing				
<i>Erynnis horatius</i>	Butterfly, Horace's duskywing				
<i>Erynnis juvenalis</i>	Butterfly, Juvenal's duskywing				
<i>Erynnis zarucco</i>	Butterfly, Zarucco duskywing				
<i>Euphyes conspicua</i>	Butterfly, black dash		IVc		
<i>Euphyes dion</i>	Butterfly, Dion skipper				
<i>Euphyes dukesi</i>	Skipper, Duke's (or scarce swamp)		IIIc		
<i>Euphyes vestris</i>	Butterfly, Dun skipper				
<i>Euptoieta claudia</i>	Butterfly, variegated fritillary				
<i>Eurema nicippe</i>	Butterfly, sleepy orange				
<i>Eurypanopeus depressus</i>	Crab, flatback mud				
<i>Eurytides marcellus</i>	Butterfly, zebra swallowtail				
<i>Everes comyntas</i>	Butterfly, eastern tailed-blue				
<i>Fallicambarus fodiens</i>	Crayfish, Digger				
<i>Haemaphysalis leporispalustris</i>	Tick, rabbit				
<i>Heliathis zea</i>	Earworm, corn				
<i>Hesperia sassacus</i>	Butterfly, Indian skipper				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Hippolyte pleuracantha</i>	Shrimp, eelgrass				
<i>Hylephila phyleus</i>	Butterfly, fiery skipper				
<i>Junonia coenia</i>	Butterfly, common buckeye				
<i>Lerema accius</i>	Butterfly, clouded skipper				
<i>Limenitis archippus</i>	Butterfly, viceroy				
<i>Limenitis arthemis astyanax</i>	Butterfly, red-spotted purple				
<i>Lymantria dispar</i>	Moth, gypsy				
<i>Nastra lherminier</i>	Butterfly, swarthy skipper				
<i>Ostrinia nubilalis</i>	Borer, European corn				
<i>Panoquina ocola</i>	Butterfly, Ocola skipper				
<i>Panoquina panoquin</i>	Butterfly, salt marsh skipper				
<i>Papilio glaucus</i>	Butterfly, eastern tiger swallowtail				
<i>Papilio palamedes</i>	Butterfly, Palamedes swallowtail				
<i>Papilio polyxenes asterius</i>	Butterfly, black swallowtail				
<i>Papilio troilus</i>	Butterfly, spicebush swallowtail				
<i>Parrhasius m-album</i>	Butterfly, white M hairstreak				
<i>Phoebis sennae eubule</i>	Butterfly, cloudless sulphur				
<i>Pholisora catullus</i>	Butterfly, common sootywing				
<i>Pieris rapae</i>	Butterfly, cabbage white				
<i>Poanes aaroni</i>	Butterfly, Aaron's skipper				
<i>Poanes viator</i>	Butterfly, broad-winged skipper				
<i>Poanes yehl</i>	Butterfly, Yehl skipper				
<i>Poanes zabulon</i>	Butterfly, Zabulon skipper				
<i>Polites carus</i>	Butterfly, carus skipper				
<i>Polites origenes</i>	Butterfly, crossline skipper				
<i>Polites peckius</i>	Butterfly, Peck's skipper				
<i>Polygonia comma</i>	Butterfly, eastern comma				
<i>Polygonia interrogationis</i>	Butterfly, question mark				
<i>Pompeius verna</i>	Butterfly, little glassywing				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Procambarus acutus</i>	Crayfish, White River				
<i>Pseudaletia unipuncta</i>	Armyworm				
<i>Pyganodon cataracta</i>	Floater, eastern				
<i>Pyrgus communis</i>	Butterfly, common checkered-skipper				
<i>Rhipicephalus sanguineus</i>	Tick, brown dog				
<i>Satyrrium calanus</i>	Butterfly, banded hairstreak				
<i>Satyrrium kingi</i>	Butterfly, King's hairstreak		IVc		
<i>Staphylus hayhurstii</i>	Butterfly, Hayhurst's scallopwing				
<i>Strymon melinus</i>	Butterfly, gray hairstreak				
<i>Thorybes bathyllus</i>	Butterfly, southern cloudywing				
<i>Thorybes confusus</i>	Butterfly, confused cloudywing				
<i>Thorybes pylades</i>	Butterfly, northern cloudywing				
<i>Tramea lacerata</i>	Dragonfly, black saddlebags				
<i>Urbanus proteus</i>	Butterfly, long-tailed skipper				
<i>Vanessa atalanta</i>	Butterfly, red admiral				
<i>Vanessa cardui</i>	Butterfly, painted lady				
<i>Vanessa virginiensis</i>	Butterfly, American lady				
<i>Wallengrenia egeremet</i>	Butterfly, northern broken dash				
<i>Wallengrenia otho</i>	Butterfly, southern broken dash				
MAMMALS					
<i>Blarina brevicauda kirtlandi</i>	Shrew, Kirtland's short-tailed				
<i>Blarina carolinensis carolinensis</i>	Shrew, southern short-tailed				
<i>Canis latrans</i>	Coyote			X	X
<i>Castor canadensis</i>	Beaver, American				
<i>Condylura cristata parva</i>	Mole, star-nosed				
<i>Corynorhinus rafinesquii macrotis</i>	Bat, Rafinesque's eastern big-eared	SE	Ia	X	
<i>Cryptotis parva parva</i>	Shrew, least				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Didelphis virginiana virginiana</i>	Opossum, Virginia			X	
<i>Eptesicus fuscus fuscus</i>	Bat, big brown			X	X
<i>Felis catus</i>	Cat, feral			X	
<i>Glaucomys volans volans</i>	Squirrel, southern flying				
<i>Lasionycteris noctivagans</i>	Bat, silver-haired		IVa	X	X
<i>Lasiurus borealis borealis</i>	Bat, eastern red		IVa	X	X
<i>Lasiurus cinereus cinereus</i>	Bat, hoary		IVa		
<i>Lasiurus intermedius floridanus</i>	Bat, northern yellow				
<i>Lontra canadensis lataxina</i>	Otter, northern river				
<i>Lynx rufus rufus</i>	Bobcat				
<i>Marmota monax monax</i>	Woodchuck				
<i>Mephitis mephitis mephitis</i>	Skunk, striped				
<i>Mephitis mephitis nigra</i>	Skunk, striped				
<i>Microtus pennsylvanicus nigrans</i>	Vole, dark meadow				
<i>Microtus pinetorum scalopsoides</i>	Vole, pine				
<i>Mus musculus musculus</i>	Mouse, house			X	X
<i>Mustela frenata noveboracensis</i>	Weasel, long-tailed				
<i>Mustela vison mink</i>	Mink, common				
<i>Myocastor coypus</i>	Nutria				
<i>Myotis austroriparius</i>	Myotis, southeastern		IVa		
<i>Myotis lucifugus lucifugus</i>	Bat, little brown	SE	Ia		
<i>Myotis septentrionalis</i>	Bat, northern long-eared	FTST	Ia		
<i>Nycticeius humeralis humeralis</i>	Bat, evening				X
<i>Ochrotomys nuttalli nuttalli</i>	Mouse, Lewis' golden				
<i>Odocoileus virginianus</i>	Deer, white-tailed				X
<i>Ondatra zibethicus macrodon</i>	Muskrat, large-toothed			X	X
<i>Oryzomys palustris palustris</i>	Rat, marsh rice				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Perimyotis subflavus</i>	Bat, tri-colored	SE	Ia	X	X
<i>Peromyscus gossypinus gossypinus</i>	Mouse, cotton		IVa		
<i>Peromyscus leucopus easti</i>	Mouse, Pungo white-footed		IIIc		
<i>Peromyscus leucopus leucopus</i>	Mouse, common white-footed			X	X
<i>Procyon lotor lotor</i>	Raccoon			X	X
<i>Rattus norvegicus norvegicus</i>	Rat, Norway			X	X
<i>Rattus rattus rattus</i>	Rat, black				
<i>Reithrodontomys humulis humulis</i>	Mouse, eastern harvest				
<i>Reithrodontomys humulis virginianus</i>	Mouse, eastern harvest				
<i>Scalopus aquaticus aquaticus</i>	Mole, eastern			X	X
<i>Sciurus carolinensis carolinensis</i>	Squirrel, eastern gray			X	X
<i>Sigmodon hispidus virginianus</i>	Rat, hispid cotton				
<i>Sorex hoyi winnemana</i>	Shrew, pygmy				
<i>Sorex longirostris fisheri</i>	Shrew, Dismal Swamp southeastern				
<i>Sorex longirostris longirostris</i>	Shrew, southeastern			X	X
<i>Sylvilagus floridanus mallurus</i>	Cottontail, eastern			X	X
<i>Sylvilagus palustris palustris</i>	Rabbit, marsh		IVa		
<i>Synaptomys cooperi helaletes</i>	Lemming, southern bog				
<i>Tamias striatus fisheri</i>	Chipmunk, Fisher's eastern				
<i>Trichechus manatus</i>	Manatee, West Indian	FESE	IVb		
<i>Tursiops truncatus</i>	Dolphin, Atlantic bottlenose		IIIb	X	
<i>Urocyon cinereoargenteus cinereoargenteus</i>	Fox, common gray			X	
<i>Ursus americanus</i>	Bear, black				X
<i>Vulpes vulpes fulva</i>	Fox, red			X	

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Zapus hudsonius americanus</i>	Mouse, meadow jumping				
REPTILES					
<i>Agkistrodon contortrix mokasen</i>	Copperhead, northern				X
<i>Agkistrodon piscivorus piscivorus</i>	Cottonmouth, eastern				X
<i>Aspidozelis sexlineata sexlineata</i>	Racerunner, eastern six-lined				
<i>Caretta caretta</i>	Turtle, loggerhead sea	FTST	Ia		
<i>Carphophis amoenus amoenus</i>	Wormsnake, eastern				
<i>Cemophora coccinea copei</i>	Scarletsnake, northern		IVa		
<i>Chelonia mydas</i>	Turtle, green sea	FTST	Ib		
<i>Chelydra serpentina</i>	Turtle, snapping		IVb		X
<i>Chrysemys picta picta</i>	Turtle, eastern painted				
<i>Clemmys guttata</i>	Turtle, spotted	CC	IIIa		
<i>Coluber constrictor constrictor</i>	Racer, northern black				
<i>Crotalus horridus</i>	Rattlesnake, canebrake	SE	IIa		
<i>Deirochelys reticularia reticularia</i>	Turtle, eastern chicken	SE	Ia		
<i>Dermochelys coriacea</i>	Turtle, leatherback sea	FESE	Ic		
<i>Diadophis punctatus edwardsii</i>	Snake, northern ring-necked				
<i>Diadophis punctatus punctatus</i>	Snake, southern ring-necked				
<i>Eretmochelys imbricata</i>	Turtle, hawksbill sea	FESE			
<i>Farancia abacura abacura</i>	Mudsnake, eastern		IVa		
<i>Farancia erythrogramma erythrogramma</i>	Snake, common rainbow		IVa		
<i>Graptemys geographica</i>	Turtle, northern map		IVa		
<i>Haldea striatula</i>	Earthsnake, rough				
<i>Hemidactylus turcicus</i>	Gecko, Mediterranean				
<i>Heterodon platirhinos</i>	Snake, eastern hog-nosed		IVc		
<i>Kinosternon baurii</i>	Turtle, striped mud				
<i>Kinosternon subrubrum subrubrum</i>	Turtle, southeastern mud				
<i>Lampropeltis getula</i>	Kingsnake, eastern				
<i>Lampropeltis triangulum</i>	Milksnake, eastern				

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<i>Lepidochelys kempii</i>	Turtle, Kemp's ridley sea	FESE	Ia		
<i>Malaclemys terrapin terrapin</i>	Terrapin, northern diamond-backed	CC	IIa		
<i>Nerodia erythrogaster</i>	Watersnake, plain-bellied				
<i>Nerodia sipedon sipedon</i>	Watersnake, northern				
<i>Nerodia taxispilota</i>	Watersnake, brown				
<i>Opheodrys aestivus aestivus</i>	Greensnake, northern rough				
<i>Ophisaurus attenuatus longicaudus</i>	Lizard, eastern slender glass		IVa		
<i>Pantherophis alleghaniensis</i>	Ratsnake, eastern				
<i>Pantherophis guttatus</i>	Cornsnake, red				
<i>Plestiodon fasciatus</i>	Skink, common five-lined				
<i>Plestiodon inexpectatus</i>	Skink, southeastern five-lined				
<i>Plestiodon laticeps</i>	Skink, broad-headed				
<i>Pseudemys rubriventris</i>	Cooter, northern red-bellied				
<i>Sceloporus undulatus</i>	Lizard, eastern fence				
<i>Scincella lateralis</i>	Skink, little brown				
<i>Sternotherus odoratus</i>	Turtle, eastern musk				
<i>Storeria dekayi dekayi</i>	Brownsnake, northern				
<i>Storeria occipitomaculata occipitomaculata</i>	Snake, northern red-bellied				
<i>Terrapene carolina carolina</i>	Turtle, woodland box		IIIa		
<i>Thamnophis sauritus sauritus</i>	Ribbonsnake, common		IVa		
<i>Thamnophis sirtalis sirtalis</i>	Gartersnake, eastern				
<i>Trachemys scripta scripta</i>	Slider, yellow-bellied		IVb		
<i>Virginia valeriae valeriae</i>	Earthsake, eastern smooth				

Notes: BOVA = Biota of Virginia;

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FC= Federal Candidate; 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;

Appendices

Scientific Name	Common Name	Status*	Tier**	Confirmed at NSN	Confirmed at CI
<p>IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need</p> <p>Virginia Wildlife Action Plan Conservation Opportunity Ranking:</p> <p>a On the ground management strategies/actions exist and can be feasibly implemented;</p> <p>b On the ground actions or research needs have been identified but cannot feasibly be implemented at this time;</p> <p>c No on the ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.</p> <p>Sources: Hager 2015; Tetra Tech 2015a, b, c; USFWS 2016; Virginia Department of Game and Inland Fisheries, Virginia Fish and Wildlife Service (VaFWIS) Search Report “Known or likely to occur within a 3 mile radius around point Naval Station Norfolk...” compiled on 20 August 2016, available at http://vafwis.org/fwis/?Menu=Home.__By+Place Name; WS 2015.</p>					

This page intentionally left blank.

Appendix F

Flora Species Checklist for NSN and CI

This page intentionally left blank.

Table F-1. Flora Species Checklist for NSN and CI

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
TREES							
<i>Acer platanoides</i>	Norway maple	I	x				Planted near residences
<i>Acer rubrum</i>	Red maple	N	x		x		
<i>Acer saccharinum</i>	Silver maple	I	x				
<i>Acer saccharum</i>	Sugar maple	N	x				Planted near residences
<i>Albizia julibrissin</i>	Mimosa	I	x		x		
<i>Betula nigra</i>	River birch	N	x				
<i>Carpinus caroliniana</i>	Ironwood	N	x		x		
<i>Carya tomentosa</i>	Mockernut hickory	N	x		x		
<i>Carya ovata</i>	Shagbark hickory	N			x		
<i>Castanea pumila</i>	Chinquapin	N	x				
<i>Celtis occidentalis</i>	Hackberry	N		x	x		
<i>Cornus florida</i>	Flowering dogwood	N	x				Planted
<i>Diospyros virginiana</i>	Common persimmon	N			x		
<i>Fagus grandifolia</i>	American beech	N	x		x		
<i>Fraxinus americana</i>	White ash	N	x	x			Planted
<i>Gleditsia triacanthos</i>	Honey locust	N	x				Form <i>inermis</i> , thornless variety
<i>Ilex opaca</i> var. <i>opaca</i>	American holly	N			x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Juniperus virginiana</i>	Eastern red cedar	N		x	x		Planted at NSN
<i>Liquidambar styraciflua</i>	Sweetgum	N	x		x		
<i>Liriodendron tulipifera</i>	Tuliptree	N	x				
<i>Magnolia grandiflora</i>	Southern magnolia	N	x				Planted
<i>Magnolia virginiana</i>	Sweet bay	N			x		
<i>Malus</i> spp.	Flowering crab apple	N		x			
<i>Morus alba</i>	White mulberry	I	x		x		
<i>Morus rubra</i>	Red mulberry	N	x		x		
<i>Nyssa sylvatica</i>	Blackgum	N	x		x		
<i>Oxydendrum arboreum</i>	Sourwood	N	x		x		
<i>Paulownia tomentosa</i>	Royal paulownia	I	x				
<i>Picea abies</i>	Norway spruce	I	x				
<i>Pinus elliottii</i>	Slash pine	N			x		
<i>Pinus strobus</i>	White pine	I			x		
<i>Pinus taeda</i>	Loblolly pine	N	x	x	x	x	
<i>Pinus virginiana</i>	Virginia pine	N			x		
<i>Platanus occidentalis</i>	American sycamore	N		x	x		Planted at NSN
<i>Populus deltoides</i>	Eastern cottonwood	N	x				Planted

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Populus heterophylla</i>	Swamp cottonwood	N			x		
<i>Prunus serotina</i> ssp. <i>serotina</i>	Black cherry	N	x		x		
<i>Pyrus calleryana</i>	Bradford pear	I	x		x		
<i>Quercus alba</i>	White oak	N			x		
<i>Quercus bicolor</i>	Swamp white oak	N	x				Likely planted
<i>Quercus falcata</i>	Southern red oak	N	x				
<i>Quercus laevis</i>	Turkey oak	N			x		
<i>Quercus marilandica</i>	Blackjack oak	N			x		
<i>Quercus michauxii</i>	Swamp chestnut oak	N	x				
<i>Quercus nigra</i>	Water oak	N	x		x		
<i>Quercus palustris</i>	Pin oak	N	x				
<i>Quercus pagoda</i>	Cherrybark oak	N			x		
<i>Quercus phellos</i>	Willow oak	N	x				
<i>Quercus rubra</i>	Northern red oak	N	x		x		
<i>Quercus velutina</i>	Black oak	N	x				
<i>Quercus virginiana</i>	Live oak	N	x				
<i>Robinia pseudoacacia</i>	Black locust	N	x				
<i>Salix alba</i>	White willow	I	x				
<i>Salix nigra</i>	Black willow	N	x		x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Salix babylonica</i>	Weeping willow	I	x				
<i>Sassafras albidum</i>	Sassafras	N	x		x		
<i>Taxodium distichum</i>	Bald cypress	N	x				Planted at NSN
<i>Thuja occidentalis</i>	Arborvitae	N		x	x		
<i>Ulmus rubra</i>	Slippery elm	N	x				
SHRUB/SUBSHRUB							
<i>Aralia spinosa</i>	Devil's walking stick	N	x		x		
<i>Asimina triloba</i>	Pawpaw	N	x		x		
<i>Azalea</i> sp.	Azalea		x				Planted
<i>Baccharis halimifolia</i>	Eastern baccharis	N	x	x		x	
<i>Clethra alnifolia</i>	Sweet pepperbush	N	x		x		
<i>Ilex vomitoria</i>	Yaupon holly	N		x			
<i>Iva frutescens</i>	Marsh elder	N		x			
<i>Ligustrum sinense</i>	Chinese Privet	I	x		x		
<i>Morella cerifera</i>	Wax myrtle	N	x	x	x	x	
<i>Rhus copallinum</i>	Winged sumac	N	x		x		
<i>Rosa multiflora</i>	Multiflora rose	I	x				
<i>Rosa rugosa</i>	Rugose rose	I		x			Planted?
<i>Rubus occidentalis</i>	Black raspberry	N	x				
<i>Rubus hispidus</i>	Bristly dewberry	N			x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Rubus sp.</i>	Blackberry		x				
<i>Salix caroliniana</i>	Carolina willow	N	x				
<i>Sambucus canadensis</i>	Common elderberry	N			x		
<i>Symplocos tinctoria</i>	Common sweetleaf	N			x		
<i>Tamarix spp.</i>	Saltcedar	I		x	x		
<i>Vaccinium pallidum</i>	Early lowbush blueberry	N	x		x		
<i>Vaccinium corymbosum</i>	Highbush blueberry	N	x		x		
HERBACEOUS							
<i>Agalinis purpurea</i>	Purple false foxglove	N			x		
<i>Agrostis hyemalis</i>	Tickle grass	N	x		x		
<i>Allium vineale</i>	Meadow garlic	N	x	x	x	x	
<i>Alternanthera philoxeroides</i>	Alligatorweed	I	x				
<i>Ambrosia artemisiifolia</i>	Common ragweed	N	x		x		
<i>Andropogon virginicus</i>	Broomsedge	N	x		x		
<i>Angelica venenosa</i>	Hairy angelica	N		x			
<i>Anthoxanthum odoratum</i>	Sweet vernalgrass	I	x		x		
<i>Apocynum cannabinum</i>	Indianhemp	N			x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Arundinaria tecta</i>	Switchcane	N	x		x		
<i>Artemisia vulgaris</i>	Mugwort	I	x				
<i>Asplenium platyneuron</i>	Ebony spleenwort	N			x		
<i>Athyrium asplenioides</i>	Lady fern	N			x		
<i>Atriplex prostrata</i>	Spear saltbush	I		x		x	
<i>Bidens aristosa</i>	Bearded beggartick	N			x		
<i>Bidens bipinnata</i>	Spanish needles	N			x		
<i>Bidens frondosa</i>	Devil's beggartick	N			x		
<i>Boehmeria cylindrica</i>	False nettle	N	x		x		
<i>Bolboschoenus robustus</i>	Saltmarsh bulrush	N		x			
<i>Briza minor</i>	Quaking-grass	I	x				
<i>Bromus</i> sp.	Brome grass	N/I		x			
<i>Carex albicans</i>	Whitetinge sedge	N	x		x		
<i>Carex digitalis</i>	Slender woodland sedge	N			x		
<i>Carex lurida</i>	Shallow sedge	N			x		
<i>Carex scoparia</i>	Broom sedge	N	x				
<i>Carex</i> spp.	Sedges	N	x	x	x	x	
<i>Cenchrus tribuloides</i>	Sanddune sandbur	N		x		x	
<i>Centella erecta</i>	Spadeleaf	N	x				

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Chamaecrista fasciculata</i>	Partridge pea	N	x				
<i>Chasmanthium laxum</i>	Slender spinegrass	N	x				
<i>Chimaphila maculata</i>	Spotted wintergreen	N	x				
<i>Cirsium vulgare</i>	Bull thistle	N			x		
<i>Commelina communis</i>	Asiatic dayflower	I	x		x		
<i>Conoclinium coelestinum</i>	Blue mistflower	N			x		
<i>Convolvulus arvensis</i>	Field bindweed	I	x		x		
<i>Cynodon dactylon</i>	Bermuda grass	I	x		x		
<i>Cyperus esculentus</i>	Yellow nutsedge	N/I			x		
<i>Cyperus spp.</i>	Flatsedges	N	x		x		Many specimens mowed
<i>Dactylis glomerata</i>	Orchardgrass	I		x			
<i>Daucus carota</i>	Queen Anne's Lace	I	x		x		
<i>Dichanthelium clandestinum</i>	Deer tongue	N	x		x		
<i>Dichanthelium dichotomum</i>	Cypress panicgrass	N	x	x	x	x	
<i>Dichanthelium scoparium</i>	Panic broom grass	N	x				
<i>Digitaria spp.</i>	Crabgrass	I	x		x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Diodia teres</i>	Buttonweed	N	x		x		
<i>Distichlis spicata</i>	Seashore saltgrass	N	x		x		
<i>Echinochloa crus-galli</i>	Barnyardgrass	N			x		
<i>Eleocharis acicularis</i>	Needle spikerush	N	x				
<i>Eleocharis compressa</i>	Flatstem spikerush	N	x		x		
<i>Eleocharis</i> spp.	Spikerush	N	x	x	x	x	Many specimens mowed. E. parvula likely at NSN.
<i>Elephantopus carolinianus</i>	Carolina elephant's foot	N			x	x	
<i>Elephantopus tomentosus</i>	Common elephant's foot	N			x		
<i>Elymus virginicus</i>	Virginia wildrye	N			x		
<i>Equisetum arvense</i>	Field horsetail	N			x		
<i>Erigeron</i> sp.	Fleabane		x		x		
<i>Eupatorium capillifolium</i>	Dog fennel	N	x		x		
<i>Eupatorium hyssopifolium</i>	Hyssop leaf thoroughwort	N			x		
<i>Eupatorium serotinum</i>	Late flowering thoroughwort	N			x		
<i>Eurybia spectabilis</i>	Eastern showy aster	N		x			

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Euthamia graminifolia</i>	Flat-top goldentop	N			x		
<i>Festuca ovina</i>	Sheep fescue	N			x		
<i>Foeniculum vulgare</i>	Fennel	I	x		x		
<i>Fragaria virginiana</i>	Wild strawberry	N	x		x		
<i>Fuirena</i> sp.	Umbrella-sedge	N	x		x		
<i>Galium obtusum</i>	Bluntleaf bedstraw	N	x			x	
<i>Galium mollugo</i>	False baby's breath	I			x		
<i>Geranium carolinianum</i>	Carolina gernanium	N	x		x		
<i>Glechoma hederacea</i>	Ground ivy	I	x		x		
<i>Helenium amarum</i>	Sneezeweed	N	x				
<i>Hibiscus moscheutos</i>	Swamp rosemallow	N		x	x	x	
<i>Huperzia</i> spp. (<i>Lycopodium</i> spp.)	Ground pines	N	x				
<i>Hydrocotyle verticillata</i>	Whorled-marsh pennywort	N	x		x		
<i>Iris virginica</i>	Blueflag	N	x				
<i>Juncus effusus</i>	Common rush	N	x		x		
<i>Kosteletzkya virginica</i>	Seashore mallow	N		x			
<i>Lactuca canadensis</i>	Wild lettuce	I	x	x			

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Lactuca serriola</i>	Prickly lettuce	I	x				
<i>Lagerstroemia indica</i>	Crape myrtle	I	x				Planted
<i>Lathyrus latifolius</i>	Perennial sweet pea	N		x			
<i>Leersia oryzoides</i>	Rice cutgrass	N	x		x		
<i>Leersia virginica</i>	Whitegrass	N	x		x		
<i>Lemna minor</i>	Duckweed	N			x		
<i>Lepidium virginicum</i>	Virginia pepperweed	N	x				
<i>Lespedeza cuneata</i>	Chinese lespedeza	I	x	x	x		
<i>Liriope</i> sp.	Liriope	I			x		
<i>Lolium arundinaceum</i>	Kentucky fescue	I			x		
<i>Lotus corniculatus</i>	Birdsfoot trefoil	I			x	x	
<i>Ludwigia</i> spp.	Seedboxes	N	x				
<i>Ludwigia palustris</i>	Marsh seedbox	N	x				
<i>Medicago lupulina</i>	Balck medick	I	x				
<i>Melilotus officinalis</i>	Yellow clover	N	x	x	x		
<i>Microstegium vimineum</i>	Japanese stilt grass	I			x		
<i>Mikania scandens</i>	Climbing hempvine	N	x				
<i>Mitchella repens</i>	Partridgeberry	N	x		x		
<i>Oenothera biennis</i>	Common evening primrose	N		x		x	

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Onoclea sensibilis</i>	Sensitive fern	N	x		x		
<i>Osmunda spectabilis</i>	Royal fern	N			x		
<i>Osmundastrum cinnamomeum</i>	Cinnamon fern	N			x		
<i>Oxalis stricta</i>	Yellow wood-sorel	N	x		x		
<i>Panicum amarum</i>	Coastal panicgrass	N		x			
<i>Panicum virgatum</i>	Switch grass	N		x			
<i>Passiflora incarnata</i>	Purple passionflower	N				x	
<i>Persicaria hydropiperoides</i>	Swamp smartweed	N			x		
<i>Persicaria</i> and <i>Polygonum spp.</i>	Smartweeds	N	x		x		
<i>Persicaria pensylvanica</i>	Smartweed	N	x		x		
<i>Persicaria maculosa</i>	Lady's thumb	I	x				
<i>Persicaria sagittata</i>	Arrowleaf tearthumb	N	x		x		
<i>Phragmites australis</i>	Common reed	I & N	x		x	x	
<i>Phytolacca americana</i>	Pokeweed	N			x		
<i>Pityopsis graminifolia</i>	Narrowleaf silkgrass	N	x				
<i>Plantago rugelii</i>	Broad-leaved plantain	N	x		x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Plantago lanceolata</i>	Narrowleaf plantain	N	x		x		
<i>Pluchea odorata</i>	Sweetscent	N	x			x	
<i>Poa annua</i>	Annual bluegrass	I	x		x		
<i>Poa pratensis</i>	Kentucky bluegrass	N & I	x		x	x	
<i>Polystichum acrostichoides</i>	Christmas fern	N			x		
<i>Portulaca oleracea</i>	Purslane	I & N		x			
<i>Potentilla norvegica</i>	Rough cinquefoil	N	x		x		
<i>Pseudognaphalium obtusifolium</i>	Rabbit-tobacco	N	x				
<i>Pteridium aquilinum</i>	Bracken fern	N			x		
<i>Ranunculus bulbosus</i>	Belbous buttercup	I	x	x	x	x	
<i>Ranunculus sceleratus</i>	Cursed buttercup	N	x		x	x	
<i>Rumex crispus</i>	Curly dock	I		x			
<i>Rumex verticillatus</i>	Swamp dock	N	x				
<i>Saururus cernuus</i>	Lizard's tail	N			x		
<i>Setaria parviflora</i>	Marsh bristlegrass	N		x	x		
<i>Sicyos angulatus</i>	Bur cucumber	N			x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Schoenoplectus tabernaemontani</i>	Softstem bulrush	N	x				
<i>Scirpus cyperinus</i>	Woolgrass	N			x		
<i>Sisyrinchium atlanticum</i>	Blue-eyed grass	N		x			
<i>Solidago gigantea</i>	Giant goldenrod	N	x		x		
<i>Solidago rugosa</i>	Wrinkleleaf goldenrod	N	x		x		
<i>Solidago sempervirens</i>	Seaside goldenrod	N		x		x	
<i>Solanum ptycanthum</i>	Climbing nightshade	I	x				
<i>Sonchus arvensis</i>	Sowthistle	I			x		
<i>Sorghum halepense</i>	Johnsongrass	I	x				
<i>Spartina alterniflora</i>	Saltmarsh cordgrass	N		x		x	
<i>Spartina patens</i>	Saltmeadow cordgrass	N		x			
<i>Sporobolus vaginiflorus</i>	Poverty dropseed	N		x			
<i>Stellaria media</i>	Chickweed	I	x	x	x	x	
<i>Strophostyles helvola</i>	Beach bean	N		x			
<i>Suaeda linearis</i>	Annual seepweed	N		x			
<i>Symphotrichum lateriflorum</i>	Small white aster	N			x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Symphotrichum novi-belgii</i>	New york aster	N	x		x		
<i>Taraxacum officinale</i>	Common dandelion	N & I	x	x	x	x	
<i>Toxicodendron radicans</i>	Eastern poison ivy	N	x	x	x	x	
<i>Tragopogon porrifolius</i>	Salsify	I		x			
<i>Hypericum virginicum</i>	Marsh St. Johnswort	N					
<i>Trifolium pratense</i>	Red clover	I	x				
<i>Trifolium sp.</i>	Clover		x				
<i>Trifolium repens</i>	White clover	I		x			
<i>Typha angustifolia</i>	Narrowleaf cattail	N	x		x	x	
<i>Typha latifolia</i>	Broadleaf cattail	N	x				
<i>Verbascum thapsus</i>	Common mullien	I	x		x		
<i>Verbena brasiliensis</i>	Brazilian vervain	I			x		
<i>Vicia spp.</i>	Vetch	N	x	x	x		Likely <i>V. sativa</i> and <i>V. villosa</i>
<i>Viola spp.</i>	Violet	N			x		
<i>Woodwardia virginica</i>	Virginia chainfern	N			x		

Appendices

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Xanthium strumarium</i>	Rough cocklebur	N		x			
<i>Xyris sp.</i>	Yellow-eyed grass	N	x				Mowed in September
<i>Yucca filamentosa</i>	Common yucca	N		x			
VINES							
<i>Campsis radicans</i>	Trumpet creeper	N	x		x		
<i>Gelsemium sempervirens</i>	Evening trumpetflower	N	x		x		
<i>Hedera helix</i>	English ivy	I			x		
<i>Ipomoea sp.</i>	Morning glory	N	x	x	x	x	
<i>Lonicera japonica</i>	Japanese honeysuckle	I	x		x		
<i>Parthenocissus quinquefolia</i>	Virginia creeper	N	x	x	x	x	
<i>Smilax bona-nox</i>	Saw greenbrier	N		x			
<i>Smilax glauca</i>	Cat greenbrier	N	x		x		
<i>Smilax rotundifolia</i>	Roundleaf greenbrier	N	x				
<i>Toxicodendron radicans</i>	Eastern poison ivy	N	x	x	x	x	repeated in herbaceous section
<i>Vinca minor</i>	Common periwinkle	I		x			
<i>Vitis rotundifolia</i>	Muscadine	N		x			
<i>Vitis sp.</i>	Grape vine	N	x		x		

Scientific Name	Common Name	Native (N)/ Invasive (I)	NAVSTA Norfolk		Craney Island		Notes
			Inland	Nearshore	Inland	Nearshore	
<i>Wisteria floribunda</i>	Japanese wisteria	I	x				Planted near residences

Appendix G

Regional Native Landscaping Species Checklist for NSN and CI

This page intentionally left blank.

Appendices

Table G-1. Regional Native Landscaping Species Checklist for NSN and CI

Common Name	Scientific Name	Height	Low Moisture	Moderate Moisture	High Moisture	Full Shade	Partial Sun	Full Sun	Suggested Uses
Forbs/Herbs									
Boneset	<i>Eupatorium</i> spp.	1'-4'	√	√	√		√	√	Reclamation, wildflower meadow
Butterfly weed	<i>Asclepias tuberosa</i>	1'-3'	√					√	Reclamation, wildflower meadow
Common milkweed	<i>Asclepias syriaca</i>	1'-2'		√	√		√	√	Reclamation, wildflower meadow
Goat's rue	<i>Tephrosia virginiana</i>	1'-2'	√	√				√	Reclamation
Goldenrod	<i>Solidago</i> spp.	2'-6'	√	√	√		√	√	Reclamation, wildflower meadow
Maryland golden aster	<i>Chrysopsis mariana</i>	<1'	√	√			√	√	Reclamation, wildflower meadow
Late purple aster	<i>Aster patens</i>	1'-4'	√	√			√	√	Reclamation, wildflower meadow
New York aster	<i>Aster novi-belgii</i>	1'-4'		√	√		√	√	Reclamation, wildflower meadow
Round-head bushclover	<i>Lespedeza capitata</i>	2'-4'	√					√	Reclamation
Sunflower	<i>Helianthus</i> spp.	1'-2'	√	√			√	√	Reclamation, wildflower meadow
Swamp milkweed	<i>Asclepias incarnata</i>	1'-2'			√		√	√	Reclamation, wildflower meadow
Threadleaf coreopsis	<i>Coreopsis verticillata</i>	2'	√				√	√	Reclamation, wildflower meadow
Wand-like bushclover	<i>Lespedeza intermedia</i>	1'-3'	√	√			√	√	Reclamation
White heath aster	<i>Aster pilosus</i>		√					√	Reclamation, wildflower meadow
Wild bergamot	<i>Monarda fistulosa</i>	<1'-3'	√					√	Reclamation, wildflower meadow
Wild indigo	<i>Baptisia tinctora</i>	3'-5'	√	√			√	√	Reclamation, wildflower meadow
Grasses									
Broomsedge	<i>Andropogon virginicus</i>	1'-3'	√	√			√	√	NWS grassland meadow
Bushy broomsedge	<i>Andropogon glomeratus</i>	1.5' -5'		√	√		√	√	NWS grassland meadow
Switchgrass	<i>Panicum virgatum</i>	3'-5'	√	√	√		√	√	NWS grassland meadow
Shore little bluestem	<i>Schizachyrium littorale</i>	2'-3'	√	√			√	√	NWS grassland meadow
Eastern gamma grass	<i>Tripsacum dactyloides</i>	1'-3'	√	√			√	√	NWS grassland meadow
Side-oats grama	<i>Bouteloua curtipendula</i>	1'-3'		√			√		NWS grassland meadow
Indian grass	<i>Sorghastrum nutans</i>	5'-6'	√	√			√	√	NWS grassland meadow
Shrubs									
Hazel alder	<i>Alnus serrulata</i>	6'-15'		√	√	√	√		Riparian buffer
Canadian serviceberry	<i>Amelanchier canadensis</i>	5'-15'		√					Landscape, wildlife
Indigobush	<i>Amorpha fruticosa</i>	6'-15'	√	√	√			√	Riparian buffer, reclamation
Chokeberry, red	<i>Aronia arbutifolia</i>	5'-10'	√	√	√		√	√	Riparian buffer, reclamation

Appendices

Common Name	Scientific Name	Height	Low Moisture	Moderate Moisture	High Moisture	Full Shade	Partial Sun	Full Sun	Suggested Uses
Chokeberry, black	<i>Aronia melanocarpa</i>	5'-10'		√	√		√		Riparian buffer
Eastern baccharis	<i>Baccharis halimifolia</i>	5'-10'	√	√	√		√	√	Riparian buffer, landscape
Common buttonbush	<i>Cephalanthus occidentalis</i>	3'-7'			√	√	√		Riparian buffer
Sweet pepperbush	<i>Clethra alnifolia</i>	3'-8'		√	√	√	√	√	Riparian buffer, landscape
Dogwood, silky	<i>Cornus amomum</i>	6'-10'		√	√		√		Riparian buffer
Dogwood, graystem	<i>Cornus racemosa</i>	10'-15'	√	√	√	√	√	√	Riparian buffer, reclamation
Hazelnut	<i>Corylus americana</i>	6'-10'		√	√		√	√	Reclamation, wildlife
Inkberry	<i>Ilex glabra</i>	2'-10'		√	√	√	√		Riparian buffer, landscape
Winterberry	<i>Ilex verticillata</i>	4'-12'		√	√		√	√	Riparian buffer
Virginia sweetspire	<i>Itea virginica</i>	3'-5'		√	√	√	√	√	Riparian buffer, landscape
Small wax myrtle	<i>Morella cerifera</i>	2'-6'		√	√		√	√	Riparian buffer
Swamp azalea	<i>Rhododendron viscosum</i>	3'-8'		√	√	√	√		Riparian buffer
Blueberry, highbush	<i>Vaccinium corymbosum</i>	2'-12'		√	√	√	√		Riparian buffer
Blueberry, lowbush	<i>Vaccinium pallidum</i>	1'-1.5'	√	√		√	√		Reclamation, wildlife
Viburnum, arrowwood	<i>Viburnum dentatum</i>	4'-8'		√	√		√	√	Riparian buffer, landscape
Viburnum, blackhaw	<i>Viburnum prunifolium</i>	8'-15'	√	√	√	√	√		Landscape, reclamation
Small Trees									
Dogwood	<i>Cornus florida</i>	20'-30'		√			√	√	Landscape
Hawthorn	<i>Crataegus</i> spp.	10'-20'		√			√	√	Landscape
Sassafras	<i>Sassafras albidum</i>	20'-40'		√			√	√	Landscape, reclamation
Serviceberry	<i>Amelanchier arborea</i>	15'-25'		√			√	√	Landscape, wildlife
Sweetbay magnolia	<i>Magnolia virginiana</i>	15'-30'		√	√	√	√		Riparian buffer, landscape
Medium to Large Trees									
American holly	<i>Ilex opaca</i>	40'-50'		√	√		√	√	Landscape, wildlife
American sycamore	<i>Platanus occidentalis</i>	75'-120'		√	√		√	√	Riparian buffer, landscape
Ash, green	<i>Fraxinus americana</i>	50'-80'		√	√			√	Riparian buffer, landscape
Ash, White	<i>Fraxinus pennsylvanica</i>	50'-60'		√	√			√	Riparian buffer, landscape
Black locust	<i>Robinia pseudoacacia</i>	30'-50'	√	√			√	√	Reclamation
Black willow	<i>Salix nigra</i>	30'-50'		√	√	√	√	√	Riparian buffer
Blackgum	<i>Nyssa sylvatica</i>	50'-70'		√	√		√	√	Riparian buffer, landscape, wildlife
Eastern Red Cedar	<i>Juniperus virginiana</i>	45'-65'	√	√	√		√	√	Visual screen

Appendices

Common Name	Scientific Name	Height	Low Moisture	Moderate Moisture	High Moisture	Full Shade	Partial Sun	Full Sun	Suggested Uses
Hackberry	<i>Celtis occidentalis</i>	40'-60'		√	√		√	√	Riparian buffer, landscape
Oak, Black	<i>Quercus velutina</i>	65'-80'	√	√			√	√	Landscape, reforestation
Oak, Cherrybark	<i>Quercus pagodaefolia</i>	70'-80'		√	√		√	√	Landscape, reforestation,
Oak, Chestnut	<i>Quercus prinus</i>	65'-80'	√				√	√	Reforestation, reclamation
Oak, Live	<i>Quercus virginiana</i>	45'-65'	√	√			√	√	Landscape, reforestation
Oak, Pin	<i>Quercus palustris</i>	60'-70'		√	√		√	√	Riparian buffer, landscape
Oak, Southern Red	<i>Quercus falcata</i>	70'-80'	√	√			√	√	Landscape, reforestation
Oak, White	<i>Quercus alba</i>	70'-80'		√			√	√	Landscape, reforestation
Oak, Willow	<i>Quercus phellos</i>	40'-60'	√	√	√		√	√	Landscape, riparian buffer,
Persimmon, common	<i>Diospyros virginiana</i>	30'-40'	√	√			√	√	Reclamation, wildlife
Pine, Loblolly	<i>Pinus taeda</i>	80'-100'	√	√	√		√	√	Landscape, reforestation
Pine, Shortleaf	<i>Pinus echinata</i>	80'-100'	√	√			√	√	Reforestation
Pine, Virginia	<i>Pinus virginiana</i>	30'-50'	√	√			√	√	Reclamation
Red Maple	<i>Acer rubrum</i>	50'-80'	√	√	√		√	√	Riparian buffer, landscape
Red mulberry	<i>Morus rubra</i>	30'-40'		√			√	√	Wildlife
River Birch	<i>Betula nigra</i>	40'-70'		√	√	√	√		Riparian buffer, landscape
Tuliptree	<i>Leriodendron tulipifera</i>	100'-150'		√			√	√	Landscape, reforestation

This page intentionally left blank.

Appendix H

NSN Chambers Field Bird/Animal Aircraft Strike Hazard (BASH) Safety Program

This page intentionally left blank.

Appendix I

Environmental Assessment on Implementation of the INRMP

This page intentionally left blank.

Appendix J
Maps/Figures

Map Index

- Figure 1-1. Naval Station Norfolk Command Organization.
- Figure 1-2. General Location of Naval Station Norfolk and Craney Island Fuel Terminal.
- Figure 1-3. Naval Station Norfolk Installation Area, City of Norfolk, Virginia.
- Figure 1-4. Craney Island Fuel Terminal Installation Area, City of Portsmouth, Virginia.
- Figure 2-1. Soils of Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-2. Soils of Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-3. Aquatic Resources of Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-4. Aquatic Resources of Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-5. Flood Zones of Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-6. Flood Zones of Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-7. Land Cover Types at Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-8. Land Cover Types at Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-9. 2015 Vegetation Survey Tracks at Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-10. 2015 Vegetation Survey Tracks at Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 2-11. 2015 Bird and Bat Survey Sites and Tracks at Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 2-12. 2015 Bird and Bat Survey Sites and Tracks at Craney Island Fuel Terminal, City of Portsmouth, Virginia.
- Figure 4-1. Natural Resources Management Units of Naval Station Norfolk, City of Norfolk, Virginia.
- Figure 4-2. Natural Resources Management Units of Craney Island, City of Portsmouth, Virginia.

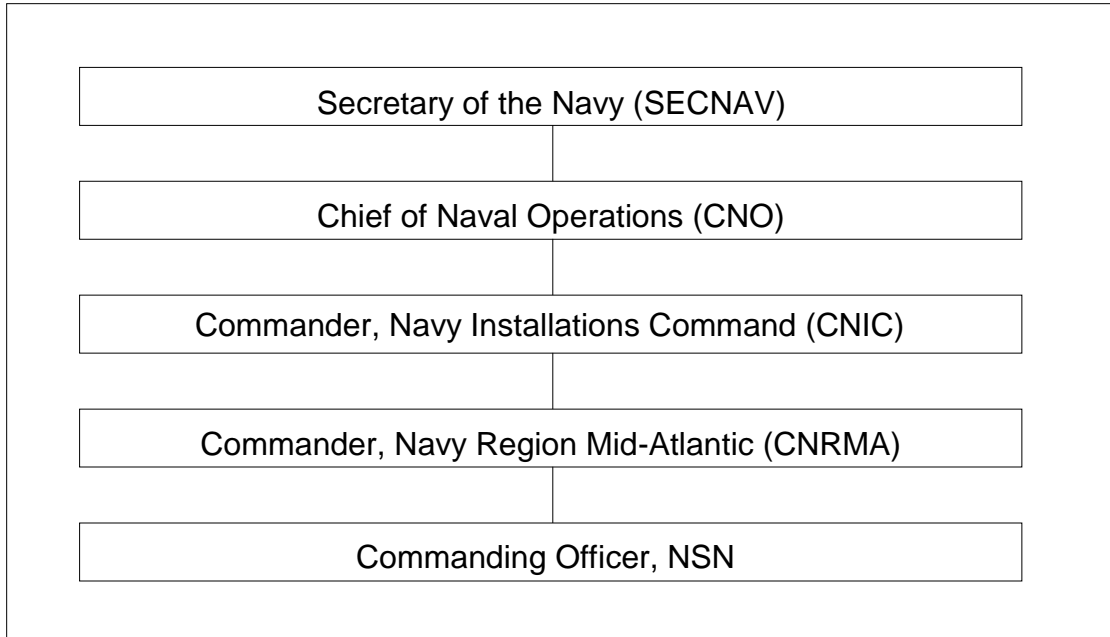


Figure 1-1. Naval Station Norfolk Command Organization.

This page intentionally left blank.

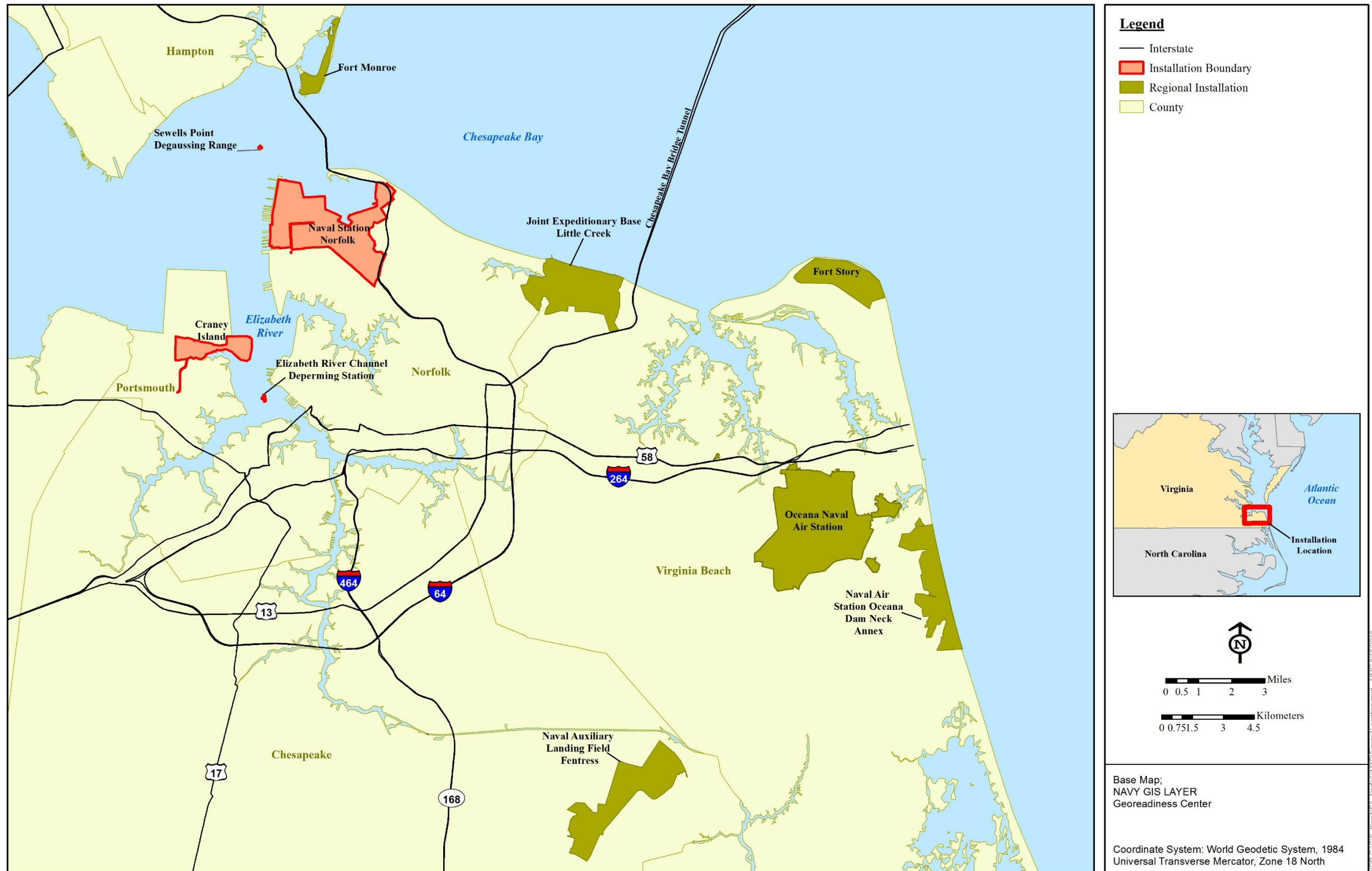


Figure 1-2. General Location of Naval Station Norfolk and Craney Island Fuel Terminal.

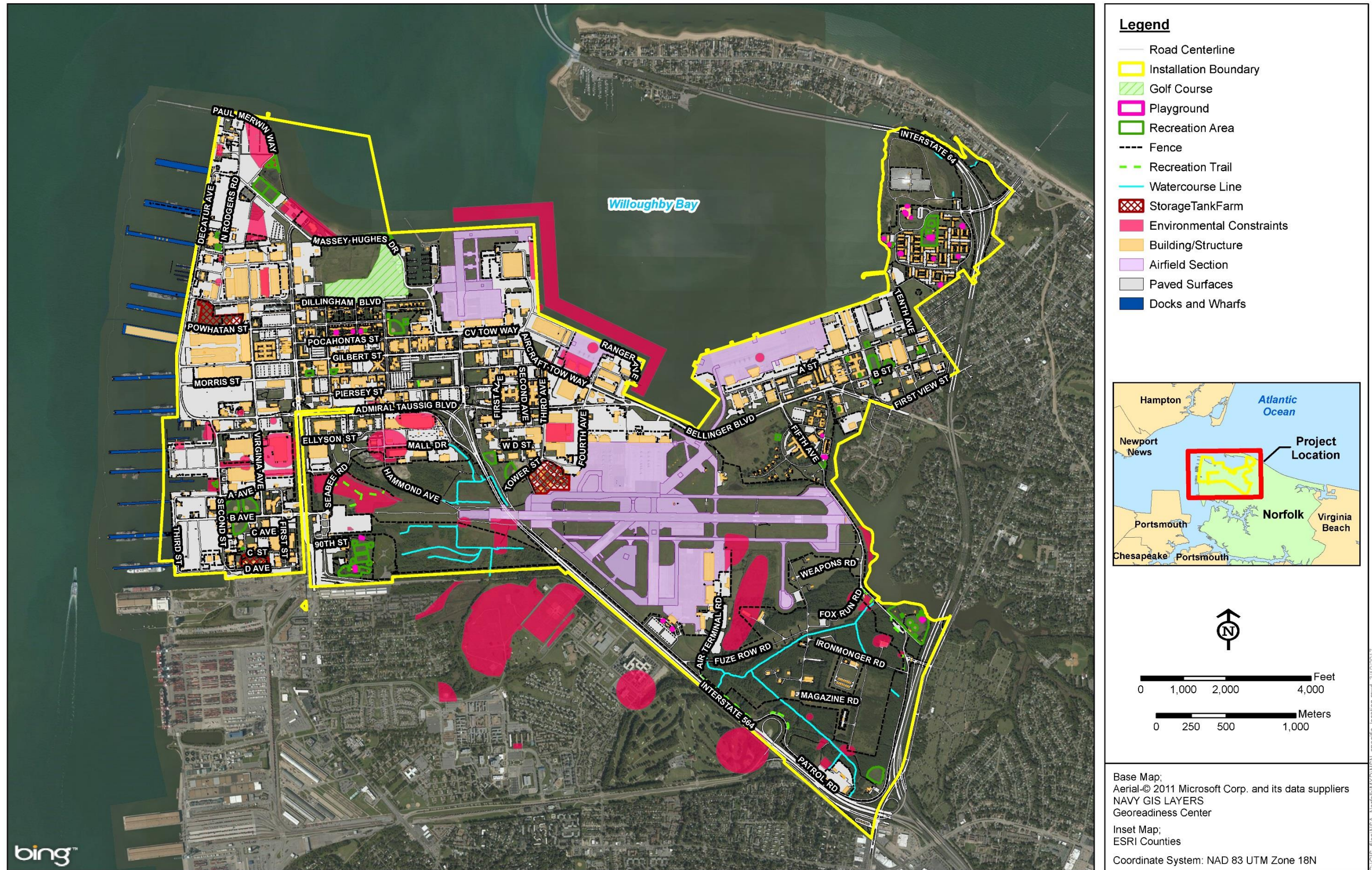


Figure 1-3. Naval Station Norfolk Installation Area, City of Norfolk, Virginia.



Figure 1-4. Craney Island Fuel Terminal Installation Area, City of Portsmouth, Virginia.

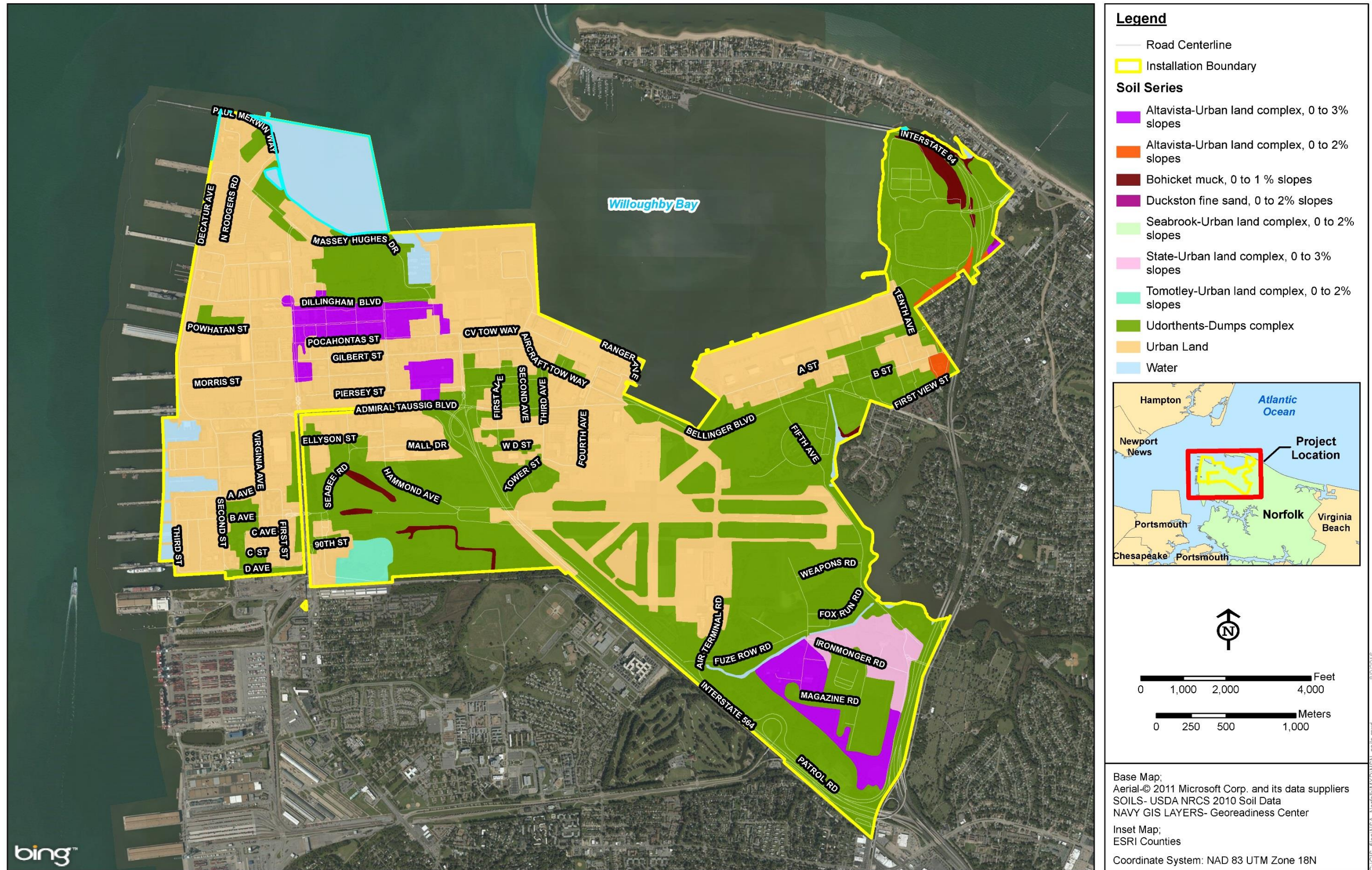


Figure 2-1. Soils of Naval Station Norfolk, City of Norfolk, Virginia.



Figure 2-2. Soils of Craney Island Fuel Terminal, City of Portsmouth, Virginia.



Figure 2-3. Aquatic Resources of Naval Station Norfolk, City of Norfolk, Virginia.



Figure 2-4. Aquatic Resources of Craney Island Fuel Terminal, City of Portsmouth, Virginia.

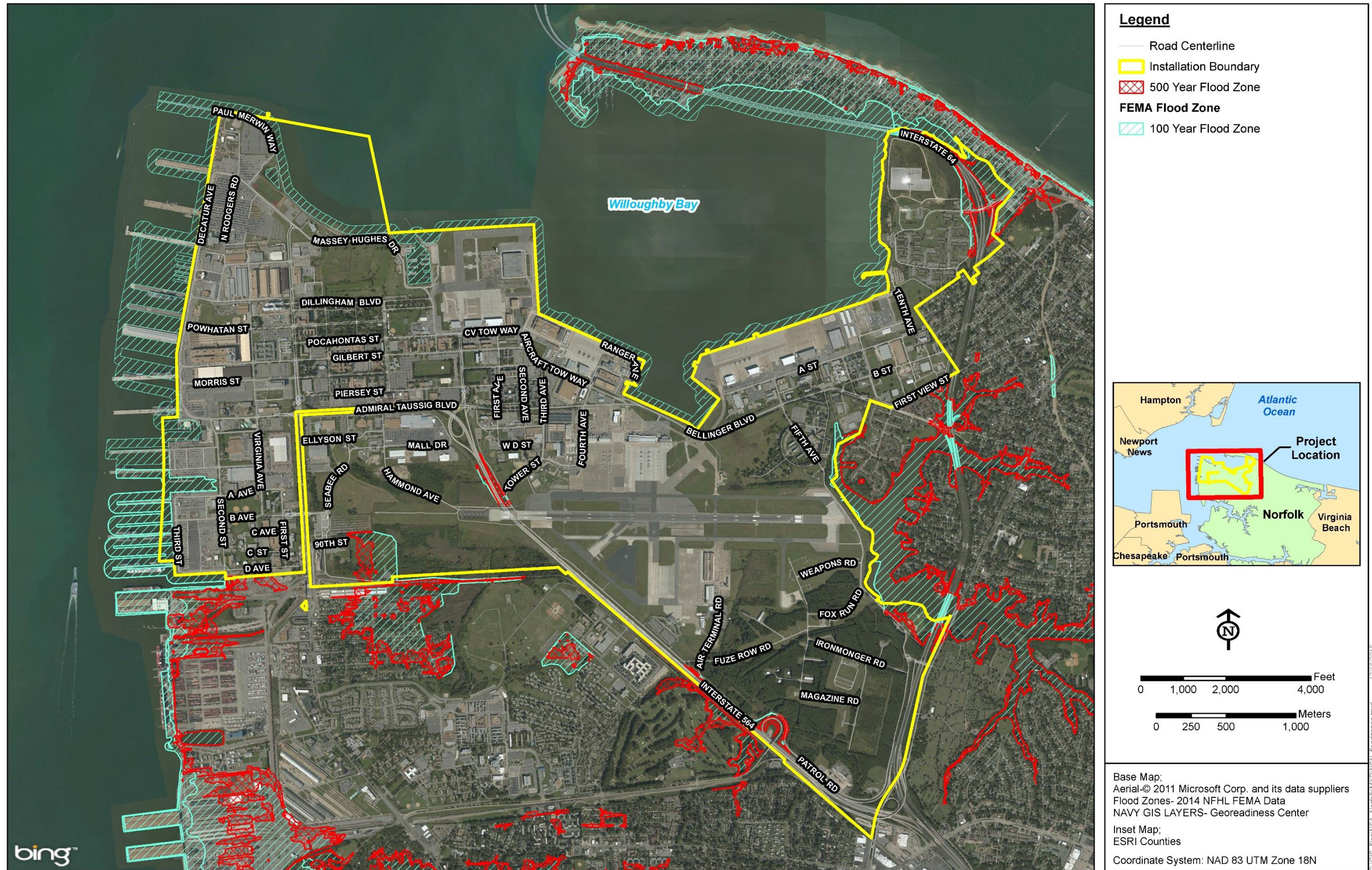


Figure 2-5. Flood Zones of Naval Station Norfolk, City of Norfolk, Virginia.

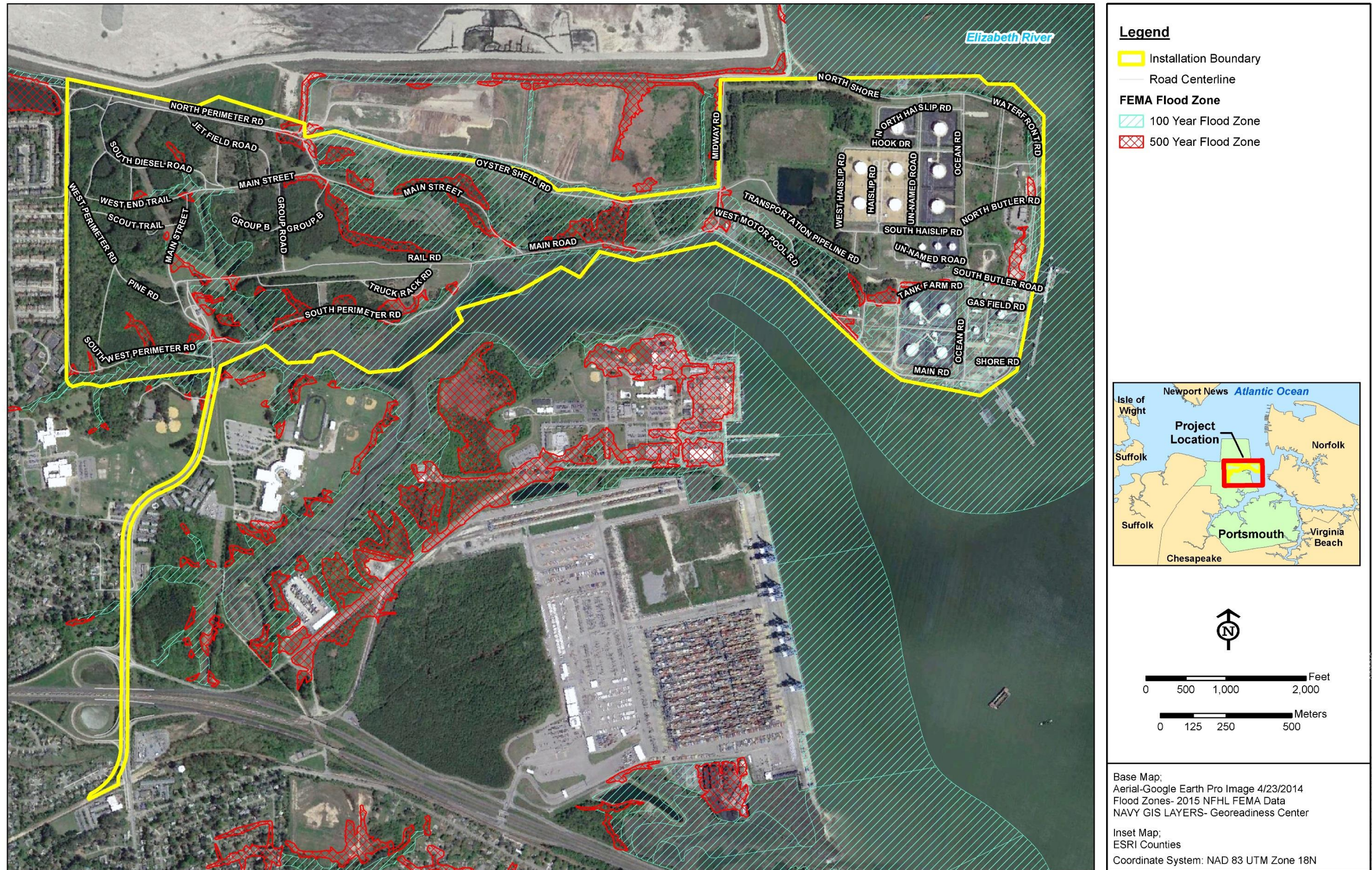


Figure 2-6. Flood Zones of Craney Island Fuel Terminal, City of Portsmouth, Virginia.

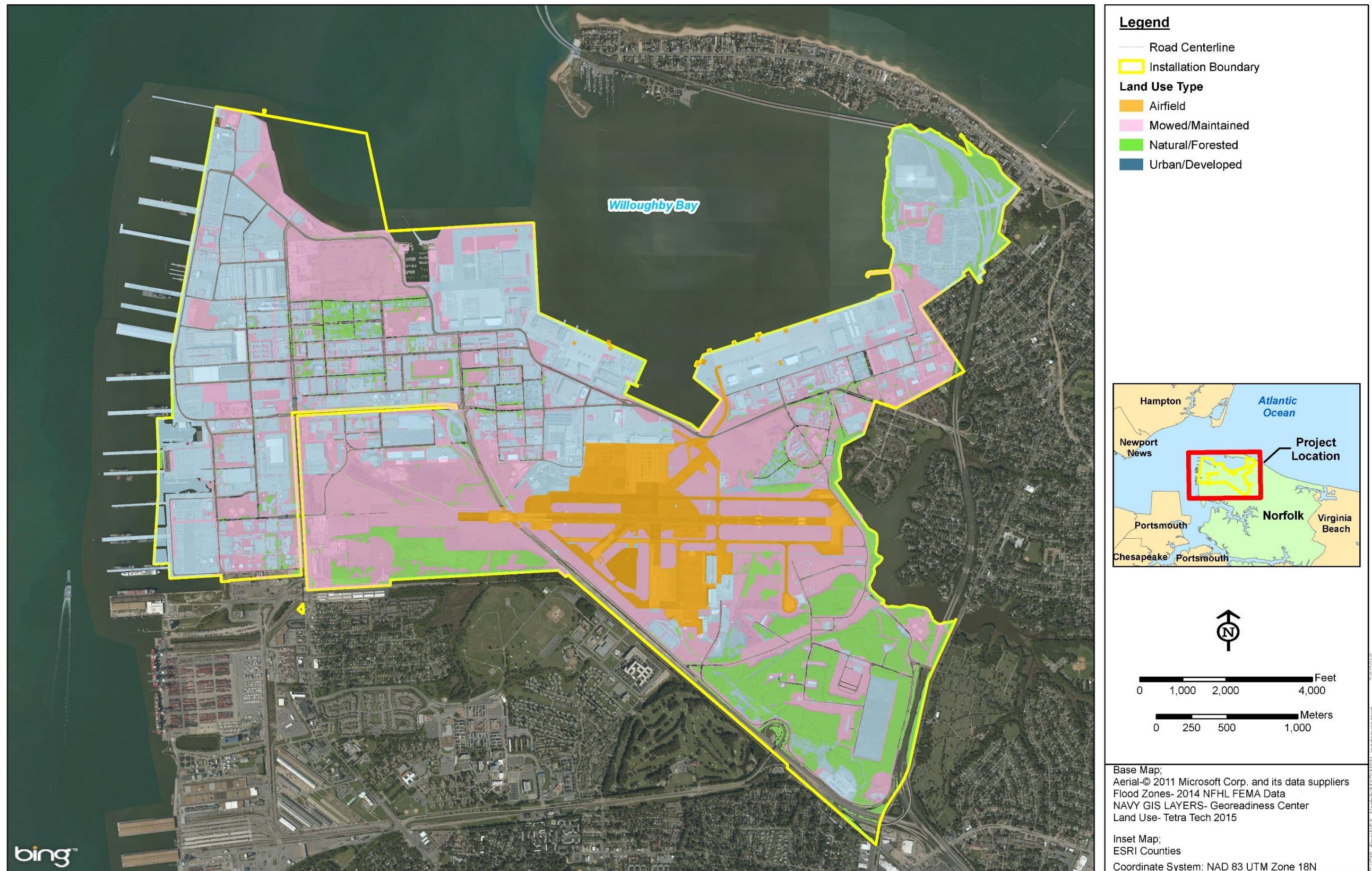


Figure 2-7. Land Cover Types at Naval Station Norfolk, City of Norfolk, Virginia.



Figure 2-8. Land Cover Types at Craney Island Fuel Terminal, City of Portsmouth, Virginia.

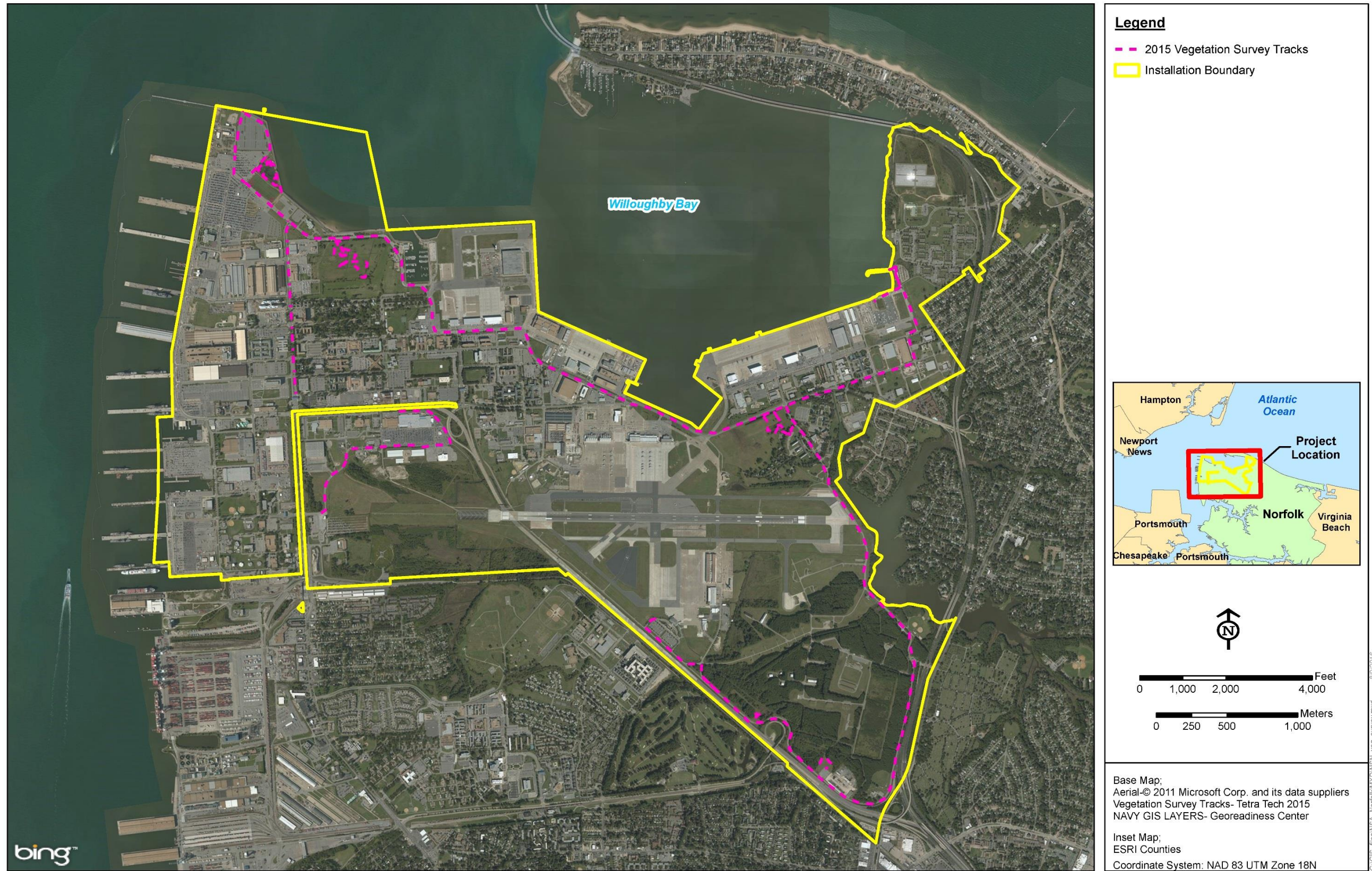


Figure 2-9. 2015 Vegetation Survey Tracks at Naval Station Norfolk, City of Norfolk, Virginia.



Legend

- - - 2015 Vegetation Survey Tracks
- Installation Boundary



Base Map;
 Aerial-Google Earth Pro Image 4/23/2014
 Vegetation Survey Tracks- Tetra Tech 2015
 NAVY GIS LAYERS- Georeadiness Center

Inset Map;
 ESRI Counties
 Coordinate System: NAD 83 UTM Zone 18N

G:\GIS_TheState\Norfolk\MD\10_Veg_survey.mxd 1/14/2016

Figure 2-10. 2015 Vegetation Survey Tracks at Craney Island Fuel Terminal, City of Portsmouth, Virginia.

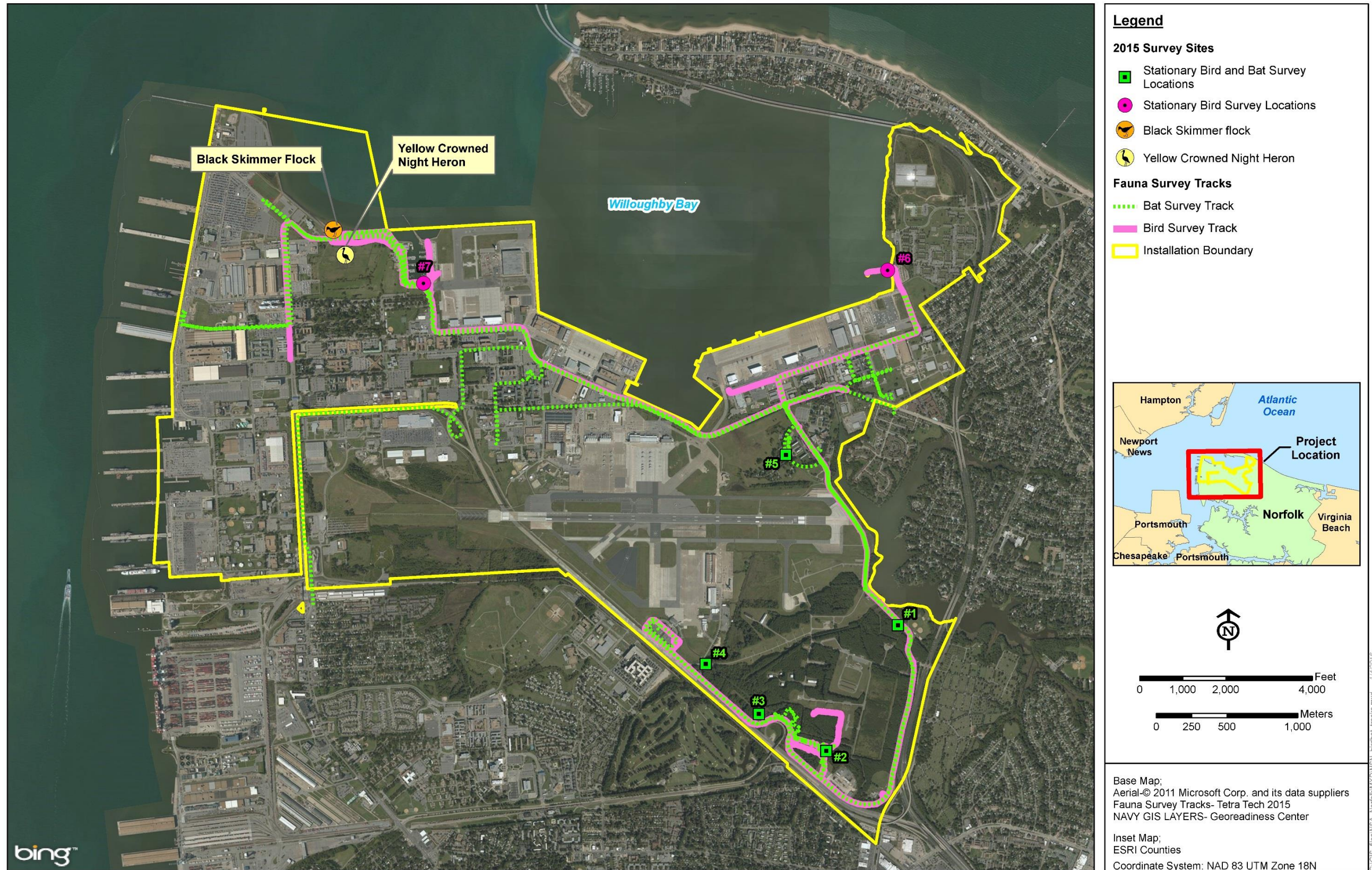


Figure 2-11. 2015 Bird and Bat Survey Sites and Tracks at Naval Station Norfolk, City of Norfolk, Virginia.



Figure 2-12. 2015 Bird and Bat Survey Sites and Tracks at Craney Island Fuel Terminal, City of Portsmouth, Virginia.

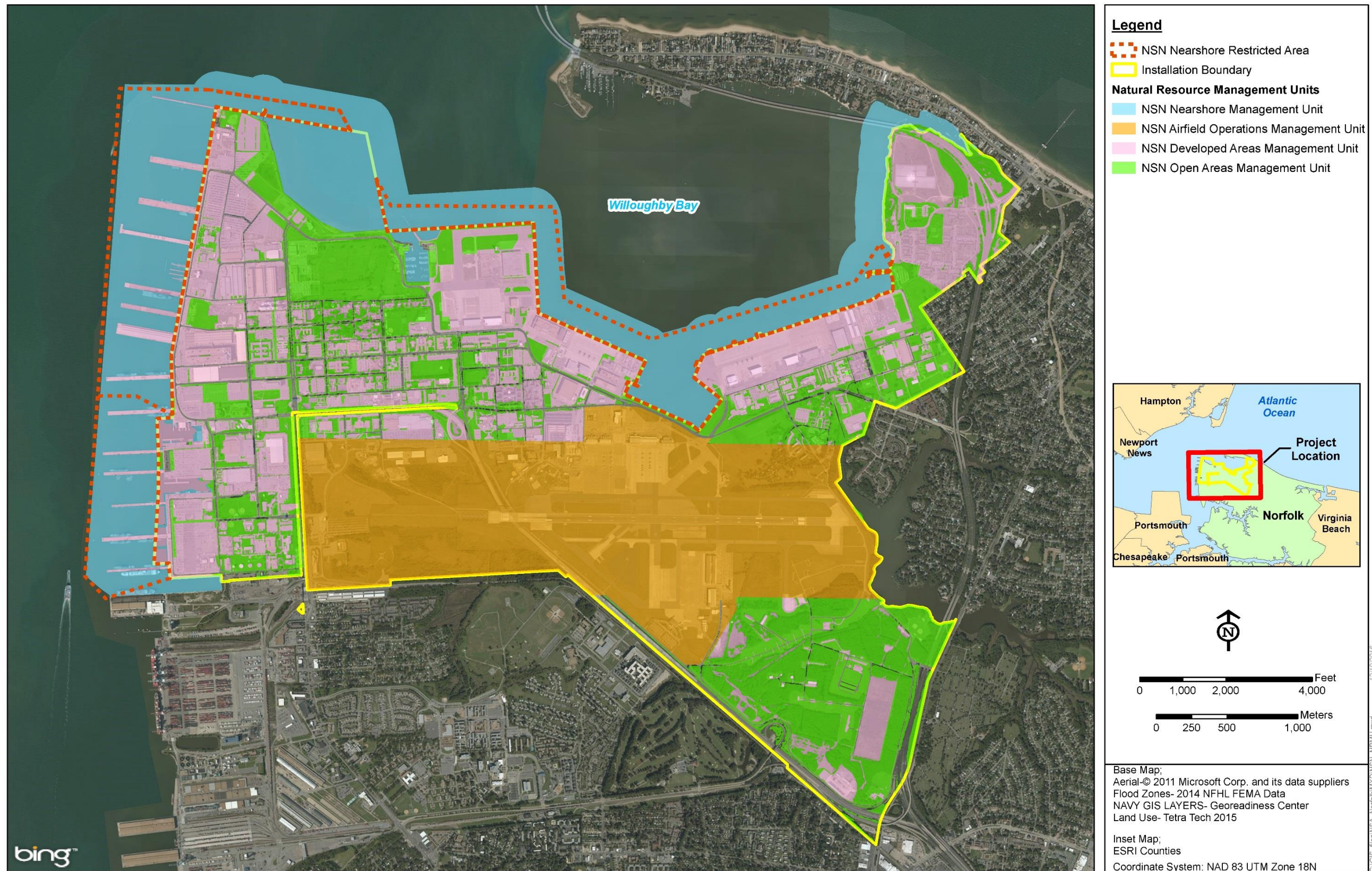


Figure 4-1. Natural Resources Management Units of Naval Station Norfolk, City of Norfolk, Virginia.

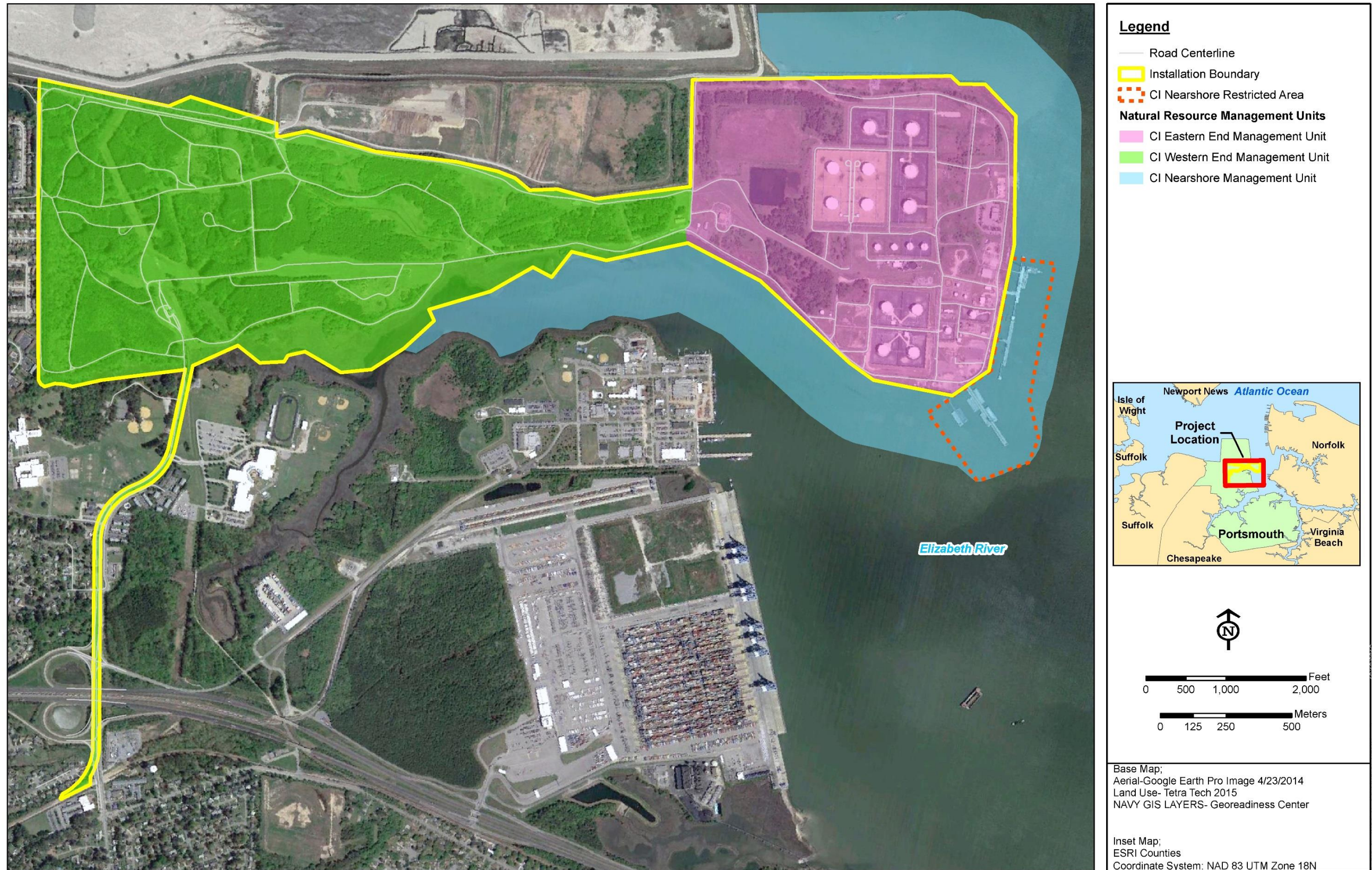


Figure 4-2. Natural Resources Management Units of Craney Island, City of Portsmouth, Virginia.

