
Integrated Natural Resources Management Plan

Naval Support Activity Annapolis

Annapolis, Maryland



Final
May 2011



Integrated Natural Resources Management Plan Naval Support Activity Annapolis Annapolis, Maryland

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Washington Division,
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Washington, D.C.

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SIGNATURE PAGE

The signatures below specify mutual consent for the implementation of this Integrated Natural Resources Management Plan for the Naval Support Activity Annapolis, including, U.S. Naval Academy, Greenbury Point, and USNA Dairy Farm, Maryland.

Naval Support Activity Annapolis Commanding Officer

Date

U.S. Fish and Wildlife Service Regional Director

Date

Maryland Department of Natural Resources Director

Date

Natural Resources Manager, Naval Facilities Engineering
Command Washington, Public Works Department, Annapolis

Date

Natural Resources Manager, Naval Facilities Engineering
Command Washington

Date

EXECUTIVE SUMMARY

The Department of Defense (DoD) manages approximately 25 million acres of land in the United States. Each military installation that has suitable habitat for conserving and managing natural ecosystems is required to prepare, maintain, and implement an Integrated Natural Resources Management Plan (INRMP). This INRMP was prepared for Naval Support Activity (NSA) Annapolis, including the U.S. Naval Academy and NSAA North Severn in Annapolis and the U.S. Naval Academy (USNA) Dairy Farm in Gambrills, Maryland. It was prepared in accordance with DoD Instruction 4715.3 – Environmental Conservation Program; Navy Instruction OPNAVINST 5090.1 – Environmental and Natural Resources Program Manual; 16 U.S. Code (USC) §670 a-f – Sikes Act, as amended; and 32 Code of Federal Regulations (CFR) Part 190 – DoD Natural Resources Management Program.

This INRMP is a long-term planning document that guides implementation of the natural resources program to ensure support of the installation mission, while protecting and enhancing installation resources for multiple use, sustainable yield, and biological integrity. This plan documents the military mission, baseline condition of natural resources, impacts to natural resources due to the military mission, the management approaches to conserve and enhance natural resources, and lists specific projects aimed at protecting and enhancing natural resources.

In accordance with the Sikes Act, this INRMP was 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 Maryland Department of Natural Resources (MDNR). Because of this coordination effort, the INRMP reflects the mutual agreement of these parties concerning conservation, protection, and management of fish and wildlife resources. Future involvement of the state and federal wildlife agencies will ensure continued mutual agreement and cooperation in managing the natural resources at NSA Annapolis. The effectiveness of this INRMP will be evaluated annually in cooperation with the appropriate field-level offices of the USFWS and state fish and wildlife agencies. Evaluation of the successes and issues resulting from INRMP implementation will be facilitated by the web-based Metrics Builder tool on the Navy Natural Resources Data Call Station website (<https://clients.emainc.com/dcs/navfac/index.asp>).

Resource-specific natural resources program elements address relevant issues at NSA Annapolis. Existing conditions, baseline survey data, current management practices, and recommended management actions have been described for each program element. Management program elements described in this INRMP include:

- Rare, Threatened, and Endangered Species Management
- Wetlands and Watershed Management
- Coastal/Marine Management
- Fish and Wildlife Management

- Migratory Bird Management
- Forest Management
- Vegetation Management
- Invasive Species Management
- Outdoor Recreation and Environmental Awareness
- Agricultural Outleasing
- Conservation Law Enforcement
- Cultural Resources Management

The management actions and projects identified for NSA Annapolis are intended to help installation commanders manage natural resources effectively, ensure installation lands remain available and in good condition, support the military mission, and 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.

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ACRONYMS and ABBREVIATIONS

ACB	Alliance for the Chesapeake Bay
ANSI	American National Standards Institute
APHIS	Animal and Plant Health Inspection Service
BCC	biological carrying capacity
BMPs	best management practices
BRAC	base realignment and closure
C	Celsius
CAA	Clean Air Act
CCC	cultural carrying capacity
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CNIC	Commander, Navy Installations Command
CNO	Chief of Naval Operations
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
dbh	diameter at breast height
DoD	Department of Defense
DoDI	Department of Defense Instruction
DoN	Department of the Navy
E	estuarine
EA	environmental assessment
EAP	Encroachment Action Plan
EFH	essential fish habitat
EO	Executive Order
EPA	Environmental Protection Agency
EPR	Environmental Projects Request
EQIP	Environmental Quality Incentives Program
ER	Environmental Restoration
ERL	Environmental Readiness Level
ERP	Environmental Restoration Program
ERS	Economic Research Service
ESA	Endangered Species Act
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FIDS	forest interior dwelling species
FONSI	finding of no significant impact
FPPA	Farmland Protection Policy Act
FR	Federal Register
FY	Fiscal Year
GCN	greatest conservation need

ACRONYMS and ABBREVIATIONS (cont'd)

GIS	Geographic Information System
GPS	global positioning system
GCN	greatest conservation need
HAPC	Habitat Area of Particular Concern
ICRMP	Integrated Cultural Resources Management Plan
IDA	Intense Development Area
INRMP	Integrated Natural Resources Management Plan
IPM	integrated pest management
IPMP	Installation Pest Management Plan
ISA	International Society of Arboriculture
L	lacustrine
LDA	Limited Development Area
LID	low-impact development
LNG	liquefied natural gas
M	marine
m	millimeters
MAPS	Monitoring Avian Productivity and Survivorship
MBTA	Migratory Bird Treaty Act
MIPR	Military Interdepartmental Purchase Request
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MDSPGP	Maryland State Programmatic General Permit
MILCON	military construction
MMPA	Marine Mammal Protection Act
MOA	Memoranda of Agreement
MOU	Memoranda of Understanding
MWR	Morale, Welfare and Recreation
NAAA	Naval Academy Athletic Association
NAGA	Naval Academy Golf Association
NAVFAC	Naval Facilities Engineering Command
NEPA	National Environment Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSA	Naval Support Activity
NWI	National Wetlands Inventory
O&MN	Operations and Maintenance, Navy
OFRF	Organic Farming Research Foundation
OMB	Office of Management and Budget
OPNAVINST	Chief of Naval Operations Operating Instruction
OSD	Office of the Secretary of Defense
OTA	Organic Trade Association

ACRONYMS and ABBREVIATIONS (cont'd)

P	palustrine
ppt	parts per thousand
PPV	public/private venture
PWD	Public Works Department
R	riverine
RAB	Restoration Advisory Board
RCA	Resource Conservation Area
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
PMPAR	Pest Management Performance Assessment Representative
RPM	Remedial Project Manager
RSC	Regulatory Services Coordination Office
SAIA	Sikes Act Improvement Act
SAV	submerged aquatic vegetation
SCA	Student Conservation Association
SCS	Soil Conservation Service
SECNAVINST	Secretary of the Navy Instruction
SHPO	State Historic Preservation Office
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFS	U.S. Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USNA	United States Naval Academy
VIMS	Virginia Institute of Marine Science
WDCP	Wildlife Diversity Conservation Plan
WS	Wildlife Services

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1. OVERVIEW

A. PURPOSE

In accordance with the Department of Defense Instruction (DoDI) 4715.3 – Environmental Conservation Program, Chief of Naval Operations Operating Instruction (OPNAVINST 5090.1C; Environmental and Natural Resource Program Manual), Naval Facilities Procedural Manual 73 (NAVFAC P-73), and 16 U.S. Code (USC) §670a-f (Sikes Act), the Department of the Navy (DoN) is required to implement and maintain a balanced and integrated program for the management of natural resources. To facilitate the natural resources program, Naval Support Activity (NSA) Annapolis must prepare and implement an Integrated Natural Resources Management Plan (INRMP). The purpose of the INRMP is to ensure consistency with the use of military installations to support military preparedness, while providing for the conservation and rehabilitation of natural resources on military installations; the sustainable multipurpose use of natural resources; natural resources stewardship; biodiversity protection; and ecosystem management. The INRMP must also ensure that natural resources management practices comply with all pertinent laws and regulations and are in accordance with Navy policy which, as summarized from OPNAVINST 5090.1C, is to incorporate ecosystem management as the basis for planning and management.

B. SCOPE

Section 101(a)(1)(B) of the Sikes Act requires that each Military Department prepare and implement an INRMP, unless the Secretary of Defense determines that the absence of significant natural resources on a particular installation makes preparation of such a plan inappropriate. Accordingly, this INRMP addresses natural resources management on those lands and near-shore areas at NSA Annapolis that are:

- Lands and near-shore areas owned by the United States and administered by the Navy;
- Lands and near-shore areas used by the Navy via license, permit, or lease for which the Navy has been assigned management responsibility;
- Lands and near-shore areas withdrawn from the public domain for use by the Navy for which the Navy has been assigned management responsibility; and
- Lands and near-shore areas leased on the installation and occupied by non- Department of Defense (DoD) entities.

NSA Annapolis consists of three main areas; the U.S. Naval Academy (USNA), NSAA North Severn, and the USNA Dairy Farm, all of which are located in Anne Arundel County, Maryland (Figure 1-1). This INRMP primarily concerns natural resources management of the undeveloped, natural areas at NSA Annapolis, USNA, and the USNA Dairy Farm, but also applies to natural resource issues in military academic, training and operational areas; developed areas such as support and administrative areas; and recreational areas.

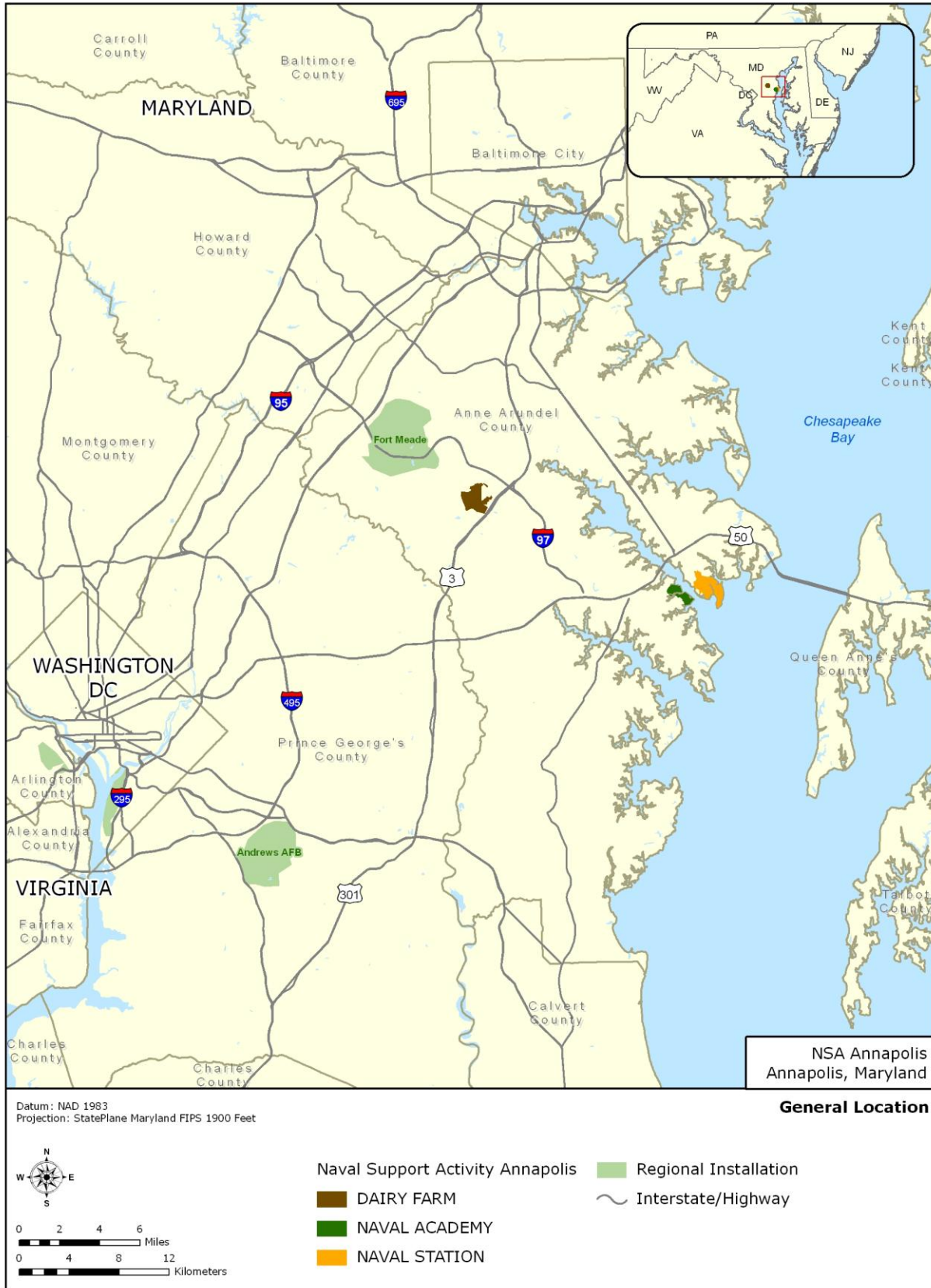


Figure 1-1. NSA Annapolis General Location

C. GOALS AND OBJECTIVES

The INRMP is a long-term planning document that guides implementation of the natural resources program at NSA Annapolis to help ensure support for the installation mission, while protecting and enhancing natural resources and providing a variety of outdoor recreational opportunities for DoD personnel, their dependents, and guests. Goals of the INRMP are to:

- Identify the responsible parties and stakeholders concerned with natural resources management;
- Describe the current and future installation mission and its requirements and constraints on natural resources;
- State the policies, management philosophy, and objectives of natural resources management;
- Provide information regarding the existing biological and physical conditions and the desired future conditions of the installation and the surrounding area;
- Identify key natural resource management issues and concerns at the installation and in the surrounding area;
- Identify and describe projects and management actions required to meet the objectives of natural resources management while ensuring no net loss in the capability of installation lands to support the military mission; and
- Identify scheduling priorities and funding opportunities for the implementation of natural resources projects and management actions.

D. RESPONSIBILITIES

The responsibility for the development, revision, and implementation of INRMPs is shared by several command elements. The roles and responsibilities for Navy natural resources management are described in OPNAVINST 5090.1C and in the Navy guidance for INRMP development and implementation (U.S. Navy 2006). A summary of responsibilities for natural resources management at NSA Annapolis follows.

Chief of Naval Operations (CNO) is the Echelon I command and serves as the principle leader to provide policy, guidance, and resources for the development, revision, and implementation of INRMPs. CNO also represents the Navy on issues and resolves high-level conflicts regarding development and implementation of INRMPs.

Commander, Navy Installation Command (CNIC) is the Echelon II command under the Chief of Naval Operations responsible for Navy-wide shore installation management. CNIC has overall shore installation management responsibility and authority as the Budget Submitting Office for installation support and the Navy point of contact for installation policy and program execution oversight (CNIC 2007). CNIC must ensure the programming of resources necessary to maintain

and implement INRMPs; participate in the development and revision of INRMPs; and provide oversight for all natural resources program elements.

Naval Facilities Engineering Command Washington (NAVFAC Washington) is the regional facilities engineering systems command and supports the mission of CNIC with technical authority, project management, and contracts management as requested. NAVFAC Washington also provides technical oversight for forest management, agricultural outlease, and fishing and hunting permit projects; facilitates agency review and cooperative agreement of INRMPs; and reviews and signs INRMPs to ensure technical sufficiency.

The NSA Annapolis Commanding Officer must ensure preparation, completion, and implementation of the INRMP and should systematically apply conservation practices set forth in the plan. It is his/her responsibility to act as steward of installation natural resources and integrate natural resources requirements into the day-to-day decision-making process; involve appropriate operational and training commands in the INRMP review process to ensure no net loss of military mission; and endorse this INRMP via Commanding Officer signature.

The natural resources program at NSA Annapolis is in the Environmental Division under the jurisdiction of the NAVFAC Washington Public Works Department (PWD). The NAVFAC PWD Annapolis Natural Resources Manager is primarily responsible for implementing this INRMP and coordinating with other personnel on the installation. Some of the implementation responsibilities include identifying personnel, internal or external to the installation, with expertise to perform the work identified; identifying the appropriate funding source to accomplish the projects; and ensuring installation personnel are familiar with the contents of this INRMP. The natural resources manager is also responsible for ensuring this plan is reviewed in coordination with the U.S. Fish and Wildlife Service (USFWS) and the Maryland Department of Natural Resources (MDNR).

E. AUTHORITY

The DoDI 4715.3, OPNAVINST 5090.1C, 32 Code of Federal Regulations (CFR) Part 190 – DoD Natural Resources Management Program), and 16 USC §670a-f (Sikes Act) are the main authorities for the development and implementation of the INRMP for NSA Annapolis.

F. STEWARDSHIP AND COMPLIANCE

Environmental compliance requirements are those that are driven by federal and state regulations, such as such as the Clean Air Act (CAA), Clean Water Act (CWA), Coastal Zone Management Act (CZMA), Sikes Act, Endangered Species Act (ESA), National Environment Policy Act (NEPA), and Migratory Bird Treaty Act (MBTA); DoDI; Executive Orders (EOs); and Memoranda of Agreements or Understanding (MOAs or MOUs). Environmental stewardship programs and projects are those that enhance the installation's natural resources,

promote proactive conservation measures, and support investments that demonstrate Navy environmental leadership and proactive environmental stewardship.

The 2008 DoN environmental strategy states that “Environmental stewardship protects and preserves the mission capabilities of our installations and training areas, ensures operational flexibility by meeting environmental laws and regulations, and sustains the resources and public support needed to carry out the mission” and that “Maintaining and improving environmental quality on installations and ranges helps ensure our ability to use them for their intended purposes, raises the quality of life for Sailors, Marines, and the local community, and avoids significant liabilities that require cleanup, restoration, or other actions, allowing our bases and operating areas continue to meet critical mission requirements” (Office of the Secretary of the Navy 2008).

This INRMP identifies both stewardship and compliance projects that help meet natural resources management goals at NSA Annapolis. However, funding priority will be given to projects that are required to meet compliance criteria. Stewardship efforts that rely on volunteer labor and enjoy the support of the military community, or have available alternate funding sources are also likely to be implemented.

G. REVIEW AND REVISION

This INRMP is a long-term planning document that requires periodic reviews of management goals and practices in order to provide the opportunity to incorporate new science and information as well as assess the performance of management actions. INRMPs must be reviewed and if necessary, revised, at intervals of not more than five years. Significant changes to the installations’ mission requirements or their natural resources would warrant an INRMP revision.

Additionally, Navy policy states that INRMPs must be reviewed annually by the installation with the cooperation of the appropriate field-level offices of the USFWS and state fish and wildlife agency. The MDNR is the lead fish and wildlife agency in Maryland. Annual reviews will enable project tracking and assessment, and will help facilitate adaptive management. These reviews may be accomplished via correspondence or in a meeting between appropriate parties. The annual review is to verify that:

- Current information on all conservation metrics is available;
- All “must fund” projects and activities have been budgeted for and implementation is on schedule;
- All required trained natural resources positions are filled or are in the process of being filled;
- Projects and activities for the upcoming year have been identified and included in the INRMP (an updated project list does not necessitate revising the INRMP);

- All required coordination has occurred; and
- All significant changes to the installation's mission requirements or its natural resources have been identified.

This evaluation is facilitated by the web-based Metrics Builder tool on the Natural Resources Data Call Station. The Metrics Builder provides the means to evaluate performance in seven areas: (1) INRMP implementation, partnerships/cooperation and effectiveness; (2) team adequacy; (3) INRMP impact on the installation mission; (4) status of federally listed species and critical habitat; (5) ecosystem integrity; (6) fish and wildlife management; and (7) public use.

Use of the Metrics Builder to accomplish the INRMP Annual Reviews will also generate Navy conservation program metrics to measure effects of the conservation program on the installation mission and the status of the Navy relationship with the USFWS and state fish and wildlife agencies.

*The Metrics Builder is available on the Data Call Station website:
<https://clients.emainc.com/dcs/navfac/index.asp>.*

H. COMMITMENT OF THE U.S. FISH AND WILDLIFE SERVICE AND MARYLAND DEPARTMENT OF NATURAL RESOURCES

Under the Sikes Act Improvement Act (SAIA) of 1997, INRMPs are required to reflect mutual agreement with the USFWS and appropriate state agencies concerning the management of fish and wildlife. 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. Per Sikes Act requirements, the USFWS and MDNR agree to cooperate in the development and review of this INRMP as to operation and effect at least once every five years. In addition to the formal five-year review, Navy policy requires reviews be conducted in coordination with the Sikes Act partners on an annual basis.

Although mutual agreement is the goal with respect to the entire INRMP, it is only required with respect to fish and wildlife management elements of the plan. No element of the SAIA is intended to either enlarge or diminish the existing responsibility and authority of the USFWS or state fish and wildlife agencies concerning natural resources management on military lands.

2. ENVIRONMENTAL MANAGEMENT STRATEGY AND MISSION SUSTAINABILITY

A. SUPPORTING SUSTAINABILITY OF THE MILITARY MISSION AND THE NATURAL ENVIRONMENT

(1) Military Mission and Sustainable Land Use

The primary mission of NSA Annapolis is to provide general support, including underway seamanship and sail training; small arms weapons familiarization; and navigation and engineering professional development, for midshipmen enrolled at USNA. This mission depends on the continued availability of a functional, attractive campus with extensive parade grounds and athletic fields; training facilities including access to open waters, unimpeded firing ranges, and a healthy natural environment; and access to and community support facilities including medical and recreational areas.

The NSA Annapolis natural resources program strives to preserve and sustain conditions that are compatible with the activities educational and support missions. Mission requirements are met through the protection and enhancement of significant resources such as wetlands, rare species, and habitat for migratory birds and other at-risk species, land and watershed management, and invasive species control. Sustainable management of natural resources helps ensure compliance with environmental laws and regulations and the continued availability of the facility to meet mission requirements.

(2) Defining Impact to the Military Mission

Any loss in the installation's ability to enable the education, training, and development of midshipmen morally, mentally, and physically from natural resources constraints would represent an impact to the NSA Annapolis mission. Planned construction activities at USNA and NSAA North Severn would likely cause minor, temporary impacts to the installation mission. There are no natural resources management activities in this INRMP required by regulation or recommended as stewardship actions that would negatively impact or constrain the military mission.

(3) Management Strategy

Navy policy on natural resources management, as summarized from OPNAVINST 5090.1C, is to manage natural resources to support and be consistent with the installation mission, while protecting and enhancing those resources for multiple use, sustainable yield, and biological integrity. Land use practices and decisions must be based on scientifically sound conservation procedures and techniques, and use scientific methods and an ecosystem management approach.

DoDI 4715.3 further requires that INRMPs incorporate the principles of ecosystem management for natural resources under the stewardship and control of DoD. The goals of this strategy are to maintain and improve the sustainability and biological diversity of terrestrial and aquatic ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations. The basic principles and guidelines of ecosystem management are to:

- Preserve the function and integrity of natural ecosystems;
- Integrate human social and economic interests with environmental considerations;
- Involve all interested parties (stakeholders) in identifying management goals; and
- Adapt to changing conditions and requirements.

An ecosystem management approach encourages management decisions to be made on the community or ecosystem level rather than at a single species level. Maintaining or improving the quality, integrity, and connectivity of the ecosystem benefits both natural communities and individual species. In areas such as NSA Annapolis, where little remaining natural area occurs, efforts to protect, enhance, and restore natural ecosystems may be the most appropriate management strategy.

In order to maintain the function and integrity of the installation ecosystem, management goals and objectives must be identified and assessed on a periodic basis. Projects and actions to achieve these goals, with measurable objectives are described in Appendix 1. Appendix 1 also provides a summary table of projects and actions for quick reference. However, as there are always unknown factors and change always occurs, management goals and prescriptions must be adaptable. Adaptive management is an iterative cycle of planning, monitoring, evaluation, and adjusting management. Periodic reviews of management goals and practices provide the opportunity to incorporate new science and information as well as assess the performance of management actions. Prescribed actions should be considered experimental and subject to change if the expected results are not achieved.

(4) Relationship to Other Plans

a. Encroachment Action Plan

Per OPNAVINST 11010.40 CNO Encroachment Management Instruction, encroachment is “Any non-Navy or Navy action planned or executed in the vicinity of a naval activity or operational area which inhibits, curtails, or possesses the potential to impede the performance of the mission of the naval activity.” The Fiscal Year (FY) 2003 Defense Authorization Act includes a provision, codified as Title 10 USC 2684a, that provides for the execution of agreements with public and private partners to acquire real estate interests near installations to help preclude environmental restrictions on military training and testing operations. Partnering

agreements may involve the Navy acquiring land to reduce or eliminate or prevent encroachment likely to restrict military activities; partnering with private conservation organizations to purchase land; or partnering with public agencies and conservation organizations to preserve or restrict land use on land parcels.

Although no official Encroachment Action Plan (EAP) is currently planned for NSA Annapolis, potential areas suitable for these encroachment partnering agreements have been identified during the development of this INRMP. Partnering opportunities primarily exist with state and local conservation organizations and universities on issues such as oyster and stream restoration that will help prevent further degradation or loss of Navy real property.

b. State Comprehensive Wildlife Plan

The Maryland Wildlife Diversity Conservation Plan (WDCP) was developed and is implemented by the MDNR Wildlife and Heritage Service (MDNR 2005). The WDCP is a 10-year strategic plan that is required for continued funding through the State Wildlife Grant Program administered by the USFWS. The WDCP was developed with extensive input from other state and federal agencies, non-governmental organizations, and private citizens.

*The Maryland WDCP is available online:
http://dnr.maryland.gov/wildlife/divplan_wdcp.asp*

The WDCP focuses on species and habitats of greatest conservation need (GCN) in Maryland; however, it is also an action plan for the conservation of all of the state's wildlife. A total of 502 GCN wildlife species and 35 key wildlife habitats are assessed and threats, conservation actions, and research needs are recommended. The WDCP identifies significant threats including habitat loss, degradation, fragmentation, disturbances (both natural and anthropogenic), pollution, and outlines conservation actions and information needs for GNC species and key habitats.

The WDCP identifies a large number of conservation actions to address problems facing Maryland's at-risk species and key wildlife habitats. Twenty-four overarching state-wide actions recommended include coordination; education and outreach; enforcement; habitat management; land protection; planning; regulations, policy, and law; and species management. Additional specific recommendations are made for individual taxon and/or habitat type. Actions recommended in this INRMP that are generally aimed at habitat improvement, which will benefit a number of GNC species, as identified in the Maryland WDCP. Specific recommendation provided in this INRMP that support the state conservation efforts include:

- Mapping and protecting wetlands from drainage, ditching, filling, and other practices that alter hydrology;
- Management and operation of the Greenbury Point Nature Center;

- Forest restoration at Greenbury Point;
- Grassland enhancement at Greenbury Point;
- Invasive species assessment and control;
- Deer population control; and
- Implementing shoreline stabilization.

c. Stormwater Pollution Prevention Plan

The NSA Annapolis Stormwater Pollution Prevention Plan (SWPPP) identifies and maps potential pollutant sources that may contribute to the contamination of the stormwater discharges from permitted outfall drainage areas (U.S. Navy 2001). 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 plan also describes stormwater management standards, stormwater management controls, and best management practices (BMPs) used at NSA Annapolis to maintain and protect water quality. The SWPPP was developed as a requirement of state and federal water pollution control regulations. 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, the SWPPP must be amended.

The CWA further requires operators of facilities that discharge stormwater associated with industrial activity obtain National Pollutant Discharge Elimination System (NPDES) permits. NSA Annapolis currently has seven permitted outfalls, four of which are located at USNA and three of which are located at NSAA North Severn (U.S. Navy 2001).

The stormwater management program must ensure the quality of stormwater runoff leaving the facility meets minimum requirements established in the Maryland Stormwater Design Manual (MDE 2000). Stormwater monitoring, including sampling, analysis, and visual observations of stormwater discharges and implementing stormwater BMPs, help USNA meet these standards. Further improvements to stormwater quality may be obtained through utilizing additional BMPs that minimize pollutants and reduce runoff. Techniques such as infiltration trenches, sand filters, and bioretention basins should be considered in the next SWPPP update and implemented where practicable to ensure no untreated stormwater leaves the facility.

In an effort to increase employee understanding and awareness of stormwater management, the Environmental Department also maintains an online stormwater pollution prevention training course that provides environmental awareness training to all employees as well as other

*The NSA Annapolis online stormwater pollution prevention course is available at:
<http://www.usna.edu/ENRP/final/index.html>*

environmental professionals at NSA Annapolis. The course is designed to teach participants to:

- Understand the basic elements of a stormwater management program,
- Identify common sources of stormwater pollution, and
- Identify steps that can be taken to prevent stormwater pollution at work and at home.

Updating the online stormwater pollution prevention website with current NPDES permit information and up-to-date information on stormwater management would further benefit site users.

When appropriate, the natural resources and stormwater managers cooperate in preventing stormwater pollution. Natural resources actions such as enhancing forested riparian buffers, Chesapeake Bay Critical Area reforestation, implementing a soil conservation plan at the USNA Dairy Farm, and protecting the stations wetlands directly support of the stormwater management program.

d. Installation Pest Management Plan

An Installation Pest Management Plan (IPMP) that describes pest management requirements, resources, and procedures at NSA Annapolis was developed in 1997 and reviewed in 2004 (Kincaid 2004). In accordance with OPNAV 6250.4 Series, IPMPs and other contracts requiring the use of pesticides must be reviewed and approved by NAVFAC Atlantic Applied Biology and the Preventive Medicine Department. This includes contracts issued by non-appropriated activities and tenant commands on base. Pest control contracts are required to be monitored by a trained Pest Management Performance Assessment Representative (PMPAR).

A pesticide approval form must be submitted to the Pest Management Coordinator and Environmental Office prior to any pesticide application and a pest management record form must be submitted following application to track pesticide usage. A hard copy of all records is kept in the Pest Control Building at Perry Center. Under new requirements, contractors will report all herbicide use on line directly to NAVFAC.

It is Navy policy to employ an integrated pest management (IPM) approach to pest control. IPM is an environmentally sound approach to pest management that promotes non-chemical controls and stresses prevention to avoid unacceptable levels of pest damage. A variety of biological, cultural, and mechanical pest management strategies are used in IPM. The goal of IPM is to make decisions that produce economically and environmentally optimum results.

e. Environmental Restoration Program

NSA Annapolis recognizes that adverse impacts to natural resources addressed in this INRMP may result from the release of hazardous substances, pollutants, and contaminants into the environment or from the actual restoration of contaminated sites. The DoN Environmental

Restoration (ER) program is responsible for identifying Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) releases, Resource Conservation and Recovery Act (RCRA) releases, and releases under related provisions and reporting such releases to the Environmental Protection Agency (EPA) and Maryland Department of the Environment (MDE).

When appropriate, the natural resources manager will help the ER program Remedial Project Manager (RPM) identify potential impacts to natural resources caused by the release of these contaminants. Also, when appropriate, the natural resources manager will make recommendations to the ER program RPM regarding cleanup strategies and site restoration. During initial monitoring protocols, the natural resources manager may suggest sampling and testing be accomplished so as to not impact sensitive or critical areas. Also during site restoration, the natural resources manager has the opportunity to recommend site restoration practices that are outlined within this INRMP.

A 42-acre ER site, located at the Navy Exchange complex, has been designated at NSA Annapolis. The EPA has reported that USNA is under a RCRA Corrective Action Permit and completed a Verification Investigation, Phase I Environmental Investigation, and Phase II Environmental Investigation of the Areas of Concern and Solid Waste Management Units (EPA 2008) (Figure 2-1).

f. Base Master Plan

An updated Base Master Plan (U.S. Navy 2007a) was developed to reassess previous planning efforts and to develop detailed analysis on specific functional requirements for the Main Campus of USNA and NSAA North Severn. An analysis of existing land use, land use conflicts and functional deficiencies, development constraints and opportunities for development, and recommendations for alternative land uses are presented. Implementation of the recommendations in the updated master plan would likely result in improved efficiency, historic integrity, and aesthetic appeal at NSA Annapolis. Proposed changes at the Lower and Upper Yards of USNA involve redevelopment and reutilization within the existing footprint and would therefore have little impact on natural resources. Proposed changes at NSAA North Severn include construction of a new Navy Exchange and Commissary, expanding the Brigade Sports Complex, a medical clinic, an Executive Learning/Conference Center, Department of Morale, Welfare, and Recreation (MWR) cottages, as well as renovation of several existing facilities. Most of Greenbury Point would remain as a conservation area under this plan. Any new development at NSAA North Severn, however, must be cognizant of potential natural and cultural resources constraints such as wetlands, floodplains, and Chesapeake Bay Critical Area criteria. Any development activities must be coordinated through the natural and cultural resources programs. Regulatory agency coordination and permitting must be sought early in the planning process.

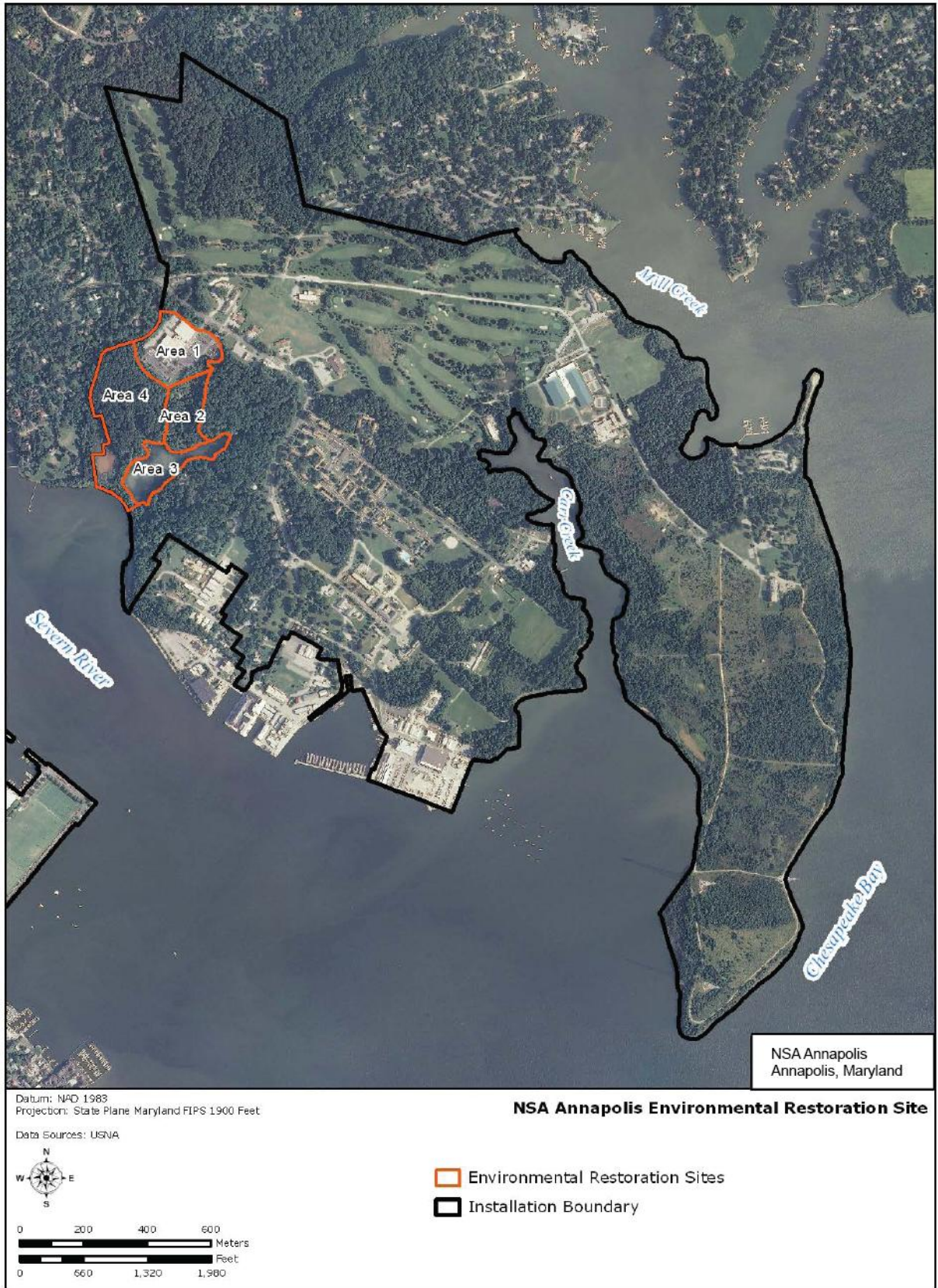


Figure 2-1. NSA Annapolis Environmental Restoration Site

g. NSAA North Severn Development Plan

An additional land use/land management plan was developed for the NSAA North Severn portion of NSA Annapolis in 2009 (U.S. Navy 2009a). The plan evaluates current land uses and development constraints, analyzes the constraints on development potential, and identifies three alternatives for maximizing development at NSAA North Severn. As with the base master plan, the Navy Exchange and Commissary, Brigade Sports Complex, medical clinic, and MWR cottages are identified as planned future expansions or development sites. Each alternative also includes fencing much of the central NSA Annapolis Command Headquarters and adding additional access gates. Two of the alternatives would limit development at Greenbury Point, though one alternative recommends relocating the small arms range to Greenbury Point. As with the base master plan, any development activities must be coordinated through the natural and cultural resources programs. Regulatory agency coordination and permitting must be sought early in the planning process.

h. Tree Survey and Management Plan for USNA

A Tree Survey and Management Plan, conducted in 2008 (U.S. Navy 2009b) at USNA, identified and assessed the condition of the urban shade trees and ornamental trees in the Upper and Lower Yards excluding those in natural areas. Recommendations and priorities for tree care and urban forest management were provided. Guidelines for tree care and management procedures also provided in the management plan are in compliance with the American National Standards Institute (ANSI) standards.

i. Soil and Water Conservation Plan (USNA Dairy Farm)

A Soil and Water Conservation Plan, developed for the USNA Dairy Farm (Appendix 5), outlines requirements for the use of fertilizers and pesticides, and provides instructions with regard to conservation practices, maintenance of drainage ditches, and protection of wetlands and riparian buffers. In accordance with the Chesapeake Bay Preservation Act, a Nutrient Management Plan must be approved by the Maryland Department of Agriculture and submitted to the Navy for concurrence. In compliance with the 1990 Farm Bill record keeping requirements, pesticide and herbicide application reporting is mandated in the soil and water conservation plan. The plan further requires the agricultural lessee to coordinate farming and grazing practices on the USNA Dairy Farm with the NAVFAC Washington Real Estate Contracting Officer and NAVFAC Washington Natural Resources personnel to facilitate the protection and enhancement of a diversity of natural ecological communities, including (1) fish and wildlife populations and their associated habitat; (2) wetlands, streams, and floodplains; and (3) rare, threatened, or endangered species.

j. Integrated Cultural Resource Management Plan

Under Section 110 of the National Historic Preservation Act (NHPA), federal agencies are required to identify all cultural resources within their landholdings that are eligible for inclusion in the National Register of Historic Places (NRHP). Section 106 of the NHPA requires federal agencies to consider the effects of their actions on historic properties and allow the Advisory Council on Historic Preservation and the State Historic Preservation Officer (SHPO) an opportunity to comment on proposed actions. Implementing regulations for Section 106 of the NHPA are contained in 36 CFR Part 800.

To fulfill these requirements, an Integrated Cultural Resources Management Plan (ICRMP) for NSA Annapolis was completed in 2000 (U.S. Navy 2000c) however, cultural resources inventory and evaluation is a continuing process and the ICRMP was updated in 2009). The ICRMP provides an inventory of known prehistoric, historic, archeological, and architectural resources for each of the activity's three main areas; USNA, NSAA North Severn, and the USNA Dairy Farm. The plan also provides a review of cultural resources management issues and recommendations for their management and defines the process for managing cultural resources at NSA Annapolis. The PWD Cultural Resources Coordinator at NSA Annapolis oversees all cultural resources issues

B. NATURAL RESOURCES REGULATORY REQUIREMENTS AND GENERAL MANAGEMENT PRACTICES

The natural resources program at NSA Annapolis is responsible for ensuring compliance with applicable federal and state federal laws, EOs, as well as Navy policy on environmental stewardship. The primary elements of the natural resources program encompass traditional natural resource issues such as forestry, fish and wildlife management, and outdoor recreation as well as regulatory issues such as rare, threatened, and endangered species protection and wetlands and watershed management. An overview of regulatory requirements and general management practices for each program element relevant to the natural resources program at the three separate areas of NSA Annapolis follows.

(1) Threatened and Endangered Species and Species of Special Status

a. Federally Listed Threatened and Endangered Species

The primary regulatory protection for threatened and endangered species on federal lands is the ESA of 1973, as amended. The ESA is federal legislation that is intended to provide a means to conserve the ecosystems

The Endangered Species Consultation Handbook is available on the USFWS website: <http://endangered.fws.gov/consultations/>.

upon which endangered and threatened species depend and provide programs for the conservation of those species to prevent extinction of plants and animals. The law is administered by the Department of Interior USFWS and Department of Commerce National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries), depending on the species. Section 7 of the ESA requires all federal agencies, in consultation with USFWS or NOAA Fisheries, to use their authorities to further the purpose of the ESA and to ensure that their actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat.

In accordance with the ESA, contemplated federal actions with potential to impact a protected species must be assessed via biological assessment to determine whether the proposed action is likely to adversely affect a listed species, proposed species, or designated critical habitat. The USFWS or NOAA Fisheries issue a biological opinion stating their opinion on whether or not a federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The terms and conditions under which incidental take may occur may be identified by the USFWS.

b. State Listed Threatened and Endangered Species

The primary Maryland state law that allows and governs the listing of endangered species is the Nongame and Endangered Species Conservation Act (Annotated Code of Maryland 10-2A-01). This Act is supported by regulations (Code of Maryland Regulations 08.03.08), which contain the official State Threatened and Endangered Species list (MDNR 2008a). State regulations prohibit the taking, possession, transportation, exportation, processing, sale, offer for sale, or shipment within the state of endangered species and closely regulate these actions with regard to threatened species. The Maryland Natural Heritage Program is the lead state agency for the identification, ranking, and protection of Maryland's rare species and significant natural areas. Secondarily, MDNR's Fisheries Service maintains an official list of game and commercial fish species that are designated as threatened or endangered in Maryland (Code of Maryland Regulations 08.02.12).

The Maryland Natural Heritage Program website provides information on state and federally listed species:
<http://www.dnr.state.md.us/wildlife/espaa.asp>

Although not strictly bound by state laws, it is Navy policy to protect state-listed species to the greatest extent practicable in order to prevent eventual listing as federally protected species and to honor the partnership established with MDNR for management of fish and wildlife resources at NSA Annapolis. Federally and state-listed threatened and endangered species known to occur in Anne Arundel County, Maryland are listed in Appendix 2.

c. Bald and Golden Eagles

The Bald and Golden Eagle Protection Act (16 USC 668-668d) (BAGEPA) is an additional federal law that protects the bald eagle (*Haliaeetus leucocephalus*), which was removed from the federal list of threatened and endangered species in 2007, and golden eagles (*Aquila chrysaetos*). The BAGEPA prohibits the taking, possession, and transportation of bald eagles and their parts, nests, and eggs for scientific, educational, and depredation control purposes. While the bald eagle was listed under the ESA, the USFWS authorized incidental take of bald eagles through take statements under ESA Section 7 and through Section 10 incidental take permits. In May 2008, a final rule extended BAGEPA authorizations to holders of existing ESA authorizations only (73 Federal Register [FR] 29075).

d. Marine Mammals

The Marine Mammal Protection Act (MMPA) established a moratorium on the taking of marine mammals in waters or on lands under the jurisdiction of the United States (16 USC §1361-1407). The MMPA defines take as to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. It also prohibits the importation of any marine mammal or marine mammal parts into the United States, unless it is for the purpose of scientific research or public display, as permitted by the Secretary of Commerce or Secretary of the Interior.

NSA Annapolis lies within the known range of 10 marine mammal species (six cetacean, three pinniped, and one sirenian species) that have regular or rare occurrences in the Chesapeake Bay. These include Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), West Indian manatee (*Trichechus manatus*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), harbor porpoise (*Phocoena phocoena*), harbor seal (*Phoca vitulina*), gray seal (*Halichoerus grypus*) and harp seal (*Pagophilus groenlandicus*) (U.S. Navy 2008).

(2) Wetlands and Watersheds Management

a. Wetlands

Intact, functioning wetlands are of extreme importance to the health of the ecosystem and the human environment because of services such as flood control, pollution abatement, erosion control, fisheries habitat, and more. A large number of federal state, and local laws, therefore, regulate land uses and actions that have the potential to impact wetlands and water quality. Wetlands are regulated by the CWA, EO 11990 – Protection of Wetlands, and Maryland state regulations. In addition, the Navy considers wetland protection a top priority as reflected by their “No Net Loss” wetland policy.

Section 404 of the CWA regulates the discharge of dredged, excavated, or fill material in wetlands, streams, rivers, and other waters of the United States. The U.S. Army Corps of Engineers (USACE) is the federal agency authorized to issue Section 404 Permits for certain activities conducted in wetlands or other United States waters. Exemptions for discharges of dredged or fill material are provided for certain activities such as normal farming or forestry activities and construction and maintenance of forest roads in accordance with BMPs if the activity is part of an established operation. Activities that bring an area into farming or forestry, however, are not considered part of an established operation and do require appropriate permits.

Section 401 of the CWA requires additional certification from the appropriate state regulatory agency. In accordance with Section 401, federal agencies must obtain a water quality certificate from the state for any action requiring a federal license or permit. MDE oversees impacts to state waters and wetlands, including isolated wetlands in Maryland. Construction and other activities with the potential to disturb wetlands must be reviewed individually with regard to wetland impacts, and appropriate permits sought as needed.

To obtain the necessary permits, the Navy must submit a joint federal/state application to the Regulatory Services Coordination Office MDE, Water Management Administration. The Regulatory Services Coordination determines what type of permit is necessary and forwards the application to the appropriate governmental agencies. The review procedures and application package materials required vary depending on the size and type of project being proposed. Activities that are likely to cause more than minimal impact to wetlands require a USACE Standard Permit (Individual Permit), which is reviewed by the USACE, MDE, and local authorities, and is subject to public review.

A General Permit may be issued for activities that are similar in nature and would have only minimal individual or cumulative adverse environmental effects. General permits can be issued on a nationwide (nationwide permit) or regional (regional general permit) basis (EPA 2007). The Baltimore District Engineer has implemented a Maryland State Programmatic General Permit (MDSPGP). This regional permit is designed to continue to authorize certain activities previously covered by the nationwide permit program and institute an integrated federal and state regulatory process (USACE 2006). It is applicable to actions that will not individually and/or cumulatively result in direct or indirect impacts to more than 1.0 acre of waters of the United States, including jurisdictional wetlands and navigable waters.

As part of the MDSPGP permit evaluation process used to authorize a particular project proposing to impact state waters (including wetlands), applicants must (1) establish that avoidance of impacts to state waters, including wetlands is not practicable; (2) demonstrate that all practicable efforts to minimize unavoidable impacts to state waters, including wetlands, have been taken in project design and construction plan; and (3) provide a plan for compensation for all unavoidable impacts.

Compensatory mitigation requirements are determined by district engineers on a case-by-case basis, after considering relevant and available information, such as the ecological conditions of the project site, the type of activity, the impacts of the activity on the aquatic environment and other public interest factors. Mitigation ratios recommended by the MDE (2008a) for various wetland types are generally as shown in Table 2-1.

Table 2-1. Mitigation Ratios

Wetland Type Replacement	Ratio
Emergent	1:1
Emergent, using a bank	1.5:1
Scrub-shrub to emergent conversion	1:1
Scrub-shrub to emergent conversion, using a bank	1.5:1
Forested to emergent conversion	1:1
Forested to emergent conversion, using a bank	1.5:1
Forested to scrub-shrub conversion*	1:1
Scrub-shrub	2:1
Scrub-shrub, using a bank	3:1
Forested	2:1
Forested, using a bank	3:1
Emergent (of special state concern)	2:1
Emergent (of special state concern), using a bank	3:1
Scrub-shrub (of special state concern)	3:1
Scrub-shrub (of special state concern), using a bank	4.5:1
Forested (of special state concern)	3:1
Forested (of special state concern), using a bank	4.5:1

*Some conversions of forested wetlands to scrub-shrub require mitigation

Source: MDE 2008a

Compensatory mitigation may be accomplished through the following ways:

- **Mitigation Banks:** A permit applicant may obtain credits from a mitigation bank, which is a wetland, stream or other aquatic resource area that has been restored, established, enhanced, or preserved. This resource area is then set aside to compensate for future impacts to aquatic resources resulting from permitted activities. The value of a bank is determined by quantifying the aquatic resource functions restored, established, enhanced, and/or preserved in terms of credits.

- **In-Lieu Fee Mitigation:** A permit applicant may make a payment to an in-lieu fee program that will conduct wetland, stream or other aquatic resource restoration, creation, enhancement, or preservation activities. In-lieu fee programs are generally administered by government agencies or non-profit organizations that have established an agreement with the regulatory agencies to use in-lieu fee payments collected from permit applicants.
- **Permittee-Responsible Mitigation:** A permittee may be required to provide compensatory mitigation through an aquatic resource restoration, establishment, enhancement, and/or preservation activity. This compensatory mitigation may be provided at or adjacent to the impact site, or at another location, usually within the same watershed as the permitted impact. The permittee retains responsibility for the implementation and success of the mitigation project.

b. Watersheds

The Chesapeake Bay is recognized as one of the most important and productive estuaries in the world and is protected by federal, state, and local regulations. The Navy 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 2000 *Chesapeake 2000 Agreement*, and the 2005 *Resolution to Enhance Federal Cooperative Conservation in the Chesapeake Bay Program*. 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. The Joint Military Services' Chesapeake Bay Program supports installations in implementing projects that strive to meet DoD's commitment to these agreements.

The Navy Coordinator for the DoD Chesapeake Bay Program can provide assistance developing projects that benefit the Bay: charles.h.wilson1@navy.mil.

In land use planning, environmentally sensitive designs and low-impact development (LID) are the first steps in watershed protection and in 2007, the Assistant Secretary of the Navy (Installations and Environment), signed a memorandum requiring the Navy to incorporate LID into all major renovation and construction projects on installations. The *Maryland Stormwater Management Guidelines for State and Federal Projects* (MDE 2001) provides LID design standards and guidelines to reduce runoff and pollution from development projects. Recommended practices such as infilling and redevelopment within developed areas, minimizing impervious surfaces, preserving trees and green space, and use of native species in landscape design are presented.

DoD has developed an additional tool for the assessment of impacts on watersheds. The Department of Defense Installation Watershed Impact Assessment Protocol is currently available to all DoD Services (<http://www.usma.edu/dhpw/rci/documents/7.18.pdf>) to assess impacts and develop solutions for watershed management.

Anne Arundel County has also implemented many strategies to protect the Chesapeake Bay and its tributaries. Watershed protection is currently accomplished through a number of individual programs including watershed management plans, the erosion and sediment control program, the stormwater management program, stormwater NPDES, stormwater permits, and the Critical Area program. Anne Arundel County has completed watershed management plan for the Severn watershed and is in the process of preparing Comprehensive Watershed Management Plans for each of its watersheds, which will provide technical support for the development, implementation, management, and refinement of the existing programs. With the preparation of the Severn River Watershed Management Plan, a Watershed Management Tool for the County was developed that helps assess the data, prioritize where to focus restoration and preservation investment as well as selection of the most appropriate alternative solutions or best management practices (Anne Arundel County 2008b).

c. Floodplains

Floodplains perform important natural functions, including temporary storage of floodwaters, moderation of peak flows, maintenance of water quality, groundwater recharge, and prevention of erosion. Floodplains also provide habitat for wildlife, recreational opportunities, and aesthetic benefits.

As with wetlands, the USACE and MDE regulate discharges of dredged or fill materials within 100-year floodplains and a joint federal/state application, *Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland*, must be submitted to the Regulatory Services Coordination Office MDE. Floodplains receive additional protection through EO 11988 – Floodplain Management, which instructs federal agencies to restore and preserve floodplains and to reduce the risk of flood-related loss. EO 11988 specifically directs federal agencies to:

- Avoid actions located in or adversely affecting floodplains unless there is no practicable alternative;
- Take action to mitigate losses if avoidance is not practicable;
- Establish a process for flood hazard evaluation based upon the 100-year base flood standard of the National Flood Insurance Program; and
- Issue implementing procedures.

The implementing procedures as described by Floodplain Management Guidelines for implementing EO 11988 provides an eight-step decision-making process for carrying out the

EO's directives. This eight-step process is: (1) determine if a proposed action is in the base floodplain; (2) provide for public review; (3) identify and evaluate practicable alternatives to locating in the base floodplain; (4) identify the impacts of the proposed action; (5) minimize threats to life and property and to natural and beneficial floodplain values and restore and preserve natural and beneficial floodplain values; (6) reevaluate alternatives; (7) issue findings and a public explanation; and (8) implement the action.

(3) Coastal/Marine Management

a. Coastal Zone Management

The federal CZMA encourages states to preserve, protect, develop, and, where possible, restore or enhance valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife supported by those habitats. Maryland's coastal zone includes 16 counties and Baltimore City (MDNR 2002). Anne Arundel County is located entirely within Maryland's coastal zone. Although federal lands and actions are exempt from state law jurisdiction, the CZMA requires activities on federal lands that are reasonably likely to affect use of lands or waters, or natural resources of the coastal zone beyond the boundaries of the federal property, to be consistent to the maximum extent practicable with the enforceable policies of the state's Coastal Zone Management Program (CZMP). Federal consistency applies to any activity that is in, or affects land use, water use or any natural resource in the coastal zone, if the activity is conducted by or on behalf of a federal government agency, requires a federal license or permit, receives federal funding, or is a plan for exploration, development or production from any area leased under the Outer Continental Shelf Lands Act (MDE 2004).

The Chesapeake Bay Critical Area Act, an enforceable policy of the Maryland CZMP, is a joint effort by state and local governments to address the impacts of land development on habitat and aquatic resources in the bay. In Maryland, the Chesapeake Bay Critical Area designation extends 1,000 feet inland from the mean high water mark or from the edge of tidal wetlands and is intended to significantly limit development on properties along significant tributaries to the Chesapeake Bay (MDE 2007).

b. Critical Areas Land Use Classifications

Three categories of land development within the Critical Area have been designated based on existing development and public services available as of December 1, 1985. The three designations are Intense Development Area (IDA), Limited Development Area (LDA), and Resource Conservation Area (RCA) (Figure 2-2).



Figure 2-2. Chesapeake Bay Critical Areas

Grading, building, and land use must follow the Critical Area Criteria specific to each designation as follows:

- IDAs are defined as areas of twenty or more adjacent acres where residential, commercial, institutional, or industrial land uses predominate. New development or redevelopment in IDAs must reduce pollution from stormwater runoff by at least 10 percent below that of existing land use through the use of BMPs. LDAs can be developed with low to medium density housing (a maximum of less than 4 units per acre), commercial and small industrial uses according to the underlying zoning designation. Existing areas of natural habitat and wildlife corridors that ensure continuity of wildlife and plant habitat must be conserved in LDAs.
- RCAs are characterized by natural environments or by resource-based activities such as agriculture, aquaculture, commercial forestry or fishing. New commercial and industrial facilities are not permitted in RCAs. Residential development is limited to one dwelling unit per 20 acres. No forest cover may be removed without replacement and impervious surface cover is limited based on the size of the lot and when it was created.

c. Specific Requirements of the Critical Area Protection Program

The Chesapeake Bay Critical Area Act further requires that each local jurisdiction identify and provide for the establishment, preservation, and maintenance of Habitat Protection Areas. Habitat Protection Areas include: a naturally vegetated buffer; nontidal wetlands; the habitats of threatened and endangered species, and species in need of conservation, and their habitat; significant plant and wildlife habitat; and, anadromous fish spawning areas.

Tidal Wetland Buffer

A fundamental requirement of the Chesapeake Bay Critical Area Protection Program is the establishment, preservation, and maintenance of naturally vegetated, forested buffer landward from the mean high water line of tidal waters or from the edge of tidal wetlands and tributary streams. RCAs require maintenance of a 200-foot, whereas, LDAs require a 100-foot buffer (House Bill 1253 legislative changes, May 20, 2008). The buffer acts as a water quality filter for the removal or reduction of sediment, nutrients, and toxic substances found in runoff. The buffer also minimizes the adverse impact of human activities on habitat within the Critical Area. No disturbance of the buffer is permitted except those associated with water dependent facilities unless an applicant can meet the strict provisions for a variance.

Nontidal Wetlands

The minimum standards established by the state and adopted by the local jurisdictions for the conservation of nontidal wetlands in the Critical Area include: (1) the establishment and maintenance of a vegetated buffer of 25 feet around areas identified as nontidal wetlands; (2)

new development must not substantially damage or change the character of nontidal wetlands; and (3) only new development that is intrinsically water-dependent, or of substantial economic benefit to the public, is allowed to disturb nontidal wetlands. In the event of such development, measures must be taken to replace lost nontidal wetlands and to provide for water quality benefits and habitat protection equal to or greater than that provided by the original wetlands.

Threatened and Endangered Species

All local jurisdictions within the Critical Area have adopted protection programs for all federally and state endangered species and their habitat. The limited distribution of the habitats of these endangered species makes them highly susceptible to local land disturbances. The Critical Area Criteria suggest a variety of measures and approaches for the protection of these threatened and endangered species, including designation of areas of nondisturbance around essential habitat, establishment of conservation easements, and land acquisition.

Significant Plant and Wildlife Habitat

The Critical Area Criteria require the protection of plant and wildlife habitats that are of significance from a state wide or local perspective. Habitats identified for protection include colonial water bird (heron, egret, tern, etc.) nesting areas; aquatic areas of historic waterfowl concentration; riparian forests (forested areas of 300 feet in width along streams and the Chesapeake Bay shoreline); relatively undisturbed, large (100 acres or more) tracts of forest that support breeding populations of forest interior dwelling birds (FIDS) such as vireos, warblers, flycatchers, and woodpeckers; certain plant and animal communities that are the best examples of their kind in Maryland; and, other areas determined to be of local significance.

Native Trees and Shrubs Recommended for Planting in the Critical Area

Native shrubs and trees are the species indigenous to an area occurring prior to European contact. Over the past several hundred years, humans have imported or bred plants to suit their cultural, aesthetic, and environmental needs. A number of species have escaped from cultivated gardens or were planted intentionally into natural areas for wildlife benefit, only to cause havoc in the local ecosystem. While some of these plants do provide benefits to wildlife, the long range results are areas that cannot provide for the year round needs of wildlife and are aesthetically unpleasing.

Anadromous Fish Spawning Areas

Anadromous fish migrate from their primary ocean habitat to spawn, or breed, in freshwater areas. Anadromous fish are valuable recreational and commercial species, and also are an important component in the bay ecosystem. The Critical Area Criteria protect spawning areas by providing for prohibitions on the construction or placement of dams that would interfere with the movement of spawning fish or their larval forms and by providing time-of-year restrictions on

development activities occurring within or near streams. Channelization and other physical alterations, including the introduction of artificial surfaces (riprap, etc.) are also limited.

Forest Mitigation

Any clearing of forest cover for new development or redevelopment must be replaced so as to ensure that the total acreage in forest cover within the Critical Area is maintained or increased. Up to 20 percent of forest acreage on a project site may be removed, but must be replaced on an equal area basis. If between 20 percent and 30 percent of forest acreage is removed, reforestation must be provided at 1.5 times the total forest acreage cleared. If more than 30 percent of forest acreage is removed, reforestation must provide forest coverage at three times the removed acreage (MDNR 2007a).

d. Essential Fish Habitat

The Magnuson-Stevens-Fishery Conservation and Management Act (Magnuson-Stevens Act) sets mandates for the NOAA Fisheries, regional fishery management councils, and federal action agencies to identify and protect important marine and anadromous fish habitat. The regional fishery management councils, with assistance from NOAA Fisheries, are required to delineate essential fish habitat (EFH) in fishery management plans or fishery management plan amendments for all federally managed species. The Magnuson-Stevens Act further requires federal agencies consult with the NOAA Fisheries on activities that may adversely affect EFH or when the NOAA Fisheries independently learns of a federal activity that may adversely affect EFH.

EFH designations emphasize the importance of habitat protection to healthy fisheries and serve to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. EFH includes both the water column (including its physical, chemical, and biological growth properties) and its underlying substrate (including sediment, hard bottom, and other submerged structures). Under the EFH definition, necessary habitat is that which is required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. EFH may be designated for a species' complete life cycle, including spawning, feeding, and growth to maturity, and may be specific for each life stage (e.g., eggs, larvae).

In accordance with the Magnuson-Stevens Act, regional fisheries councils and NOAA Fisheries have identified EFH in major estuaries, bays, and rivers along the northeastern coast of the United States. EFH has been designated and described for 12 fish species within the Chesapeake Bay and its tributaries, including the Severn River (U.S. Navy 2008). Of these species, nine have designated EFH in the vicinity of NSA Annapolis. If land use changes, shoreline stabilization, or military operations with potential to impact these areas are planned, a consultation with NOAA Fisheries would be required under the Magnuson-Stevens Act. EFH

has been designated and described for the following species in the Severn River and its tributaries:

- Atlantic Herring (*Clupea harengus*). Atlantic herring are a pelagic schooling species found at various depths depending on lifestage, season, and geographic location. EFH for adult Atlantic herring includes the seawater salinity zone of the Chesapeake Bay.
- Windowpane Flounder (*Scopthalmus aquosus*). EFH for juvenile and adult windowpane flounder includes bottom habitats with a substrate of mud or fine-grained sand, water temperatures below 25° Celsius (C) , and salinities between 5.5 and 36 parts per thousand (ppt).
- Summer Flounder (*Paralichthys dentatus*). EFH for juvenile and adult summer flounder includes demersal (i.e., bottom) waters, including tidal guts. Juveniles may use estuarine habitats such as submerged aquatic vegetation (SAV) beds and open bay areas as nursery areas, and adults generally inhabit shallow estuarine waters during the warmer months.
- Bluefish (*Pomatomus saltatrix*). Bluefish is a highly migratory, schooling pelagic species found along the Atlantic coast. EFH for juvenile and adult Bluefish includes the pelagic water column, and inland within the mixing and seawater zones of between 0.5 and 25 ppt, and greater than 25 ppt salinity, respectively.
- Coastal migratory pelagic species including King Mackerel (*Scomberomorus cavalla*), Spanish Mackerel (*Scomberomorus maculatus*), and Cobia (*Rachycentron canadum*). EFH has been designated for all life stages of these species in the Chesapeake Bay and Severn River. EFH includes sandy shoals of capes and offshore bars, high-profile rocky bottom and barrier island ocean-side water, and all coastal inlets. EFH also includes estuaries and SAV for Cobia.
- Red Drum (*Sciaenops ocellatus*). EFH for the various life stages of red drum includes tidal inlets and creeks, salt marshes, SAV, and unconsolidated bottom.
- Red Hake (*Urophycis chuss*). Juvenile and adult red hakes are seasonal visitors in Chesapeake Bay that are common during the late winter and spring months. They occur in the deeper channels of the bay mainstem as well as the deep channels of Hampton Roads Harbor, and occasionally are found in the upper bay, extending as far north as the Patuxent River.

EFH that is either important to the long-term productivity of one or more managed species populations or deemed to be particularly vulnerable to degradation may be identified by fishery management councils and NOAA Fisheries as a Habitat Area of Particular Concern (HAPC). SAV beds of the Chesapeake Bay and its tributaries are considered HAPC for adult and juvenile summer flounder and all life stages of red drum.

e. Submerged Aquatic Vegetation

SAV refers to benthic macroalgae and seagrasses that grow in or attach to soft sediments or hard substrates in coastal habitats. SAV beds are considered Special Aquatic Sites, as defined in 40 CFR Part 230 (Section 404 (b)(1) and are an important resource that provides protection and

nursery habitat for a broad range of aquatic organisms and contributes to the oxygenation of the water. SAV is comprised of vascular plants that grow completely submerged below the low-tide line in water depths up to 9 feet (Chesapeake Bay Program 2009a). SAV is an important contributor to the primary and secondary production of the Chesapeake Bay. SAV beds provide food and habitat for waterfowl, fish, shellfish, and invertebrates. They also produce oxygen, filter and trap sediments, protect shorelines from erosion by reducing the energy of wave action, and remove excess nutrients from the water column (thereby reducing the occurrence of algal blooms) (Chesapeake Bay Program 2009a).

Seventeen species of SAV are commonly found in the Chesapeake Bay and its tidal tributaries. Redhead grass (*Potamogeton perfoliatus*), sago pondweed (*Potamogeton pectinatus*), horned pondweed (*Panicum palustris*), and Eurasian milfoil (*Myriophyllum spicatum*) are common in the middle and upper portions of the bay where salinities are lower. Widgeon Grass (*Ruppia maritima*) is tolerant of both high- and low-salinity waters and is common through all regions of the bay (Virginia Institute of Marine Science [VIMS] 2007). Eelgrass (*Zostera marina*) is the dominant SAV species in areas of higher salinities in the lower portion of the bay.

Historically, SAV was present in more than 200,000 acres of the Chesapeake Bay, however, concentrations of SAV steadily declined from the late 1950s through the 1970s and by the 1970s less than 40,000 acres of SAV were present (Moore et al. 2004). VIMS has mapped SAV in different regions of the Chesapeake Bay regularly since 1971 using aerial photo-interpretation and ground verification. The entire bay was most recently mapped in 2005 (VIMS 2007) (Figure 2-3).

f. Oyster Reefs

Until the 1980s, oysters supported the most valuable fishery in the Chesapeake Bay. As a result of pollution, over-harvesting, and disease, the bay's native oyster population is now estimated as less than one percent of historic levels (USACE 2008). Native oysters are still an important part of the bay's ecology as they filter pollutants and provide habitat for many other aquatic organisms.

Oyster reefs consist of densely packed both live and dead oysters that exist in small clumps or large mounds (up to 10 millimeters (m) in diameter) on river or estuarine floors. They are generally found in a 3 to 10 m water depth, and in some cases down to a 30 m water depth. Within the Chesapeake Bay, oyster reefs are generally made up of the eastern oyster species (*Crassostrea virginica*), and are found in the subtidal areas and lower tributaries (Figure 2-4). They grow best on clean, hard surfaces, such as on rock, hard sand or mud, on other oyster shells, and in either brackish or high salinity (0.5 to 30 ppt) waters (Reshetiloff 2004).

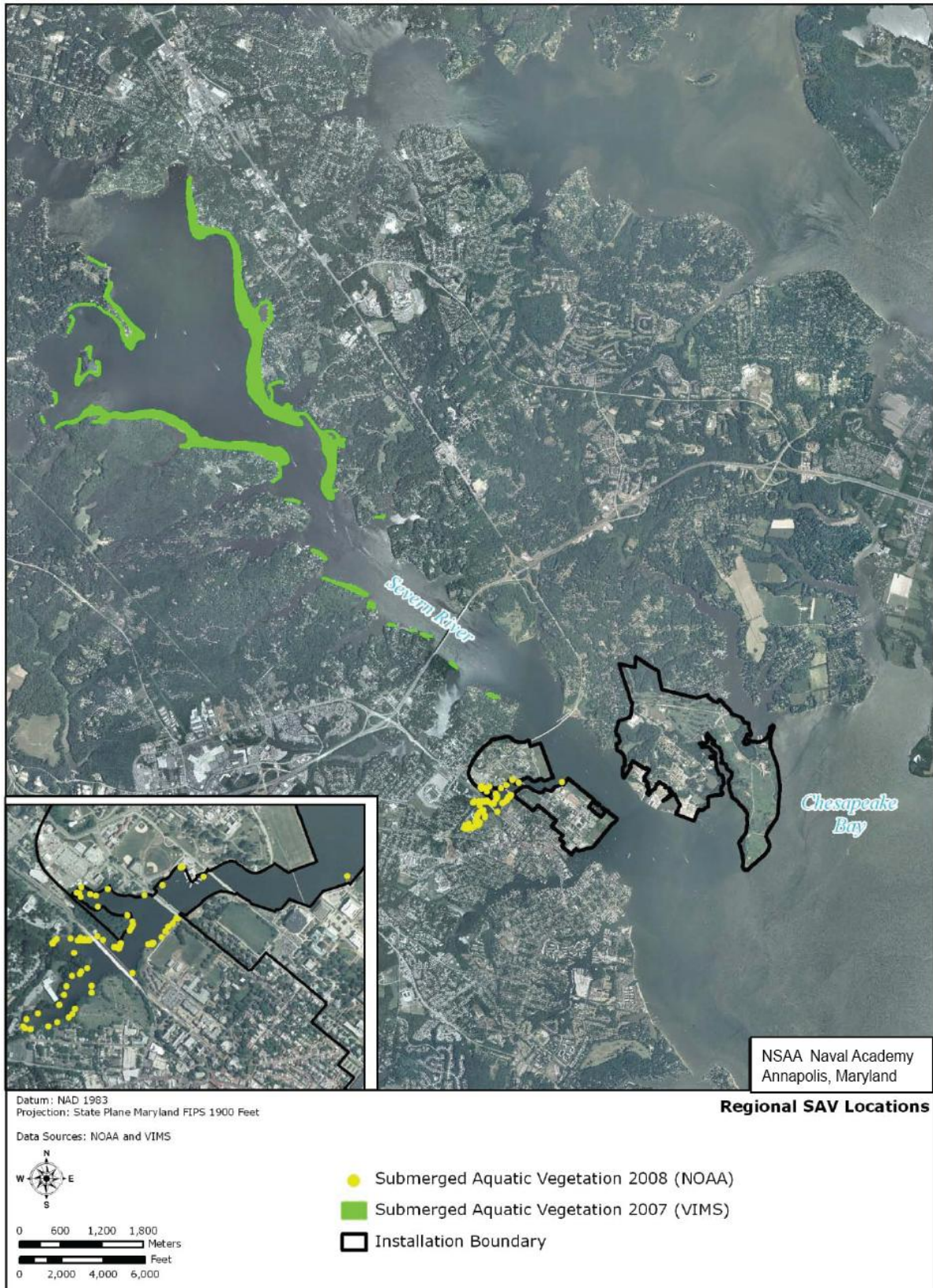


Figure 2-3. Regional SAV Locations

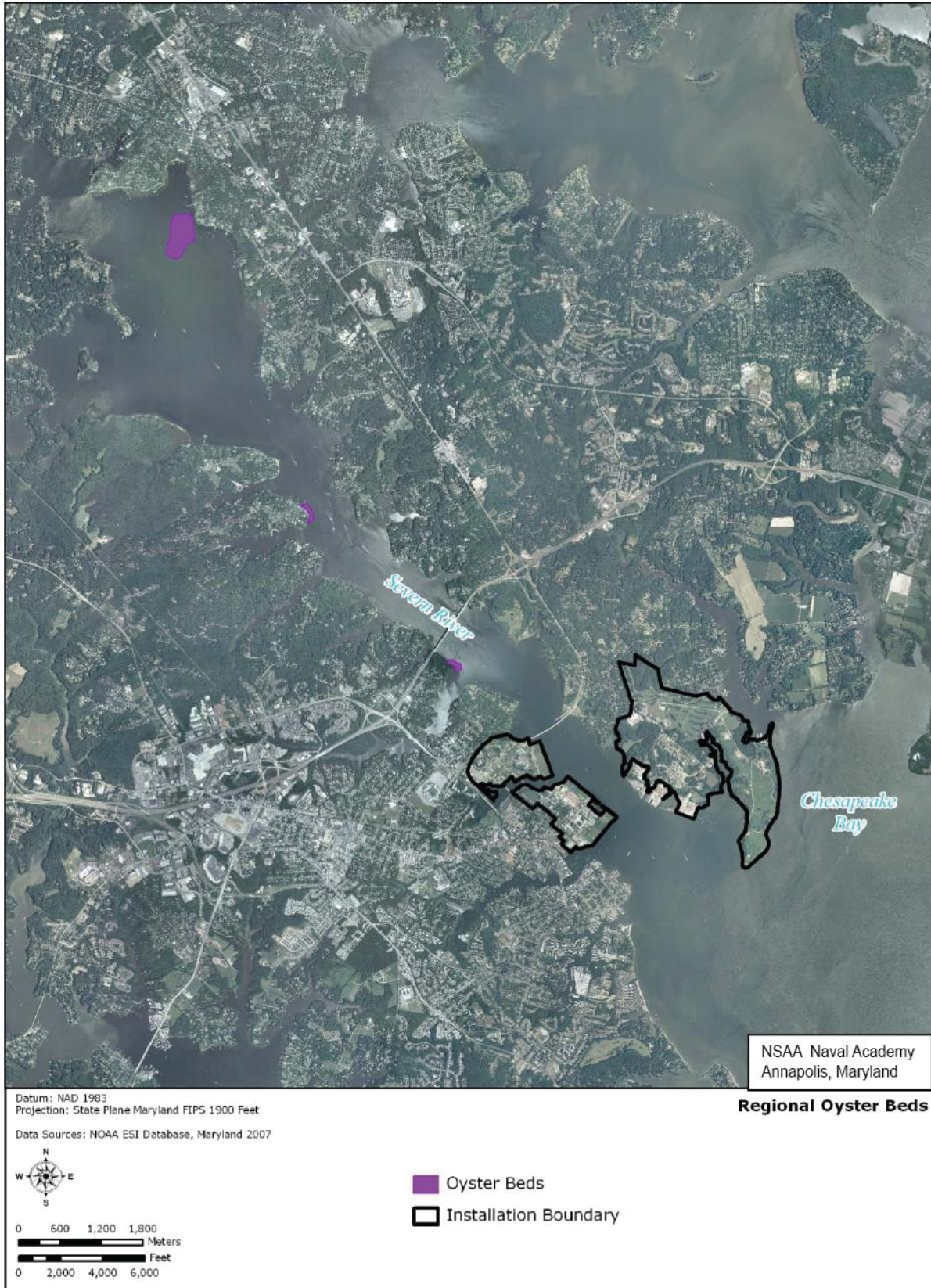


Figure 2-4. Regional Oyster Beds

Oysters help improve the water quality of the Chesapeake Bay by consuming phytoplankton, water-borne nutrients, small diatoms, bacteria and detritus, and thereby increasing light penetration through the water column. Oysters are filter feeders and they pump water through their gills and obtain food from the water in this manner. They also filter organic matter and sediments out of the water column, thus reducing the amount of pollutants (Reshetiloff 2004). They produce feces that are rich in organic matter which provide energy sources for organisms at the bottom of the food chain in the oyster reef community. When oysters die, their shell becomes a substrate for younger oysters. Oyster reefs in the bay are also good for the commercial and recreational fishing industries, in that they provide an abundant supply of eastern oysters, blue crabs, as well as various finfish species (U.S. Navy 2008).

Oysters grow best at salinities of about 15 ppt, which is higher than the average Severn River salinity, but since Dermo (*Perkinsus marinus*) requires higher salt concentrations than oysters, the Severn is considered a good site for oyster restoration projects and has been designated an oyster sanctuary where no shellfish harvest is allowed (MDNR 2008c). The diseases Dermo and MSX (*Haplosporidium nelsoni*) are parasitic organisms that are in part responsible for the decline of oysters in the bay.

A number of partner organizations including DoD, MDNR, MDE, the Chesapeake Bay Foundation, the Alliance for the Chesapeake Bay, and many local watershed groups such as Friends of College Creek and members of the USNA biology department and midshipmen are working together to restore oyster populations in the bay. An important restoration technique is the creation of oyster reefs. Oyster reef creation involves laying a bed of oyster shell or other appropriate material in a bed four to eight feet deep then planting hatchery-raised spat-on-shell on the created reef. Hatchery-raised spat are preferable for restoration projects because they are from select stock and are more likely to be disease free (MDNR 2008c).

(4) Fish and Wildlife Management

The Sikes Act is the primary federal law governing wildlife management on military installations. This act provides for cooperation by the DoD with the USFWS and state wildlife agencies in planning, development, and maintenance of fish and wildlife resources on military reservations and requires the cooperative development and implementation of an INRMP on installations with sufficient natural resources. In addition EO 12962 – Recreational Fisheries encourages the development and enhancement of recreational fisheries by federal agencies. The MBTA, MMPA, BAGEPA, ESA, and Magnuson-Stevens Act are other statutes that relate to fish and wildlife management. Fish and wildlife management, fish and wildlife-oriented recreation, and fish and wildlife habitat enhancement are elements of the INRMP required by the Sikes Act.

NSA Annapolis is located in a densely developed portion of Maryland, has little undeveloped acreage, and therefore has limited opportunity for wildlife management. Nuisance wildlife

control, habitat enhancement, and fisheries management are the primary fish and wildlife management issues of particular importance at NSA Annapolis.

a. Nuisance Wildlife

Nuisance wildlife are wildlife that, because of their feeding or nesting habits, interfere with the installation mission or well-being of domestic animals, other wildlife, or humans. Nuisance animals generally include birds, rodents, deer, and feral cats. Rats, mice, and other pests in buildings and structures are the responsibility of the PWD pest control officer and should be reported to the help desk. Nuisance wildlife including deer, geese, and feral cats, should be reported to the Environmental Office.

DoDI 4150.07, DoD Pest Management Program requires all federal, state, and local permits are obtained for pest management. Contractors that supply pest management services must also be permitted by Maryland laws and regulations to operate as a pest management business. In Maryland, permits are required for the control of all nuisance wildlife species, except nutria, woodchuck, European starlings (*Sturnus vulgaris*), house sparrows (*Passer domesticus*), and pigeons (*Columba livia*); and mice, rats, moles, and voles when they are causing damage to personal property (MDNR 2008d). The state of Maryland issues a Wildlife Damage Control permit to control other nuisance wildlife. Deer and Canada geese are managed under separate permit held by U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) Wildlife Services (WS). APHIS-WS provides wildlife damage management services when requested via an Interagency Agreement or Cooperative Service Agreement. Such an agreement was made with the Naval Academy Golf Association (NAGA) to conduct live-capture and removal of the resident Canada geese at the golf course. APHIS-WS submits an annual take report to the USFWS as a condition of their depredation permit.

Whitetail Deer

Whitetail deer (*Odocoileus virginianus*) are the most abundant large herbivores in the United States and eastern Canada. Although whitetail deer populations were small and scattered during the early 1900s, populations have rebounded and are at or exceed biological carrying capacity (BCC) throughout much of their range (Northeast Deer Technical Committee 2008). When the number of deer surpasses the number that can coexist compatibly with humans as in many urban areas, cultural carrying capacity (CCC) can also be exceeded. With a lack of predators and other control factors, deer populations can expand to levels that have profound impacts on natural ecosystems, cause human/deer conflicts, and reduce deer herd health. The best approach to maintaining deer within BCC and CCC is an integrated approach that includes population management, habitat management, and monitoring.

Population Management. Regulated hunting programs are recognized by wildlife management agencies as the most efficient and effective deer population management tool

(Northeast Deer Technical Committee 2008). Regulated hunting programs achieve population management goals by manipulating the size and sex composition of the harvest through hunter bag limits and the issuance of antlerless permits, season type, season timing, season length, number of permits issued, and land-access policies.

Although expensive relative to regulated hunting, sharpshooting programs may be useful in urban and suburban areas by reducing the size of the local deer population where there is not sufficient undeveloped land to support traditional regulated deer hunting programs. A typical sharpshooting program involves the systematic culling of deer by skilled marksmen who are highly trained wildlife professionals. Venison harvested by sharpshooting programs is generally donated to local food banks.

Nonlethal deer population management options available to natural resources managers include contraception and translocation. Capture and translocation has been demonstrated to be impractical, stressful to the deer handled, and may result in high postrelease mortality (DeNicola et al. 2000). It may also not be feasible because deer populations are high throughout the eastern United States and sites that are capable of receiving deer are scarce.

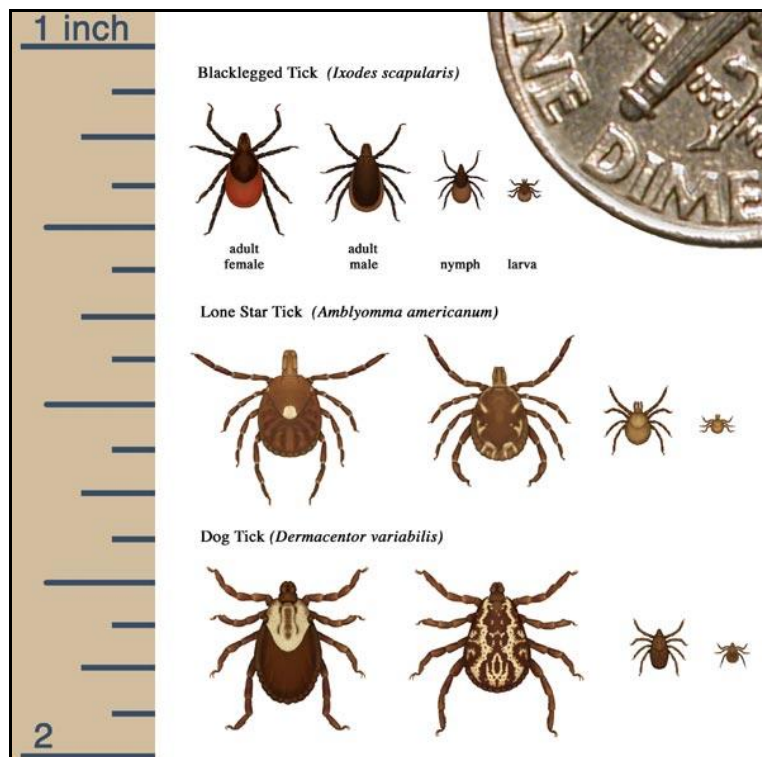
Implementing a contraception program for whitetail deer is a nonlethal method of population control that has become more tenable in over the past decade. Immunofertility agents have been successfully employed to control deer reproduction in both captive and free-ranging deer herds. Most promising is a program conducted by APHIS-WS at the Federal Research Center at White Oak, Maryland, using an immunocontraceptive vaccine, GonaCon™. Results of this study indicated fawning rates were reduced by 86 percent when compared to the reproductive success of untreated does at an adjacent federal facility. GonaCon™ was initially formulated as a two-shot contraceptive agent, but has now been refined so that a single injection can produce infertility for multiple years (Gionfriddo et al. 2006).

Habitat Management. Although deer are generalist foragers and eat most any plant within reach when hungry, they do have preferences for certain plant species. Selecting less palatable herbaceous and woody plants can minimize deer browsing to ornamental plants. By maintaining a diverse landscape in terms of plants species and by planting those that are less favored by deer, the impact of deer browsing on the landscape can be reduced. A list of landscaping plants and their palatability by deer is in Appendix 3.

Monitoring. Prior to implementing deer population control measures, a monitoring program to assess baseline population estimates should be conducted. Annual population surveys should then be conducted to assess the effectiveness of the program. A variety of methods for estimating density exist including spotlight surveys, track counts, aerial infrared surveys, and pellet group counting.

Ticks

Ticks are another type of nuisance wildlife that occurs throughout the region. Whitetail deer serve as the primary host for a number of tick species, including deer ticks (*Ixodes scapularis*), which carry Lyme disease. Other diseases such as ehrlichiosis and Rocky Mountain spotted fever are also spread by ticks and are present in the eastern U.S. (Center for Disease Control 2010). Deer density directly influences tick survival and abundance and human exposure to these diseases (Wilson and Childs 1997), therefore measures to reduce the deer population may help control ticks and tick-borne diseases.



Common Ticks of the Eastern U.S.

(photo from : <http://www.fairfaxcounty.gov/hd/westnile/tickscommon.htm>)

Preventive measures can also be taken that can greatly reduce the risks of contracting tick-borne diseases. Simple avoidance of areas where ticks are likely to be found may be effective, but not always practical. If activities must be undertaken where tick exposure is likely, light-colored clothing should be worn to allow ticks to be easily seen and pant legs should be tucked inside of socks. Repellents, such as those containing DEET or permethrin, should be used to discourage ticks. (NOTE: DEET should be used with caution when applied to children and permethrin may only be applied to clothing, not directly to skin). Additionally, thorough body checks should be conducted after at-risk activities. Adherence to these precautions may not prevent all tick bites; however, prompt removal of ticks will reduce the risk of disease transmission.

Additional studies aimed at reducing tick populations at NSA Annapolis are recommended. Tick control efforts in deer populations have been particularly effective using 4 poster deer treatment bait stations. The USDA has patented a device for the topical application of pesticides to deer for the control of ticks. The device, called a 4-poster deer treatment bait station, has paint rollers mounted on each corner that apply pesticide to the head and neck areas while deer feed from two troughs containing corn. Studies show that the use of the 4-poster bait station with approved tickicide has resulted in control of 92 to 100 percent of ticks after 3 years of use with approved tickicide (Solberg et al. 2003). The EPA has approved a specially formulated 10 percent permethrin based tickicide for use in treating ticks on deer.

Canada Geese

The resident Canada goose (*Branta canadensis*) population has grown significantly throughout the eastern United States during the past several decades and Canada geese are now considered a nuisance in many places. Resident Canada geese are those that nest within the region in the months of March, April, May, or June, or that reside within the region in the months of April, May, June, July, and August (USFWS 2007). These large populations can damage grass areas through overgrazing, trampling, and through their excrement. Large amounts of fecal droppings around the facility create unsanitary work conditions, increase the transmission of fecal coli form bacteria, and create excess nutrients in the surrounding water resources, which can lead to water quality problems.

In 2006, the USFWS revised regulations that pertain to resident Canada geese (71 FR 45964). The regulation allows landowners to remove Canada geese at airports, in agricultural areas, and in other areas where they are causing conflicts with human populations. The Nest and Egg Depredation Order is an additional tool that will allow landowners to destroy resident Canada goose nests and eggs when necessary to resolve or prevent injury to people, property, agricultural crops, or other interests. Under this order no permit is required, but the landowner must register with the USFWS in order to conduct this activity. The landowner or land manager (including employees that may conduct the work) must register each year prior to taking nests and eggs. Nests and eggs may be taken only between March 1 and June 30.

Feral Pets

Pets that have been abandoned or left behind by owners often become serious pests on military installations. Feral pets may carry diseases such as rabies, distemper, and feline leukemia (in cats) and pose a serious health threat to humans and other family pets. It is therefore important to ensure that pets are properly vaccinated, tagged, and registered when brought onto NSA Annapolis. In addition, feral animals and loose pets, particularly cats, are known to be very damaging to migratory bird populations and other native wildlife. To reduce impacts to native wildlife and in accordance with OPNAVINST 5090.1C, privately owned animals are not

permitted to run at large on the installation. Pet owners should also be encouraged to neuter their pets to reduce the occurrence of unwanted animals.

The CNO Policy Letter of January 2002 on Preventing Feral Cat and Dog Populations on Navy Property states Navy policy on feral pets. Due to the potential of feral or free ranging cat populations to act as disease reservoirs, threatening human health, native wildlife populations and natural ecosystems, Navy commands shall not allow trap, neuter, release or similar programs on their lands. Increasing public awareness on the problems associated with feral cats is a primary factor in controlling feral pet populations. In accordance with Navy policy, NSA Annapolis must adopt proactive pet management procedures that prevent the establishment of free-roaming cat and dog populations and must ensure the humane capture and removal of feral cats and dogs if they occur. Installation personnel and residents should understand that feeding feral cats and dogs is an unacceptable practice that may cause feral and other predator populations such as raccoons to increase. Prompt garbage removal and keeping dumpster and refuse receptacles covered with tight-fitting lids are other important practices.

b. Habitat Enhancement

Vegetation Management

Because of the level of development at NSA Annapolis, the conservation and enhancement of any remaining natural habitat is important to protecting the installation's wildlife resources. Further efforts that focus on maintaining a diversity of habitat types that provide year-round food and cover (coniferous vegetation) as well as seasonal food and cover (mast producing deciduous vegetation) provide the greatest benefits for wildlife. Supplemental plantings of native trees and shrubs in maintained open areas and around building and recreational areas, where consistent with current and planned land uses, would help enhance habitat diversity and meet wildlife management objectives.

Nest Box Program

Artificial nest boxes are useful for enhancing habitat conditions for a number of bird and wildlife species in areas where there are few natural cavity trees or where competition from aggressive nonnative species such as house sparrows and European starlings is great. If they are not properly watched and maintained however,

nest boxes can unintentionally increase populations of nonnative invasive species by providing additional nesting habitat. Placement of structures that benefit insectivorous birds in urban and housing areas also provides a benefit to people as these birds consume thousands of insects a day and provide enjoyment for human observers.

The University of Maryland College of Agricultural and Natural Resources has informative publications on maintaining bird nest boxes and other structures: <http://extension.umd.edu/publications/>.

Eastern bluebirds (*Sialis sialis*), tree swallows (*Tachycineta bicolor*), Carolina wren (*Thryothorus ludovicianus*), house wrens (*Troglodytes aedon*), purple martins (*Progne subis*), various owls, wood ducks (*Aix sponsa*), mice, squirrels, and bats are species that commonly utilize artificial structures. Nest box construction and placement should consider the availability of appropriate habitat and structural requirements for the intended species. Other important considerations in nest box construction are competition from European starlings and house sparrows and predation by raccoons and cats. Closing nest boxes by plugging the entrance following nesting season and opening in mid-March and evicting house sparrows or European starlings that are seen to use the house are important measures that help ensure nesting success. Predictor guards should be installed or repaired, as necessary on all nest boxes.

c. Fisheries Management

In accordance with EO 12962 – Recreational Fisheries and OPNAVINST 5090.1C, Navy installations are directed to improve the quantity, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunities by restoring degraded habitat, fostering conservation, and providing access and awareness of opportunities for recreational fishing.

The Chesapeake Bay has historically been a productive fishery in the nation. However, fish populations in the Chesapeake Bay and its tributaries have decreased significantly from historic numbers because of overconsumption, pollution, disease, and water quality degradation (Chesapeake Bay Program 2009b). A number of projects have been undertaken at NSA Annapolis in cooperation with local and regional partners to improve water quality and fish habitat. Included are shoreline stabilization efforts, riparian forest buffer enhancement, oyster restoration, and SAV plantings at various locations along the shoreline have also helped reduce erosion and improve aquatic habitats.

Nonnative, invasive aquatic species are becoming a major problem in the Chesapeake Bay and its tributaries (Chesapeake Bay Program 2009b). The introduction of invasive aquatics is largely caused by the release or escape of bait fish and other organisms released by anglers. Although the state of Maryland does not currently have restrictions on nonnative live bait, the Navy should be implemented proactive measures to protect native fish populations and prevent the spread of aggressive nonnative species by prohibiting use of all live bait other than night crawlers and bloodworms. Additional measures including prohibiting use of all live nonnative bait and the release of live bait (on land or water) would also help prevent the introduction and spread of invasive species. All unused bait should be put in a plastic bag or container and placed it in the trash for proper disposal. Use of nonnative alternative live baits such as Nuclear Worms (*Namalycastis abiuma*), will continue to be prohibited at NSA Annapolis.

The installation also participates in the state's Clean Marina Program (MDNR 2009). The Clean Marina Initiative is a voluntary program that encourages marina operators and recreational

boaters to protect coastal water quality by engaging in environmentally-sound operating and maintenance procedures. Certified marinas meet the rigorous pollution prevention standards established by the Maryland Clean Marina Committee and the MDNR. In January 2009, the Mill Creek Marina received a "Clean Marina Partner" designation from MDNR in recognition of efforts focused on environmental protection and conscientiousness. The Carr Creek Marina is still in the process of making improvements.

(5) Migratory Bird Management

Migratory birds are a large, diverse group of birds that utilize breeding grounds in the United States and Canada, and overwinter in southern North America, Central and South America, the West Indies, and the Caribbean. The MBTA, 16 USC §703-711 is the primary legislation in the United States established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds their eggs, parts, and nests unless permitted by regulation. As of March 2010, 1007 species were included on the list of migratory birds (75 FR 9282). Nonnative species such as house sparrow, European starling, rock pigeon, and mute swan are not protected by the MBTA.

The Final Rule on Take of Migratory Birds by the Armed Forces (50 CFR Part 21) allows for the incidental take of migratory birds by DoD during military readiness activities. This rule authorizes such take, with limitations, that result from military readiness activities. If DoD determines that a proposed or an ongoing military readiness activity may result in a significant adverse effect on a population of a migratory bird species, they must confer and cooperate with the USFWS to develop appropriate and reasonable conservation measures to minimize or mitigate identified significant adverse effects.

Military readiness activities include 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. Military readiness does not include: the routine operation of installation support functions, such as: administrative offices; military exchanges; commissaries; water treatment facilities; storage facilities; schools; housing; motor pools; laundries; MWR activities; shops; mess halls; the operation of industrial activities; or, the construction or demolition of facilities listed above (72 FR 8931). 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.

Additional protection for migratory birds on federal properties is provided by EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds of 2001. This EO stresses incorporating bird conservation principles in agency management plans and requires federal agencies to enter into a MOU on migratory birds with the USFWS.

(6) Forest Management

The forest communities at NSA Annapolis are relatively small with little or no potential for commercial timber production. Therefore, forest management at the installation primarily concerns urban forest management and conservation and enhancement of existing forest resources. Although forest resources are not managed for timber production, they do provide a number of social, environmental, and economic benefits to the base. Specific benefits provided by urban forests and woodland communities include watershed protection, wildlife habitat, visual buffers, and recreational opportunities for installation personnel.

(7) Vegetation Management

The primary guidances on grounds maintenance practices on Navy properties are DoDI 4715.3 – Environmental Conservation Program and the 1994 President’s Executive Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds (60 Federal Register 40837). DoDI 4715.3 states that each installation shall, to the extent practical, use regionally native plants and other beneficial techniques for landscaping. The concept of beneficial landscaping emphasizes:

- Using regionally native plants;
- Using construction practices that minimize adverse effects on the natural habitat;
- Preventing pollution by reducing fertilizers and pesticides, using IPM techniques, recycling green waste, and minimizing runoff;
- Using water-efficient practices; and
- Creating outdoor demonstrations incorporating native plants, as well as pollution prevention and water conservation techniques, to promote awareness of the environmental and economic benefits of implementing this directive.

Beneficial landscaping integrates native vegetation and wildlife habitat into the landscape and minimizes the adverse effects that landscaping has on the natural environment. The use of regionally native plant species, which are generally better suited for local site conditions than nonnative species, reduces the need for intensive maintenance and the use of fertilizers and pesticides. Native plant species are also less likely to become invasive pests than nonnative species and serve as better sources of food and cover for native wildlife.

(8) Invasive Species Management

Invasive species are any species that are not native to a given ecosystem, and whose introduction causes or is likely to cause economic or environmental harm and/or harm to human health (EO 13112 – Invasive Species). Because of their ability to alter natural ecosystems and diminish the abundance or survival of native species, invasive species are recognized as a leading threat to natural ecosystems and biodiversity, as well as a leading cause of species becoming threatened

and endangered. It is estimated that 42 percent of the species protected by the ESA are at risk primarily because of nonnative, invasive species (Pimentel et al. 2005).

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 into native ecosystems, and 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,
- Promote public education on invasive species,
- Conduct research on invasive species to prevent their introduction and provide for environmentally sound control, and
- Not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species.

In addition, the Federal Noxious Weed Act of 1974 (7 USC 2814) provides for the control of noxious plants on lands under the control or jurisdiction of the federal government. Section 15 of the Act requires federal land management agencies to develop and establish a management program for control of undesirable plants that are classified under state or federal law as undesirable, noxious, harmful, injurious, or poisonous, on federal lands where similar programs are being implemented on state and private lands in the same area. Of the seven listed noxious weeds in Maryland (Maryland Department of Agriculture 2010), two have been found at NSA Annapolis. Canada thistle (*Cirsium arvense*) and Johnsongrass (*Sorghum halepense*) have been documented at both USNA and NSAA North Severn.

a. Detection and Monitoring

Early detection and rapid response are the principal strategies to successful invasive plant management (Federal Interagency Committee for the Management of Noxious and Exotic Weeds 2003). Detection strategies include the use of remote imaging, random surveys, and roadside surveys. Such techniques are appropriate for use on large land areas when the goal is to detect nascent infestations before they become fully established. For small land areas or areas with known invasive species populations, pedestrian surveys using handheld global positioning system (GPS) units to document the location and extent of invasive species, provide the most accurate and useful information for detecting and assessing infestations.

Monitoring is important in assessing the spread of invasive species populations and/or the effectiveness of control efforts. To facilitate monitoring, precise treatment areas should be mapped or delineated in the field. Invasive species that have been identified, but not treated, should also be monitored periodically (approximately 2-3 year intervals) to assess site conditions. If the population is determined to be spreading, treatment options should be considered. An accurate assessment of the extent and location of invasive species is the first step to a successful invasive species control program.

b. General Control Methods

In accordance with DoD policy on pest management, invasive species management should employ the principles of IPM to help minimize use of pesticides. In IPM, the full range of pest control options (biological, mechanical, 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.

Biological controls involve the use of natural enemies that limit the spread of plants or other animals through parasitism, predation, disease, or feeding. The use of biological controls would require coordination with APHIS-WS, which is responsible for controlling introductions of species brought into the United States for biological control of plants. In some cases the natural enemy of the invasive species itself becomes a problem by attacking native species thus increasing disturbance and the overall problem. Biological controls are not generally recommended for use at NSA Annapolis.

Mechanical controls including mowing, cutting, pulling, girdling, and burning are frequently used to manage and eradicate invasive species. Small infestations may often be controlled by hand pulling, grubbing with a hoe, or by using other mechanical devices if incorporated into a long-term management plan. However, such methods cause soil disturbance, which can encourage reinvasion, incursions by other pests, and potentially increased soil erosion. These methods are also generally not practical in eradicating large infestations unless combined with chemical controls. Using a combination of mowing or cutting and a selective application of herbicide on targeted invasive plant species is often the most effective approach.

Herbicide use is the most commonly used method of controlling invasive species. Because of environmental risks, herbicide treatments that rely on selective application methods, which minimize the release of the herbicide into the environment, are generally preferred over broadcast methods. These methods help avoid or minimize impacts to desirable, non-target species and are more consistent with the Navy's policy on IPM and reduction in pesticide use (DoDI 4150.7). Direct foliar sprays, basal bark applications, and cut-surface (also called cut-stump) treatments are the selective application methods that are generally recommended for control of invasive species at NSA Annapolis. Any herbicide used at NSA Annapolis must be on the installation's list of approved pesticides as provided by the installation IPMP (U.S. Navy

1997). All installation pest management personnel who apply or supervise the application of pesticides must be trained and certified within two years of employment in accordance with the DoD Plan for the Certification of Pesticide Applicators and all contractor pesticide applicator must hold a Pesticide Applicator Certificate and License issued by the Maryland Department of Agriculture.

(9) Outdoor Recreation and Environmental Awareness

It is Navy policy to provide outdoor educational and recreational opportunities appropriate to the mission and the resources of Navy installations. In addition, the Sikes Act requires that installations provide public access for natural resources uses to the extent it is appropriate and consistent with the installation mission. The development of recreational fisheries opportunities are further promoted by EO 12962 – Recreational Fisheries, which requires federal agencies to improve the quantity, function, sustainable productivity, and distribution of aquatic resources for recreational fishing. An MOU between DoD and the Department of the Interior provides guidance on the management of natural resources for outdoor recreation.

Opportunities for natural resources-based outdoor recreation improve quality of life for Navy personnel and foster environmental awareness and a sense of stewardship among Navy personnel and guests. Outdoor recreation includes any consumptive or non-consumptive program, activity, or opportunity dependent on the natural environment. Consumptive outdoor recreation includes activities such as fishing and hunting. Non-consumptive outdoor recreation includes hiking, camping, bird watching, and other forms of nature study.

(10) Agricultural Outleasing

In accordance with OPNAVINST 5090.1C, the Navy must identify lands that are suitable for agricultural outlease purposes when compatible with military needs. Outleasing land that is suitable for agriculture and is not used in direct support of the installation mission is a practice that helps reduce maintenance costs to the installation, earns revenue for the installation that can be used to support other natural resources programs, and benefits the local economy. Each agricultural outlease must include a conservation plan that details the best management practices to protect the natural resources and government interests under the lease. NAVFAC provides the technical and administrative functions of this program in accordance with reference. In addition, the Navy must identify and minimize adverse effects of their actions on prime and unique farmlands in accordance with 7 USC 4201 et seq. (Farm Land Protection Policy).

(11) Wildland Fire Management

Although there is a low probability of wildland fire occurring at NSA Annapolis, prescribed burning may be used as a natural resources management tool at NSAA North Severn and is therefore included in this INRMP. Two DoD instructions that address wildland fire management

are DoDI 6055.06 (DoD Fire and Emergency Services Program) and DoDI 4715.3 – Environmental Conservation Program. DoDI 6055.06 directs installations to plan for and respond to wildland fires on using 2001 Federal Wildland Fire Management Policy (Interagency Federal Wildland Fire Policy Review Working Group 2001); whereas DoDI 4715.3 states that all DoD components must manage fire in a manner to preserve health and safety, protect facilities, and facilitate the health and maintenance of natural systems.

(12) Conservation Law Enforcement

According to OPNAVINST 5090.1C, conservation law enforcement is the enforcement of laws aimed at protecting natural resources (and recreation activities that depend on natural resources). Military installations with active hunting and fishing programs or with federally protected species may be best served by including conservation law as integral part of a natural resources program. There is little need for conservation law requirement at NSA Annapolis and the USNA Security Department handles all law enforcement. If a natural resources violation were to occur, state and/or federal conservation officers would be permitted access to enforce natural resources laws after taking proper safety and security measures.

(13) Cultural Resources

Cultural resources consist of prehistoric and historic sites, shipwrecks, buildings, engineering structures, districts, artifacts, or any other physical evidence of human activities considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources can be divided into three major categories: (1) archaeological resources (prehistoric and historic); (2) architectural resources; and (3) traditional cultural properties. Archaeological resources are locations and objects from past human activities. Architectural resources are those standing structures that are usually over 50 years of age and are of significant historic or aesthetic importance to be considered for inclusion in the NRHP. Traditional cultural resources are those that hold importance or significance to Native Americans or other ethnic groups in the persistence of traditional culture.

Prehistoric occupation in the Mid-Atlantic region, including Anne Arundel County, is divided into three major periods that reflect technological and social adaptation and development. These periods are the Paleo-Indian, Archaic, and Woodland. The Archaic and Woodland periods are further divided into Early, Middle, and Late subperiods.

Paleo-Indian period (10,000–7500 B.C.) sites are characterized by the presence of portable, versatile toolkits containing finely crafted, fluted stone projectile points, usually made of high quality cryptocrystalline stone.

The Archaic period (7500–2000 B.C.) is marked by the onset of a gradual warming period that brought about technological and cultural adaptations. The Early Archaic subperiod (7500–6000 B.C.) serves as a transitional phase as smaller projectile point styles were introduced (DoN

2006e). During the Middle Archaic subperiod (6000–4000 B.C.) food technologies changed, including the introduction of ground stone tools for food preparation, and an increased reliance on fishing and shellfish gathering. The Late Archaic subperiod (4000–2000 B.C.), also known as the Terminal Archaic or Transitional period, had a large increase in population and social complexity.

The Woodland period (2000 B.C.–A.D. 1600) is defined by the introduction of pottery. By the Late Woodland subperiod (AD 900–1600), horticulture became a significant part of the overall subsistence system. Hundreds of prehistoric archaeological sites have been recorded in the Chesapeake Bay region, including along the Severn River and its tributaries.

Historic archaeological sites ranging from the Colonial period through the early twentieth century are also numerous in the project region. The Chesapeake Bay and other area waterways have served as vital routes of transportation and trade from Colonial times to the present. Beginning in the seventeenth century, the earliest European settlers established large estates along the larger rivers that flowed to the Chesapeake Bay.

Anne Arundel County and Annapolis, in particular, are rich in history and cultural resources. Cultural resources at NSA Annapolis sites have been found to represent almost every identified phase of Mid-Atlantic region human occupation and settlement. Sites range from small prehistoric activity sites and shell middens to the remains of domestic, agricultural, commercial, and military complexes dating from the seventeenth through the nineteenth century.

C. NATIONAL ENVIRONMENTAL POLICY ACT COMPLIANCE

NEPA of 1969, 42 USC §4232 et seq., requires all federal agencies take into consideration the potential environmental consequences of proposed actions in their decision-making process. The objectives of NEPA are to ensure that the government makes informed decisions and the public is included in the decision-making process and that all reasonable alternatives for an action are considered.

NEPA is a procedural law that requires review and compliance with other laws. These include, but are not limited to: the CAA; CWA; CZMA; MMPA; NHPA; Research and Sanctuaries Act; Pollution Prevention Act; and ESA.

Per Section 102 of NEPA, all agencies of the federal government must address the following environmental planning requirements:

- Utilize a systematic, interdisciplinary approach to ensure the consideration of natural resources and the environment in planning and decision making;
- Prepare a detailed statement (i.e., an Environmental Impact Statement) for major federal actions significantly affecting the quality of the environment;

- Study, develop, and describe appropriate alternatives to actions that use or impact natural resources or the environment;
- Recognize the worldwide and long-range character of environmental problems; and
- Initiate and utilize ecological information in the planning and development of resource-oriented projects.

The Secretary of the Navy Instruction (SECNAVINST) 5090.6A and OPNAVINST 5090.1C establish Navy policy, procedures, and responsibilities for NEPA documentation for Navy actions. It is Navy policy to initiate the NEPA processes at the earliest possible time to be an effective decision-making tool in the course of identifying a proposed action and to develop and carefully consider a reasonable range of alternatives for achieving the purpose of the proposed action.

The Council on Environmental Quality (CEQ) defines an INRMP as a major federal action requiring NEPA analysis. As a result, the Navy Office of General Counsel has determined that Sikes Act requirements for INRMP implementation necessitate the preparation of NEPA documentation prior to INRMP approval. It is expected that updates and revisions would be covered under the original NEPA documentation unless there has been a major change in installation mission or program scope.

An environmental assessment (EA) was developed for the implementation of the USNA INRMP in 2001 (U.S. Navy 2001a). The EA resulted in a finding of no significant impact (FONSI). No major change in program scope has occurred since that time; therefore, no new NEPA documentation nor opportunity for public review are required for this INRMP update. Individual projects and actions identified in the INRMP, however, may require further NEPA documentation.

To ensure compliance with NEPA and other substantive regulations, the proponent of any action at NSA Annapolis with the potential to impact the environment or that requires state or federal permits must contact the Asset Management Branch who fill out appropriate environmental checklists, which ensure planners and natural resource managers are actively involved with and aware of the various projects that require environmental review and coordination. Two environmental forms; the NEPA Worksheet/Record of Decision (ROD) and Project Environmental Permits Record of Decision are required and are available on the PWD Annapolis share drive.

D. BENEFICIAL PARTNERSHIPS AND COLLABORATIVE RESOURCE PLANNING

The development of partnerships with state and federal natural resources agencies as well as local conservation and academic institutions makes such expertise available to natural resources personnel to accomplish set goals and objectives. An added benefit of cooperating with volunteers and conservation groups to assist with natural resources projects is that it fosters good

community relationships and allows the volunteers to become invested in the area's natural resources. The following is a list of groups and agencies that have formed or may be available to form significant partnerships with the NSA Annapolis natural resources program.

- The USFWS is a primary stakeholder in the development and review of this INRMP and provides assistance in matters that concern the conservation, protection, and management of fish and wildlife species.
- The MDNR Wildlife and Heritage Service assists in matters that concern the conservation, protection, and management of fish and wildlife species.
- The MDNR Natural Heritage Program provides information and guidance related to threatened and endangered species information.
- Anne Arundel Community College Environmental Center, the Severn River Association, and the Anne Arundel County Soil Conservation District provided assistance with shoreline erosion control and the creation of beach strand and tidal marshes.
- The MDNR Forest Service assisted with prescribed burns of the native grasses and provided technical advice for a six-acre pine plantation.
- The MDNR Fisheries Service cooperated on a terrapin study and exhibit at the Greenbury Point Nature Center.
- Friends of College Creek has worked to improve the health of College Creek watershed. Projects include inventory storm water outfalls, trash pickup, locating abandoned boats, turning a lawn area at USNA into a butterfly meadow, and investigating the feasibility of removing a bulkhead along USNA shores and restoring marshlands.
- The Severn River Tributary Team holds monthly meetings and sends email updates on local events, in which the natural resources manager participates.
- Partners in Flight provided for the establishment and monitoring of Migratory Avian Productivity and Survivorship mist-netting stations.
- The Alliance for the Chesapeake Bay provides assistance in meeting the mandates of the Agreement of Federal Facilities on Ecosystem Management in the Chesapeake Bay.
- The Chesapeake Bay Program is a regional partnership that's been directing and conducting the restoration of the Chesapeake Bay since the signing of the historic Chesapeake Bay Agreement of 1983. The Navy is a key partner in the program. The Bay Program and its partners offer multiple grant opportunities to help fund restoration projects of all sizes across the Chesapeake Watershed. The DoD Chesapeake Bay Program provides assistance in meeting the mandates of the Agreement of Federal Facilities on Ecosystem Management in the Chesapeake Bay and other Chesapeake Bay Agreements.
- The Midshipmen Action Group is a community relations program organized and maintained by the Brigade of Midshipmen. The Midshipmen Action Group supports a variety of educational, environmental, and social service volunteer projects.

- The National Aquarium in Baltimore provides volunteers through partnership to support conservation projects in the Chesapeake Bay watershed.

E. INRMP IMPLEMENTATION

(1) Preparing Prescriptions and Projects

During development of this INRMP, the natural resources manager and cooperating parties have defined goals, identified legal drivers, and collaborated to develop natural resources management objectives at NSA Annapolis. A list of management prescriptions necessary to meet these goals and objectives was also developed. Detailed management prescriptions including recommended actions, cost estimates, funding classification, and an implementation schedule are in Appendix 1.

(2) Achieving No Net Loss

The Sikes Act states that an INRMP shall provide for no net loss in the capability of military installation lands to support the military mission of the installation. Therefore, mission requirements and considerations have been integrated into this INRMP and the capability to support the mission is a natural resources priority. Natural resources activities that reduce soil erosion; protect rare species to prevent them from becoming federally listed; protect and restore land and waterways from invasive nonnative species infestation; and promote the protection and enhancement of wetlands and floodplains help achieve no net loss of the NSA Annapolis mission.

(3) Use of Cooperative Agreements

A Cooperative Agreement is used to acquire goods or services or stimulate an activity authorized by Federal statute. Use of cooperative agreements requires substantial involvement between the federal agency and recipient during performance of the activity. Sikes Act Cooperative Agreements may be used to accomplish work identified in the INRMP and may be entered into with states, local governments, non-governmental organizations, and individuals to provide for the maintenance and improvement of natural resources or to benefit natural resources research on DoD installations. Cooperative Agreements authorized by the Sikes Act are not subject to the provisions of the Federal Grant and Cooperative Agreement Act, but must comply with the procedural requirements of the DoD Grant and Cooperative Agreement Regulations. In accordance with the Sikes Act, funds approved for a particular fiscal year may be obligated to cover the costs of goods and services provided under a Cooperative Agreement during any 18-month period beginning in that fiscal year. Using cooperative agreements to accomplish projects is an efficient means to implement INRMPs and can be administered through the NAVFAC Washington office.

(4) Funding INRMP Implementation

a. Project Classification

The Office of Management and Budget (OMB) and the EPA require federal agencies to classify natural resources projects based in part on compliance requirements. DoDI 4715.3, Enclosure 4, provides detailed guidance on programming and budgeting natural resources projects. The priority classifications (Class 0 through Class III) are summarized below.

Class 0: Recurring Natural Resources Conservation Management Requirements. Includes activities needed to cover the recurring administrative, personnel, and other costs associated with managing the DoD conservation program. Recurring costs consist of manpower, training, supplies, hazardous waste disposal, recycling activities, permits, fees, testing and monitoring and/or sampling and analysis, reporting and record keeping, maintenance of environmental conservation equipment, and compliance self-assessments.

Class I: Current Compliance. Includes projects and activities needed because an installation is currently out of compliance; has a signed compliance agreement; has received a consent order; has not met requirements based on applicable federal or state laws, regulations, standards, presidential EOs, or DoD policies; and/or are immediate and essential to maintain operational integrity or sustain readiness of the military mission.

Class II: Maintenance Requirements. Includes projects and activities not currently out of compliance but which will be out of compliance if projects or activities are not implemented in time to meet an established deadline beyond the current program year.

Class III: Enhancement Actions Beyond Compliance. Includes those projects and activities that enhance conservation resources or the integrity of the installation mission, or are needed to address overall environmental goals and objectives, but are not specifically required under regulation or EO and are not of an immediate nature.

An additional Navy funding classification consists of four Environmental Readiness Levels (ERLs). Environmental Readiness Level 4 are “must fund” conservation requirements that meet recurring natural and cultural resources conservation management or current legal compliance needs, including EOs.

Specifically, Environmental Readiness Level 4:

- Supports all actions specifically required by law, regulation or EO (DoD Class I and II requirements);
- Supports all DoD Class 0 requirements as they relate to a specific statute such as hazardous waste disposal, permits, fees, monitoring, sampling and analysis, reporting and record keeping;

- Supports recurring administrative, personnel and other costs associated with managing environmental programs that are necessary to meet applicable compliance requirements (DoD Class 0);
- Supports DoD policy requirement to comply with overseas Final Governing Standards and Overseas Environmental Baseline guidance Document; and
- Supports minimum feasible Navy executive agent responsibilities, participation in Office of the Secretary of Defense (OSD) sponsored inter-department and inter-agency efforts, and OSD mandated regional coordination efforts.

Environmental Readiness Level 3:

- Supports all capabilities provided by ERL4
- Supports existing level of Navy executive agent responsibilities, participation in OSD sponsored inter-department and inter-agency efforts, and OSD mandated regional coordination efforts;
- Supports proactive involvement in the legislative and regulatory process to identify and mitigate requirements that will impose excessive costs or restrictions on operations and training; and
- Supports proactive initiatives critical to the protection of Navy operational readiness.

Environmental Readiness Level 2:

- Supports all capabilities provided under ERL3;
- Supports enhanced proactive initiatives critical to the protection of Navy operational readiness;
- Supports all Navy and DoD policy requirements; and
- Supports investments in pollution reduction, compliance enhancement, energy conservation and cost reduction.

Environmental Readiness Level 1:

- Supports all capabilities provided under ERL2;
- Supports proactive actions required to ensure compliance with pending/strong anticipated laws and regulations in a timely manner and/or to prevent adverse impact to Navy mission; and
- Supports investments that demonstrate Navy environmental leadership and proactive environmental stewardship.

An additional assessment level is assigned to projects to assist in recognizing appropriate funding sources in environmental program requirements exhibits. The following descriptions of Navy Assessment Levels are summarized from the Navy Environmental Requirements Guidebook (CNO 2003). Navy Level 1 requirements are those prescribed by state or federal laws, regulations, and EOs; Level 1 requirements include OMB/EPA Class 0, I, or II projects and ongoing efforts. Navy Level 2 requirements are derived from DoD or Navy policy; Level 3

requirements are for pending regulations; Level 4 requirements meet future requirements; and Level 5 requirements are leadership initiatives.

All conservation, compliance, and stewardship projects must be entered into the Environmental Projects Request (EPR)-web system and receive approval up the chain of command. CNO N45 is the final authority for designating the appropriate Environmental Readiness Level. Proposed projects necessary to implement this INRMP, an implementation schedule, funding level, and proposed funding source are described in Appendix 1. All actions contemplated in this INRMP are subject to the availability of funds properly authorized and appropriated under federal law. Nothing in this INRMP is intended to be nor must be construed to be a violation of the Anti-Deficiency Act (31 USC 1341 et seq.).

b. Funding Sources

Operations and Maintenance, Navy (O&MN) environmental funds are the primary sources of resources to support OMB/EPA Classes 0, I, and II and ERL4 actions. Other special DoD initiatives to fund natural resources projects also become available on a limited basis. In addition, alternate funding sources for special projects and initiatives may be sought from cooperative grants and partnership programs. These grants require a written proposal and often are cost sharing opportunities. A list of funding resources is in Table 2-2.

(5) Geographic Information Systems Management

Geographic data and information are an integral part of natural resources and environmental protection and planning at NSA Annapolis. A geographic information system (GIS), created by Eagan, McAllister Associates, Inc., was maintained by the natural resources program until 2002. The NSA Annapolis GIS is now maintained as part of the NAVFAC GeoReadiness Repository. This repository was developed to provide geospatial information relative to the Navy's Real Property Inventory to support functional areas including facilities management, environmental management, antiterrorism/force protection, base development/planning, regional planning, and range management. The GeoReadiness Repository, completed in 2004, provides a single source of authoritative strategic-level geospatial data for Class I (land) and Class II (facilities) properties (Carlen and Bason 2004). The GeoReadiness Repository enforces the Spatial Data Standards for Facilities, Infrastructure, and Environment. The GeoReadiness Repository provides a corporate resource for sharing existing data at the Regional level and must be kept current by updates from the NSA Annapolis and NAVFAC Washington natural resources managers.

(6) Training of Natural Resource Personnel

The Sikes Act requires, to the extent practicable using available resources, the Navy ensure that sufficient numbers of professionally trained natural resources management personnel and natural resources law enforcement personnel are available and assigned responsibility to perform tasks

necessary to carry out natural resources management programs. In support of this requirement, a variety of formal Navy environmental training courses are available through (1) the Naval School, Civil Engineer Corps Officer, Port Hueneme, California; (2) Naval Occupational Safety and Health and Environmental Training Center, Norfolk, Virginia; and (3) the Interservice Environmental Education Review Board.

The list of courses offered and billet-specific environmental training requirements are identified in Appendix P of OPNAVINST 5090.1C.

Other courses that are pertinent to natural resources management at NSA Annapolis include:

- Wetlands Regulations
- Wetlands Delineation & Practicum
- CZMA/Chesapeake Bay Act/Coastal Consistency Determinations
- Invasive Species Control
- Coastal Ecology/Shoreline Stabilization

Annual National Military Fish and Wildlife Conference

Table 2-2. Traditional and Alternative Funding Sources

Funding Source	Description	Proposal Deadline
Navy Funding		
Operations and Maintenance Navy (O&MN)	Annual appropriations for the operation and maintenance of the Navy. Includes such costs as operations, civilian salaries and awards, travel, fuel, minor construction projects up to \$750K, installation maintenance and operations support.	see POM
Operations and Maintenance, Navy Reserve (O&MNR)	Annual appropriations for the operation and maintenance of the Navy Reserves	See POM
Commercial Forestry Funds	Supports commercial forestry operations at Navy installations or commands incurring obligations for the production and sale of forest products. Forest management program obligations must be related directly to the economic production and sale of forest products and the enhancement, protection, conservation and management of Navy forests. Reimbursable obligations do not include expenses that are for the protection of forests that are incapable of economic production of forest products.	Annual Increment (plan for upcoming fiscal year due no later than 1 May)
Forestry Reserve Project Funds	DoD Forestry Reserve Account funds may be used on Navy installations for: improvement of forest lands; unanticipated contingencies in the administration of forest lands and the production of forest; natural resource management that implements approved plans and agreements.	No later than 1 February
Agricultural Outleasing Funds	Available to Navy installations for natural resources conservation projects. These funds may be used for the development, update, and implementation of stewardship projects such as wildlife habitat enhancement, agricultural improvements, and equipment maintenance as listed in the INRMP. Priority is given to funding agricultural outleasing program expenses.	No later than 1 Sept
Recycling Funds	Installations with a Qualified Recycling Program (QRP) may use proceeds for some types of natural resource projects. Up to 50 % of net proceeds may be used for pollution prevention/abatement projects such as wetlands or riparian forest restoration or outdoor recreation projects such as trail construction and maintenance.	Based on Regional Instructions
Alternative Funding		
Legacy Resources Management Program (Legacy)	Supports a range of DoD efforts to preserve natural and cultural resources on regional level. Partnerships are generally required. https://www.dodlegacy.org/legacy/index.aspx	Variable, check website
National Public Lands Day	Small grants up to \$6,500 available for base-level projects that use volunteers to improve and enhance the public lands. http://www.publiclandsday.org/managers/funding_and_awards.htm	No later than 1 June
Strategic Environmental Research and Development Program (SERDP)	DoD environmental science and technology program that funds environmental research and development through a competitive process. Funding opportunities are offered for four core focus areas; environmental restoration, munitions management, sustainable infrastructure, and weapons systems platforms. http://www.serdp.org/funding/ .	Variable, check website
The National Fish and Wildlife Foundation	Offers matching grants for on-the-ground conservation projects for the conservation of fish, wildlife, plants and the habitats on which they depend. Grant programs include Pulling Together, Native Plant Conservation Initiative, and Regional IPM Competitive Grant Program. http://www.nfwf.org/Content/NavigationMenu/Grants/GrantGuidelines/default.htm	Project proposals are received on a year-round, revolving basis with two decision cycles per year.
Chesapeake Bay Program	The Chesapeake Bay Program and its partners offer multiple grant opportunities to help fund restoration projects of all sizes across the Chesapeake watershed. http://www.epa.gov/region03/chesapeake/grants.htm	Variable, check website
USFWS Neotropical Migratory Bird Conservation Act Grants Program	Provides matching grants for the protection and management of neotropical migratory bird populations. Grant requests must be matched by partner contributions at no less than a 3:1 by non-federal funds. http://www.fws.gov/birdhabitat/Grants/index.shtm .	November
USFWS North American Wetlands Conservation Act Grant Program	Supports projects that involve long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitats. Grant requests must be matched by partner contributions at no less than a 1:1 by non-federal funds. http://www.fws.gov/birdhabitat/Grants/index.shtm	Variable, check website
NOAA Community-based Restoration Program (CRP)	Provides financial and technical assistance that helps communities implement sound habitat restoration projects including tidal wetlands, shellfish reefs, submerged aquatic vegetation, and coastal streams. http://www.nmfs.noaa.gov/habitat/restoration/funding_opportunities/funding_ner.html	Variable, check website

3. REGIONAL HISTORY AND ENVIRONMENT

A. GENERAL LOCATION

NSA Annapolis is located in Anne Arundel County, Maryland and is approximately 30 miles east of Washington, DC and 20 miles southeast of Baltimore. The activity is comprised of the 342 acres of the USNA Main Campus, 827 acres of NSAA North Severn, and 857 acres of the USNA Dairy Farm, and totals 2,023 acres. Anne Arundel County is in the Western Shore Region of Maryland and is bordered to the east by the Chesapeake Bay.

USNA and NSAA North Severn are in the eastern portion of Anne Arundel County. USNA lies on the western shore of the Severn River and is divided into two parcels, the Upper Yard and Lower Yard, by College Creek. NSAA North Severn lies on the river's eastern shore and is bounded by the Chesapeake Bay to the south and east. The USNA Dairy Farm is located in north-central Anne Arundel County, 17 miles northwest of USNA in Gambrills, Maryland.

B. REGIONAL HISTORY

The land currently occupied by NSA Annapolis has a long history of human habitation and use (U.S. Navy 2000c). Archeological evidence indicates indigenous peoples have occupied the coastal region of Maryland from the Paleo-Indian/Early Archaic period through the Woodland period. The discovery of a fluted projectile point near the head of the Severn River indicates the presence of humans there as early as 10,000 years ago. Traces found in the Broadneck area date to the Late Archaic period. During the Late Woodland period, seasonal camps were located along the coastline for fishing, clamming, and hunting, and permanent villages and croplands were located inland along the Severn River (Anne Arundel County 2009b). Before European settlers arrived in Maryland, Algonquin-speaking tribes occupied the region. The Algonquin tribes lived in small hamlets along the western shore of the Chesapeake Bay and rivers where they farmed, fished, hunted, and traded. By the time of English settlement, however, the Algonquin tribes had been forced out by raiding parties of the Susquehannock tribe, who used the area as hunting grounds (Brugger and Requardt 1996). The early European settlers signed a treaty with the Susquehannocks in 1652. The Susquehannocks then moved northward where, in 1661, they began a period of warfare with the Cayugas and Senecas. The Susquehannocks were defeated after smallpox killed over half of their warriors in 1674. After the withdrawal of the Susquehannocks, other Indians-primarily Choptanks, Mattaponys, and Piscataways frequented the area briefly, but the Severn had become dominated by English settlements (Anne Arundel County 2009b).

In 1649, a settlement was founded on the north shore of the Severn River at Greenbury Point by Puritan exiles from Virginia. The town of Providence was located near Mill Creek and it is believed that the first meeting house was constructed at the head of Carr Creek. Several other structures were constructed at the settlement, including a fort at the end of Greenbury Point as

protection from the Susquehannock. By 1660, Providence had grown considerably and increasing trade prompted the need for a seaport. The best site was determined to be across the Severn and slightly upriver from Providence. The site was first surveyed by Thomas Todd in 1651 and soon became known as Proctor's Landing or Town at Proctor's, then Town at the Severn, and later Anne Arundel Town, after the wife of Lord Baltimore.

The town was nearly surrounded by water, and a wall was constructed from Acton's Cove on Spa Creek to Crocus Creek, which was a cove of Dorsey Creek (now College Creek) (Severn River Commission 2008). In 1694, the state capitol was moved from St. Mary's to the site and in 1695 the town was renamed Annapolis in honor of the Princess Anne (Brugger and Requardt 1996).

In the mid-1770s, at the beginning of the Revolutionary War, forts and gun emplacements were built overlooking the harbor at Greenberry Point and Windmill Point to provide defenses for the strategically important Annapolis port. After the war, the State House briefly served as the capitol of the new nation and is where Washington resigned his commission.

In 1808, renewed tension with Britain led to the building of forts to protect American ports. One of these was Fort Severn. It was built on a ten-acre site at Windmill Point and had a circular brick rampart and a ten-gun battery. Fort Madison, slightly larger, was built across the river at the same time. Another important feature of the time was the lighthouse on Greenberry Point, which stood from approximately 1846-1878. However, the site was destroyed by erosion (since 1849 Greenberry Point has been reduced approximately 500 feet) (Severn River Commission 2008). In 1845, the Army transferred Fort Severn to the Navy for use as a training school for officers.

C. REGIONAL LAND USE

Based on Maryland Department of Planning 2002 GIS land use data, Anne Arundel County is 30 percent (114,007 acres) open water and 70 percent (265,347 acres) land. Land uses/land cover classifications for the county is 30 percent (111,620 acres) urban, 11 percent agriculture (42,225 acres), 29 percent (14,214 acres) forest, less than 1 percent (1,646 acres) wetland, and less than 1 percent (596 acres) barren land or beaches.

USNA is adjacent to the city of Annapolis. Annapolis is a relatively small city, though it is the state capitol, with a population of 36,600 (U.S. Census Bureau 2009). Downtown Annapolis, located between Spa Creek and College Creek, supports business, government, and housing. The city's historic core, a largely intact pre-industrial colonial city, is designated a National Historic Landmark (City of Annapolis 2008). Residential neighborhoods surround the city's core area. USNA, St. John's College, and the Maryland State Government are the major institutions located in downtown. The maritime industry is another key part of the Annapolis economy. Maritime businesses including sailing, fishing, and recreational boating as well as marine related trades are concentrated along Annapolis' waterfront areas.

The NSAA North Severn site is located across the Severn River from USNA on the Broadneck Peninsula. The peninsula supports sparse residential and commercial development, recreation, and agriculture. The town of Arnold, Maryland, population 24,400 (U.S. Census Bureau 2009), Anne Arundel Community College, and Sandy Point State Park are located on Broadneck Peninsula.

The USNA Dairy Farm is located in a rural portion of the county with low density residential development, though urban encroachment from Washington and Baltimore threaten the rural character of the area. The USNA Dairy Farm lies within a planned “Greenways Network”, which is an interconnected network of protected corridors of woodlands and open space that will protect ecologically valuable lands, provide open space and recreational benefits, and preserve wildlife habitats (Anne Arundel County 2008a). Fort Meade and the Patuxent Research Refuge are other major federal facilities located near the USNA Dairy Farm.

D. GENERAL PHYSICAL ENVIRONMENT

(1) Climate and Weather

The winter climate in Maryland is intermediate between the cold of the northeastern United States and the mild weather of the South. Extremely cold air masses from the interior of the continent are moderated by passage over the Appalachian Mountains and in the Annapolis area, by the nearby Chesapeake Bay. Summer is characterized by considerable warm weather including hot, humid periods; however, nights are usually quite comfortable. January is the coldest month with a normal average low of 25.4 degrees Fahrenheit (°F) (Table 3-1) and July is the warmest month with a normal average high of 88.2°F (Southeast Regional Climate Center 2008). The average annual precipitation is 43.6 inches, which is distributed relatively evenly throughout the year, with March and August receiving slightly greater amounts. No more than a few inches of snow typically accumulates and such events usually last only a few days.

Table 3-1. Annapolis, Maryland Monthly Climate Summary (1951-2005)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave. Max Temp (F)	43.3	46.2	54.8	66.7	76.3	84.2	88.2	86.2	80.2	68.4	57.6	46.7	66.6
Ave. Min Temp (F)	25.4	27.5	34.4	44.3	53.8	62.4	67.5	66.3	60.0	47.7	38.1	29.0	46.4
Ave. Annual Precipitation (in)	3.06	2.94	4.27	3.47	4.03	3.56	4.00	4.26	3.84	3.21	3.40	3.54	43.6
Mean Snowfall (in)	4.0	3.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.9	11.0
Ave. Snow Depth (in)	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Source: Southeast Regional Climate Center 2009

(2) Physiography, Geology, and Soils

Anne Arundel County is in the Atlantic Coastal Plain physiographic province in Maryland (Maryland Geological Survey 2001). The Atlantic Coastal Plain province extends from Cape Cod south to Florida along the Atlantic Ocean and west to Texas along the Gulf Coast. The Coastal Plain Province is underlain by a wedge of unconsolidated sediments including gravel, sand, silt, and clay. The sediments are complexly stratified, forming a sequence of aquifers and confining beds. The sediments of the Coastal Plain dip eastward at a low angle, generally less than one degree, which thickens to more than 8,000 feet at the Atlantic coast line. In Anne Arundel County the Coastal Plain deposits range in thickness from a few tens of feet along its northwestern boundary with Howard County to as much as 2,500 feet at the Chesapeake Bay shore (Maryland Geological Survey 2007).

The sediments of the Coastal Plain range in age from Triassic to Quaternary periods. The younger formations crop out successively to the southeast across Southern Maryland and the Eastern Shore. A thin layer of Quaternary gravel and sand covers the older formations throughout much of the area (Maryland Geological Survey 2001). The primary geologic formations underlying the Anne Arundel County area include Lowland Deposits from the Quaternary period, and the Aquia, Matawan, Brightseat, Magothy, and Nanjemoy formations from the Tertiary period (Maryland Geological Survey 1968). There are no major geographical structural features and no fault lines in the area and no earthquakes have been recorded since 1876 (Maryland Geological Survey 2003).

The soils of Anne Arundel County formed in unconsolidated marine sediments and are generally deep and well-drained to excessively-drained. Exceptions to the well-drained soils are the hydric soils. Hydric soils are defined by the National Technical Committee for Hydric Soils as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

Many of the soils in Anne Arundel County are also classified as prime farmland, which is land that has the best combination of physical and chemical characteristics to meet the food and fiber needs of the country (USDA, NRCS 2008), or farmland of state importance. Farmland of state importance includes land that does not meet the criteria for prime, but is considered to be statewide importance for the production of food, feed, fiber, forage, and oilseed crops. It may include tracts of land that have been designated for agriculture by state law. Prime farmland and farmland of state importance are regulated under the Farmland Protection Policy Act (FPPA [7 USC §4201 et seq.]). The FPPA restricts actions of the federal government that would cause the irreversible conversion of prime and unique farmland to nonagricultural uses. Construction for national defense purposes however is not subject to the FPPA.

(3) Hydrology

a. Watersheds

NSA Annapolis is located in the Upper Chesapeake hydrologic subregion of the Chesapeake Bay watershed (Figure 3-1). The Chesapeake Bay watershed is the largest estuary in the United States and encompasses more than 64,000 square miles including portions of Virginia, Maryland, Delaware, West Virginia New York, Pennsylvania, and the District of Columbia (Chesapeake Bay Program 2008b).

On a more regional level, USNA and NSAA North Severn are located in the Severn River watershed within the Lower Western Shore tributary basin (Anne Arundel County 2008b). The Severn River watershed covers an 81 square mile-area and empties into the Chesapeake Bay just past Spa Creek.

The USNA Dairy Farm is primarily (approximately 93 percent) located in the Little Patuxent watershed within Patuxent River tributary basin. The Little Patuxent River joins the Patuxent River just southeast of the Patuxent Research Refuge between the towns of Bowie and Crofton.

The drainage area of the Little Patuxent River watershed is 103 square miles (MDE 2008b). A smaller portion of USNA Dairy Farm land (approximately 7 percent) drains eastward into Jabez Branch, which is in the Severn River watershed. Jabez Branch is a watershed of high concern, as it is the only natural trout stream in the Coastal Plain physiographic province.

b. Wetlands

Wetlands are defined as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Environmental Laboratory 1987). Wetlands provide a valuable ecological service by acting as filters to cleanse polluted waters, protect shorelines from erosion and recharge aquifers. Additionally, wetlands are highly productive ecosystems that support both terrestrial and aquatic life, and act as climate stabilizers and carbon sinks on a global scale (Armentano and Menges 1986).

Based on the Cowardin wetland classification system (Cowardin et al. 1979), wetlands can be divided into five major types: marine (M), estuarine (E), riverine (R), lacustrine (L), and palustrine (P). Each system is further divided into a series of subsystems and classes.

Estuarine

Estuarine wetlands are those that are periodically flooded with tidally influenced salty or brackish waters with salinity greater than 0.5 parts per thousand ppt. Estuarine wetlands may be subtidal (E1) if the substrate is continuously submerged or intertidal (E2) if the substrate is exposed and flooded by tides.

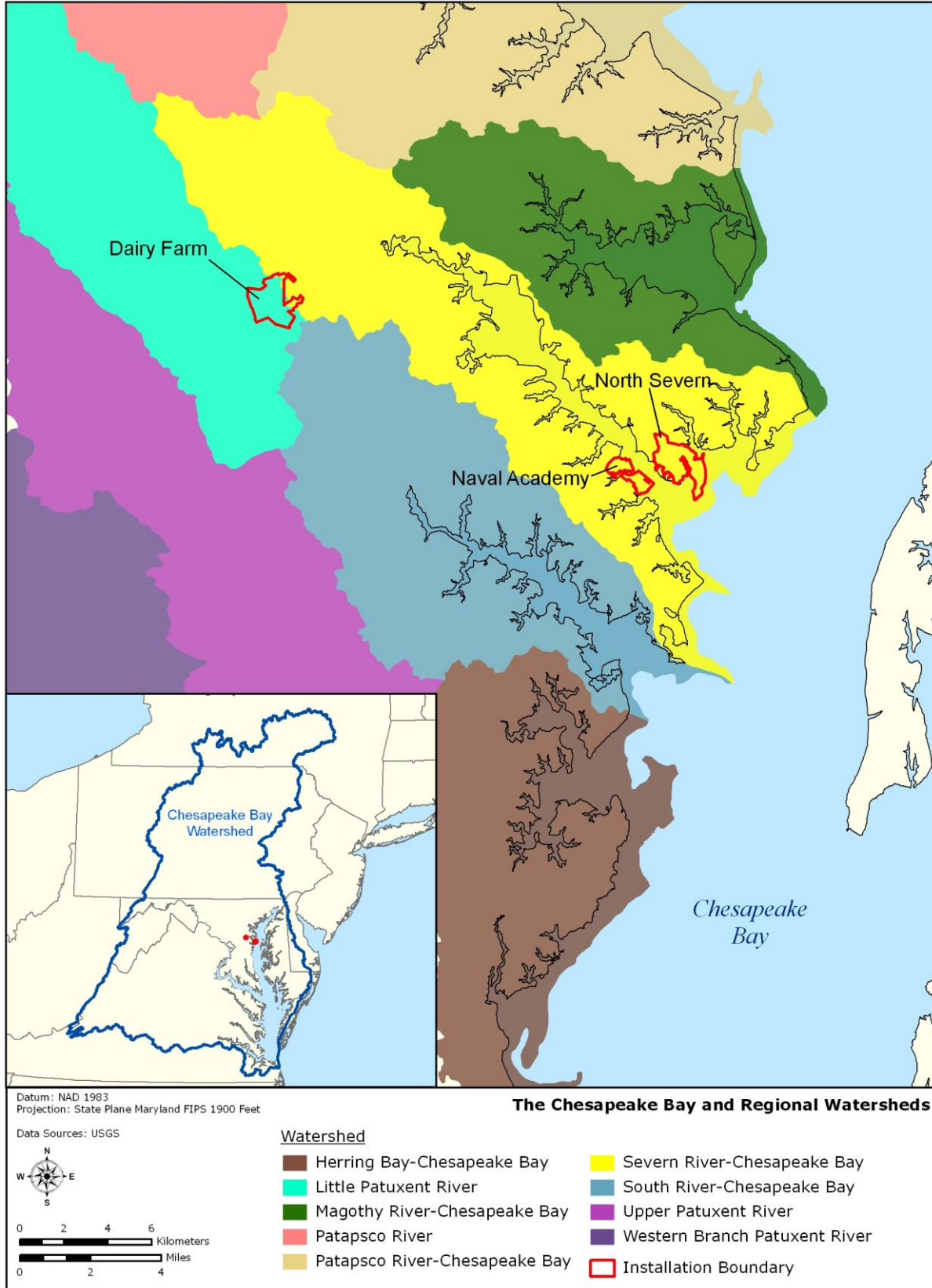


Figure 3-1. The Chesapeake Bay and Regional Watersheds

Riverine

The riverine system includes natural or artificially created wetlands that are contained within a channel and are not dominated by persistent vegetation nor have salinity greater than 0.5 ppt. Riverine systems may be tidal (R1) if water velocity fluctuates under tidal influence; perennial (R2 or R3) if there is a constant flow of water throughout the year; or intermittent (R4) if the channel contains water for only part of the year.

Lacustrine

The lacustrine system includes areas of open water that are greater than 20 acres or deeper than 6.6 feet at low water. Lacustrine waters may be tidal or nontidal, but must have salinity less than 0.5 ppt. Lacustrine wetlands lack trees, shrubs, and persistent emergent vegetation.

Palustrine

Palustrine wetlands are nontidal vegetated wetlands or open water habitats less than 20 acres or 6.6 feet deep that have salinity less than 0.5 ppt. Palustrine wetlands can include unconsolidated bottom (PUB), emergent (PEM), scrub-shrub (PSS), and forested (PFO). Mixed categories can also occur.

c. Floodplains

Anne Arundel County is prone to three types of flooding: nontidal flooding from rivers and streams; tidal flooding from storm surges and tides; and coastal flooding caused by intense winds and heavy rains from tropical storms and hurricanes (Anne Arundel County 2008a). The Federal Emergency Management Agency (FEMA) is the federal agency responsible for floodplain management. Floodplains are defined as an area likely to be inundated by a flood with a particular degree of frequency. One hundred- year flood levels for the Severn River and its tributaries that could pose a potential flood-threat to NSA Annapolis are established in the FEMA maps. FEMA defines the 100-year flood as an area that has a one percent chance of being equaled or exceeded in any given year and is the standard used by federal agencies for floodplain management. Rarer, but potentially more devastating 500-year floods also occur at USNA. A 500-year flood has a 0.2 percent chance of occurring in any given year. Currently, FEMA is working in partnership with MDE to update floodplain studies and associated mapping for 17 Maryland counties. Anne Arundel County's updated floodplain study is expected to be completed in 2011 and will more accurately estimate the flooding risk in the county (Maryland 2011).

d. Surface Water

The Chesapeake Bay and Severn River are the major surface water features in the vicinity of NSA Annapolis. The Chesapeake Bay is the largest estuarine system in the United States and is located along the mid-Atlantic coastal region bordering Maryland, Virginia and Washington

D.C. (Reshetiloff 2004). The bay is almost 190 miles in length and varies from 4 miles wide at its narrowest point 35 miles at the mouth of the Potomac River. It has an average depth of 21 feet, though there is a relatively deep (65 to 95 feet) one-half mile-wide channel extending down the central axis. Including the broad shallow areas that flank each side of the long central channel, the surface of the Chesapeake Bay covers over 64,000 square miles (Kemp et al. 2005). Salinity is one of the primary factors influencing the physical make up of the Chesapeake Bay. Salinity in the bay ranges from tidal freshwater (salinity <0.5 practical units [psu]) in northern reaches to polyhaline (salinity >18 psu) conditions near the mouth of the bay (Marshall et al. 2005).

The 23-mile long Severn was declared a Scenic River by the General Assembly of Maryland in 1971 and has also been listed by the MDE as an impaired waterway by failing to maintain water quality adequate to sustain its designated uses. The Severn was listed as impaired based on sediments, nutrients, fecal coliform in tidal portions of the basin, and impacts to biological communities (MDE 2009). Commercial and residential development, shoreline erosion, runoff from farms, urban runoff, and in adequate public sewers and private septic systems, however, all contribute to the low water quality of the Severn (Chesapeake Bay Alliance 2003). The Severn ranges in salinity from approximately 10 to 15 psu, depending on season and rainfall (U.S. Navy 2008).

e. Groundwater

Anne Arundel County relies primarily on ground water pumped from the Upper Patapsco, Lower Patapsco, and Patuxent aquifers (Maryland Geological Survey 2007). The city of Annapolis owns and operates its own water supply system and uses groundwater from the Magothy and Patapsco aquifers. The Magothy aquifer has elevated iron concentrations, which make it less appealing for residential use; therefore it is used primarily for irrigation and minor public supply.

As water demand increases with population growth, groundwater levels are lowered. Water levels measured in observation wells in any of the aquifers Anne Arundel County generally do not exceed 75 feet below sea level; however, in response to pumping, water levels have declined to as much as 90 feet below sea level. Pumpage from the well fields has also caused significant cones-of-depression in several locations across the county. Water-levels in the Upper Patapsco, Lower Patapsco, and Patuxent aquifers have declined at rates of up to 1.5 feet per year (Maryland Geological Survey 2007). Water levels have declined at rates ranging from 0.2 to 1.4 feet per year in the Aquia aquifer and 0.7 to 0.9 feet per year in the Magothy aquifer (Maryland Geological Survey 2002).

Groundwater from Maryland's confined aquifers are regulated in order to assure a continued supply of water and to prevent dewatering of the confined aquifer. Applications for groundwater appropriation permits are evaluated by MDE to determine whether the water-level decline resulting from those withdrawals exceeds a management level (Maryland Geological Survey

2007). Special management considerations are also taken into account when permitting withdrawals for the Aquia aquifer in the Annapolis Neck area of Anne Arundel County to prevent saltwater intrusion (MDE 2007).

Although natural groundwater quality is generally good, some areas have been shown to have elevated levels of iron, radium, copper, lead, barium, nitrate, and other contaminants. Surveys of naturally-occurring radionuclides in groundwater have shown that portions of the Magothy, Patapsco, and Patuxent aquifers in Anne Arundel County are subject to high levels of radium. Radium, lead, cadmium, aluminum, and other contaminants were also found to exceed EPA standards for drinking water in the western portion of the county near Gambrills (Maryland Department of Health 2007). MDE and the Department of Health have worked with Anne Arundel County to address groundwater contaminants in the aquifers in the northern portion of the county. The county health department currently requires new wells in the affected area to be sampled for gross alpha and radium, and if test results indicate radionuclides above the drinking water standard, owners must employ treatment to remove the radium prior to obtaining a certificate of potability for the well (MDE 2007).

E. REGIONAL BIOTIC ENVIRONMENT

(1) Flora

According to the U.S. Forest Service (USFS) Ecological Units of the United States (USFS 2005) Maryland encompasses portions of three ecological provinces; the Eastern Broadleaf Forest Province, Central Appalachian Broadleaf – Coniferous Forest Province, and Outer Coastal Plain Mixed Forest Province. The eastern portion of the state is in the Outer Coastal Plain Mixed Forest Province. More specifically, Anne Arundel County is in the Northern Atlantic Coastal Plain Section, which is characterized by forests of oak – hickory, oak – pine, and loblolly – shortleaf pine cover types (USFS 2005). Various forest alliances including white oak (*Quercus alba*) – northern red oak (*Quercus rubra*), hickory (*Carya* spp.) and loblolly pine (*Pinus taeda*) – white oak forests occur on dry upland sites, whereas sweetgum (*Liquidambar styraciflua*) – red maple (*Acer rubrum*) and sycamore (*Platanus occidentalis*) – ash (*Fraxinus* spp.) – sugarberry (*Celtis occidentalis*) forests occur in forested wetlands (MDNR 2004).

Three federally listed plant species, sensitive joint vetch (*Aeschynomene virginica*), swamp pink (*Helonias bullata*), and American chaffseed (*Schwalbea americana*) are known to occur in Anne Arundel County (MDNR 2007). None of these has been documented at NSA Annapolis.

(2) Fauna

a. Mammals

Ecoregions in Maryland are highly diverse, ranging from vast open water areas to forested mountains, providing a rich array of wildlife habitat that is crucial for faunal abundance and diversity. Including introduced and native species, 75 species of land mammals are estimated to occur within the state (MDNR 2005). Mammals inhabiting terrestrial and wetland areas across Maryland and in most of its counties include smaller insectivores and rodents like the northern short-tailed shrew (*Blarina brevicauda*), eastern mole (*Scalopus aquaticus*), eastern gray squirrel (*Sciurus carolinensis*), southern flying squirrel (*Glaucomys volans*), Norway rat (*Rattus norvegicus*), and several species of mice, including the house mouse (*Mus musculus*) and white-footed mouse (*Peromyscus leucopus*). Other common small mammals include the eastern cottontail (*Sylvilagus floridanus*), big brown bat (*Eptesicus fuscus*) and little brown bat (*Myotis lucifugus*). Larger to medium-sized mammals include whitetail deer, American beaver (*Castor canadensis*), Virginia opossum (*Didelphis virginiana*), red and gray foxes (*Vulpes vulpes*, *Urocyon cinereoargenteus*, respectively), muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*), striped skunk (*Mephitis mephitis*), groundhog (*Marmota monax*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*). The coyote, originally a western animal, is now found in all Maryland counties (MDNR 2006, 2007b).

b. Marine Mammals

NSA Annapolis lies within the known range of 10 marine mammal species (six cetacean, three pinniped, and one sirenian species) that have regular or rare occurrences in the Chesapeake Bay. These include the North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), West Indian manatee (*Trichechus manatus*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), harbor porpoise (*Phocoena phocoena*), harbor seal (*Phoca vitulina*), gray seal (*Halichoerus grypus*) and harp seal (*Pagophilus groenlandicus*). Of these, three baleen whale species (North Atlantic right, humpback, and fin whale) and one sirenian species (West Indian Manatee) are listed as endangered under the ESA (U.S Navy 2008). With the exception of grey and harp seals, which are sporadic (rare) visitors, the other eight species occur regularly in the Chesapeake Bay (U.S Navy 2008). The bottlenose dolphin and harbor porpoise are expected to be the most common species in Chesapeake Bay with others generally present at very low densities. However, no stranding, bycatch, or sightings have been documented for NSA Annapolis for any of the marine mammals (U.S Navy 2008).

c. Sea Turtles

Five species of sea turtles have been recorded in the Chesapeake Bay and may occur, if rarely, in the vicinity of NSA Annapolis. These include the leatherback (*Dermochelys coriacea*),

loggerhead (*Caretta caretta*), Kemp's ridley (*Leipidochelys kempii*), Atlantic green (*Chelonia mydas*), and Atlantic hawksbill (*Eretmochelys imbricate*) turtles. The ESA categorizes the leatherback, Kemp's ridley, and hawksbill turtles as endangered, with the loggerhead and green turtles listed as threatened (U.S. Navy 2008).

Areas in the Chesapeake Bay designated as 'primary occurrence' are those areas and habitats where the species is expected to be primarily found; areas of 'secondary occurrence' are areas and habitats where the species may be found, especially during anomalous environmental conditions (hurricanes, etc.); and areas of 'rare occurrence' are where the species is not expected to be found with any regularity (U.S. Navy 2008).

Based on research to date, the vicinity of NSA Annapolis is designated as an area of primary occurrence for Kemp's ridley and green turtles from May to October; an area of secondary occurrence for the loggerhead from May to June and September to October; and an area of rare occurrence for the leatherback from May to October. During the months of July and August, the mouth of the Severn River is designated a primary area of occurrence and the tributaries secondary areas of occurrence for the loggerhead turtle. Hawksbill turtles are considered extralimital in the Chesapeake Bay as only three hawksbills have been encountered within the Bay since 1979. No stranding, bycatch, or sightings have been documented for NSA Annapolis for any of the sea turtles (U.S. Navy 2008).

d. Birds

The diverse ecological communities in Maryland provide habitat for a variety of migratory and resident bird groups including wetland-open water species, woodland species, successional-scrub species, grassland species, and urban species. The avian community is the most diverse faunal community in Maryland and reflects the wide variety of available habitats. Over 400 species of birds have been identified on the *Official List of the Birds of Maryland* (MDNR 2007b). Additionally, Maryland is an important stop in the Atlantic Flyway, a major migratory flight route in North America. Migratory birds are a large, diverse group of species and portions of Maryland serve as an important stopover for their breeding and overwintering, especially wintering waterfowl and wading birds in summer. Many breed in the state, others overwinter on their migration from the north and some simply pass through the state during spring and fall migrations (MDNR 2005).

Familiar birds common to the region's urban settings, open fields and forested areas include the house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchos*), rock pigeon (*Columba livia*), mourning dove (*Zenaida macroura*), Carolina chickadee (*Poecile carolinensis*), chimney swift (*Chaetura pelagica*), European starling (*Sturnus vulgaris*), northern mockingbird (*Mimus polyglottos*), American robin (*Turdus migratorius*), northern cardinal (*Cardinalis cardinalis*), killdeer (*Charadrius vociferus*), northern bobwhite quail (*Colinus virginianus*), American kestrel (*Falco*

sparverius), eastern bluebird, brown thrasher (*Toxostoma rufum*), wild turkey (*Meleagris gallopavo*), barn owl (*Tyto alba*), eastern screech owl (*Otus asio*), and a variety of warblers, wrens and woodpeckers.

The area's coastal environment is a significant raptor habitat for bald eagles, osprey (*Pandion haliaetus*), turkey vultures (*Cathartes aura*), and red-tailed hawk (*Buteo jamaicensis*). Wetlands and open water habitats support a variety of wading birds and waterfowl, including the red-winged blackbird (*Agelaius phoeniceus*), great blue heron (*Ardea herodias*), yellow-crowned night heron (*Nycticorax violacea*), great egret (*Ardea alba*), various sandpiper and tern species (*Calidris* spp. and *Sterna* spp. respectively), wood duck, mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), grebes (*Podiceps* spp.), pelicans (*Pelecanus* spp.), and Canada goose. Common gulls include the herring gull (*Larus argentatus*), laughing gull (*Larus atracilla*) and ring-billed gull (*Larus delawarensis*) (MDNR 2007b).

Rare, threatened, and endangered birds, as identified by the ESA, and birds of conservation concern, as identified by the USFWS (2008) that occur in the region are listed in Appendix 2.

e. Fish

Fish are another abundant wildlife group that inhabits the tidal waters off the shore of NSA Annapolis. Regional fish surveys (MDNR 2003a, USGS 1997, USACE 1996) indicate a number of species of environmental and/or economical importance are indigenous to the estuarine reaches of the Patuxent River and its tributaries. About 350 species of fish are known to occur in the Chesapeake Bay (Chesapeake Bay Program 2008a). The bay and its tributaries, such as the Severn River, serve as important spawning or nursery sites for many important commercial and recreational finfish and shellfish species. Several of these species are anadromous fish, which spend their adult life in the bay then migrate to the brackish or freshwater tributaries to spawn. Included are American and hickory shad (*Alosa sapidissim* and *Alosa mediocris*), blueback and alewife herring (*Alosa aestivalis* and *Alosa pseudoharengus*), and striped bass (*Morone saxatilis*).

Fish that occur in the Severn are affected by salinity, with freshwater fish dominating the fresher tidal headwater areas of the tributaries and the more salt tolerant marine fish dominating the major tidal waters. Fish that spawn in the freshwater ends of the Severn's tidal tributaries include pumpkinseed sunfish (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), and the invasive nonnative chain pickerel (*Esox niger*) and common carp (*Cyprinus carpio*). The tidal Severn supports American eel (*Anguilla rostrata*), white perch (*Morone Americana*), and smaller species such as Atlantic herring (*Clupea harengus*), hogchokers (*Trinectes maculates*) and banded killifish (*Fundulus diaphanus*). Saltwater fish that may enter the Severn River and its creeks include bluefish (*Pomatomus saltatrix*), spot (*Leiostomus xanthurus*), and the anadromous American shad, striped bass and needlefish (*Strongylura marina*) (Anne Arundel County 2008b).

Finfish and shell fish of the zones with higher salinity are species such as spot, croaker, striped bass, flounder, menhaden, herring, and shad as well as Blue Crabs, oysters, and clams.

f. Herpetofauna

Maryland is home to 90 herpetofauna species, a large number relative to the state's land mass. However, amphibians and reptiles are declining at alarming rates, with one of three species globally threatened. Habitat loss and degradation, biological and chemical contaminants, incompatible agricultural practices, disease, introduced invasive species, and global climate are some of the leading causes for declining populations (MDNR 2005). Frogs, especially, are highly sensitive to changes in the environment. With permeable skin that allows water and air to pass through without being filtered by the stomach, frogs are more vulnerable to harm by environmental pollutants and pathogens than many other animals. As such, frogs are considered biological indicators of ecosystem health (Bishop et al. 2003). Since the mid-1990s the incidence of frog malformations has gained international attention. The wide geographic distribution of malformed frogs and the variety of malformations are a concern to resource managers, research scientists, and public health officials. Any deformities observed in frogs at NSA Annapolis will be reported to the Reporting Center for Amphibian Malformations.

Commonly occurring amphibians in Maryland include frogs, toads, and salamanders. Several of the common frog and toad species are the American bullfrog (*Lithobates catesbeiana*), green treefrog (*Hyla cinerea*), gray treefrog (*Hyla chrysoscelis*), Cope's gray treefrog (*Hyla chrysoscelis*), northern green frog (*Lithobates clamitans melanota*), wood frog (*Lithobates sylvaticus*), eastern cricket frog (*Acris crepitans crepitans*), southern leopard frog (*Lithobates sphenoccephalus utricularius*), northern spring peeper (*Pseudacris crucifer*), upland chorus frog (*Pseudacris feriarum*), and American and Fowler's toads (*Bufo americanus* and *Bufo woodhousii fowleri*, respectively). Common salamanders include the marbled salamander (*Ambystoma opacum*), spotted salamander (*Ambystoma maculatum*), eastern red-spotted newt (*Notophthalmus viridescens viridescens*), eastern red-backed salamander (*Plethodon cinereus*), northern dusky salamander (*Desmognathus fuscus*), northern two-lined salamander (*Eurycea bislineata*), and the four-toed salamander (*Hemidactylium scutatum*) (MDNR 2007b).

Maryland reptiles of common occurrence include a wide variety of snakes, lizards, and turtles. Common snakes include the common ribbon snake (*Thamnophis sauritus sauritus*), eastern rat snake (*Pantherophis alleghaniensis*), eastern garter snake (*Thamnophis sirtalis sirtalis*), eastern hognose snake (*Heterodon platirhinos*), eastern king snake (*Lampropeltis getula getula*), eastern worm snake (*Carphophis amoenus amoenus*), northern black racer (*Coluber constrictor constrictor*), northern brown snake (*Storeria dekayi dekayi*), northern copperhead (*Agkistrodon contortrix contortrix*), northern ring-necked snake (*Diadophis punctatus edwardsi*), northern rough green snake (*Opheodrys aestivus*), northern water snake (*Nerodia sipedon sipedon*), smooth green snake (*Opheodrys vernalis vernalis*), and southern ring-necked snake (*Diadophis*

punctatus punctatus) (MDNR 2007b). Common lizards include the eastern fence lizard (*Sceloporus undulatus*), common five-lined skink (*Pleistiodon fasciatus*), and broad-headed skink (*Pleistiodon laticeps*). Common turtles include the eastern snapping turtle (*Chelydra serpentina serpentina*), northern red-bellied scooter (*Pseudemys rubriventris*), eastern box turtle (*Terrapene carolina carolina*), eastern mud turtle (*Kinosternon subrubrum subrubrum*), spotted turtle (*Clemmys guttata*), eastern painted turtle (*Chrysemys picta picta*), and the stinkpot (*Sternotherus odoratus*) (MDNR 2007b).

4. U.S. NAVAL ACADEMY

A. INSTALLATION INFORMATION

(1) General Location

USNA encompasses 342 acres located on the west bank of the Severn River, adjacent to the town of Annapolis, Maryland. It is divided by College Creek into two areas; the Lower Yard and Upper Yard. The Lower Yard area is east of College Creek and houses the majority of the academic functions. The Upper Yard is located to the west of College Creek and has administrative, medical, and housing functions (DoN 2007).

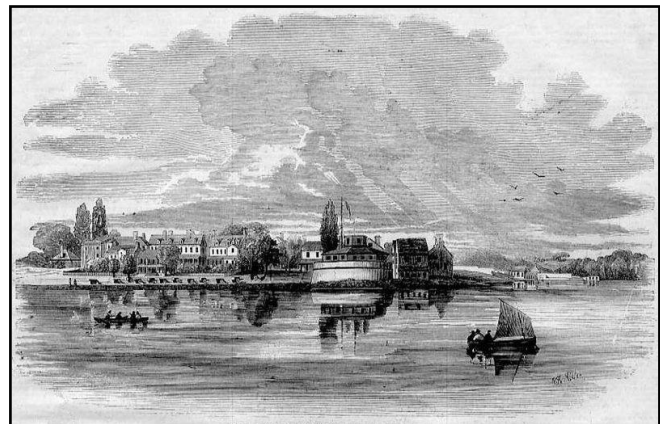
(2) Military Mission

USNA is an undergraduate professional four-year service academy for the Navy that prepares men and women to become professional officers in the U.S. Navy and Marine Corps. The mission of USNA is to “develop midshipmen morally, mentally, and physically and to imbue them with the highest ideals of duty, honor, and loyalty in order to provide graduates who are dedicated to a career of naval service and have potential for future development in mind and character to assume the highest responsibilities of command, citizenship and government” (U.S. Navy 2007a). The 4,000 men and women at USNA train at naval bases and on ships of the fleet each summer, while subjects such as small arms, drill, seamanship and navigation, tactics, naval engineering, naval weapons, leadership, ethics, and military law are taught during a four-year program. Bachelor of Science degrees specifying a major field are awarded to midshipmen upon graduation. They are commissioned as ensigns in the U.S. Navy or second lieutenants in the U.S. Marine Corps and will serve at least five as naval officers.

(3) Installation History

USNA was established as the Naval School in 1845 on approximately 10 acres of the abandoned Fort Severn at the junction of the Severn River and the Chesapeake Bay. The old fort buildings were initially used to support the functions of the new school. The Naval School was reorganized in 1850 as USNA with a four-year basic curriculum and summer program to train aboard ships.

Between 1846 and 1892 additional acreage was purchased and a series of expansions



General View of the Naval Academy, W. R. Miller, 1853

and modernizations were conducted. In 1895, comprehensive plans for rebuilding the Naval Academy using a French Renaissance design by architect Ernest Flagg were begun. The last building under this plan was completed in 1908. Just before the turn of the century, spoil from dredging operations was used to extend USNA shoreline to its current extent.

In 1932, Congress passed legislation authorizing USNA to confer the Bachelor of Science degree upon all graduates and enrollment climbed, reaching a peak of 3,100 midshipmen in 1941. In subsequent years, the Manning Commission (1947) and the Moreell Commission (1961) were appointed to re-examine the growth of USNA and modernization of the programs. In 1965, a new master plan was adopted that addressed the modernization and expansion of academic, athletic, and support facilities and utility systems necessary to support 4,000 plus midshipmen.

In 1963, USNA was designated a National Historic Landmark and placed on the National Register of Historic Places. In 1977, as defined by the National Register of Historic Places, a historic district was delineated at USNA. The district includes the entire main facility, excluding the family housing area north of Maryland Route 450 and the Perry Center complex.

(4) Operations and Activities

Operations and activities at USNA are in support of the education, training, development, and care of the 4,000 enlisted midshipmen. Operations are generally separated into different land use areas at the Academy. Included are:

- Academic
- Physical Education and Athletics
- Community Support
- Facilities Maintenance

Facilities at the Upper Yard include the facilities maintenance area, which is concentrated at the Perry Center and contains the Public Works contractors. A large housing area, now a public/private venture (PPV) operated by Lincoln Properties is located on a hill on the western edge of the Upper Yard overlooking the Severn River. Facilities at the Lower Yard include most of the athletic and academic facilities and Bancroft Hall, which houses the midshipmen (Figure 4-1).

Although future land use changes will likely affect the percentages of land dedicated to each operation and activity, currently approximately 102 acres (31 percent) on the Main Campus are dedicated to academics, 113 acres (33 percent) to athletics, 76 acres (23 percent) to community support, and 33 acres (10 percent) to facilities maintenance and industrial activities. Several small areas of field and forest, with no dedicated land use, also occur.

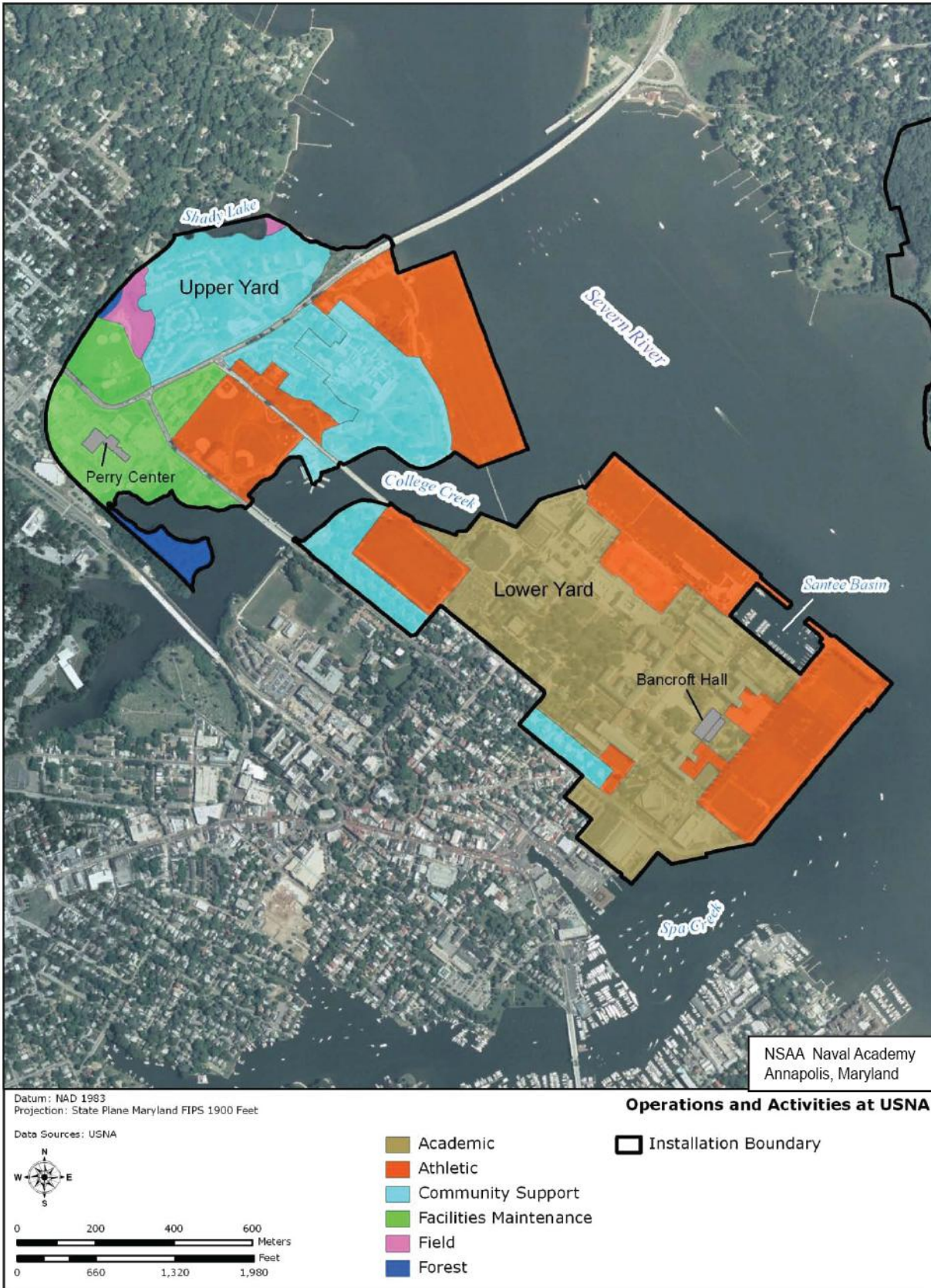


Figure 4-1. Operations and Activities at USNA

B. CONSTRAINTS AND OPPORTUNITIES

The dense concentration of development is the primary constraint to future development and land use change at USNA. Approximately 80 percent (272 acres) of the Main Campus is developed (buildings, parking and roads or other impermeable surface) or consists of athletic fields and parade grounds. These facilities are important to the USNA mission and are considered operational constraints to future development at the Academy.

A small area of wetlands (2 acres) on the Upper Yard presents a natural resources constraint to future development and land use change at USNA. Flooding is another constraint, as experienced during the 2003 Hurricane Isabel. However, as a large portion (42 percent) of USNA was developed within flood zones (FEMA 1996), flood damage reduction measures such as elevating any new construction and use of flood walls and berms are the facility's best option for avoiding flood damage. The historic district at USNA occupies another 54 acres. SAV beds are considered Special Aquatic Sites, as defined in 40 CFR Part 230 and are HAPC for a number of species. Therefore, the SAV that occurs off the USNA shoreline could pose an additional environmental constraint to development. Figure 4-2 illustrates the areas constrained by natural and cultural resources at USNA.

Overall, approximately 322 acres (94 percent) at USNA have operational, environmental, and/or cultural resources constraints. Areas with little or no constraints provide the best opportunities for mission growth and change. The 2007 USNA master plan update addresses the best options for consolidation, moving existing activities, and reutilization of developed parcels. Only 20 acres are not constrained by natural or cultural resources or existing operational activities.

C. GENERAL PHYSICAL ENVIRONMENT

(1) Physiography, Topography, and Soils

USNA is located in the Western Shore Lowlands Region of the Coastal Plain physiographic province. The area is characterized as a series of low (generally below 50 feet elevation) fluvial and estuarine terraces, beaches, and drowned river mouths that fringe the Western Shore Uplands (Maryland Geological Survey 2008). USNA occupies a relatively low profile along the adjacent Severn River. The lowest areas of USNA are along College Creek and the predominantly bulkheaded shoreline, which vary in elevation from sea level to approximately 10 feet (Figure 4-3). The highest point at USNA is at approximately 80 feet in elevation and is located at the staff housing area in the northwest portion of the facility. Steep slopes are generally restricted to the area north of College Creek and east of Bowyer Road. The USDA, NRCS has published several soil surveys for Anne Arundel County. The previous 1973 version (USDA, SCS 1973) was updated in 2002 and made available on the internet-based Web Soil Survey (USDA, NRCS 2008).

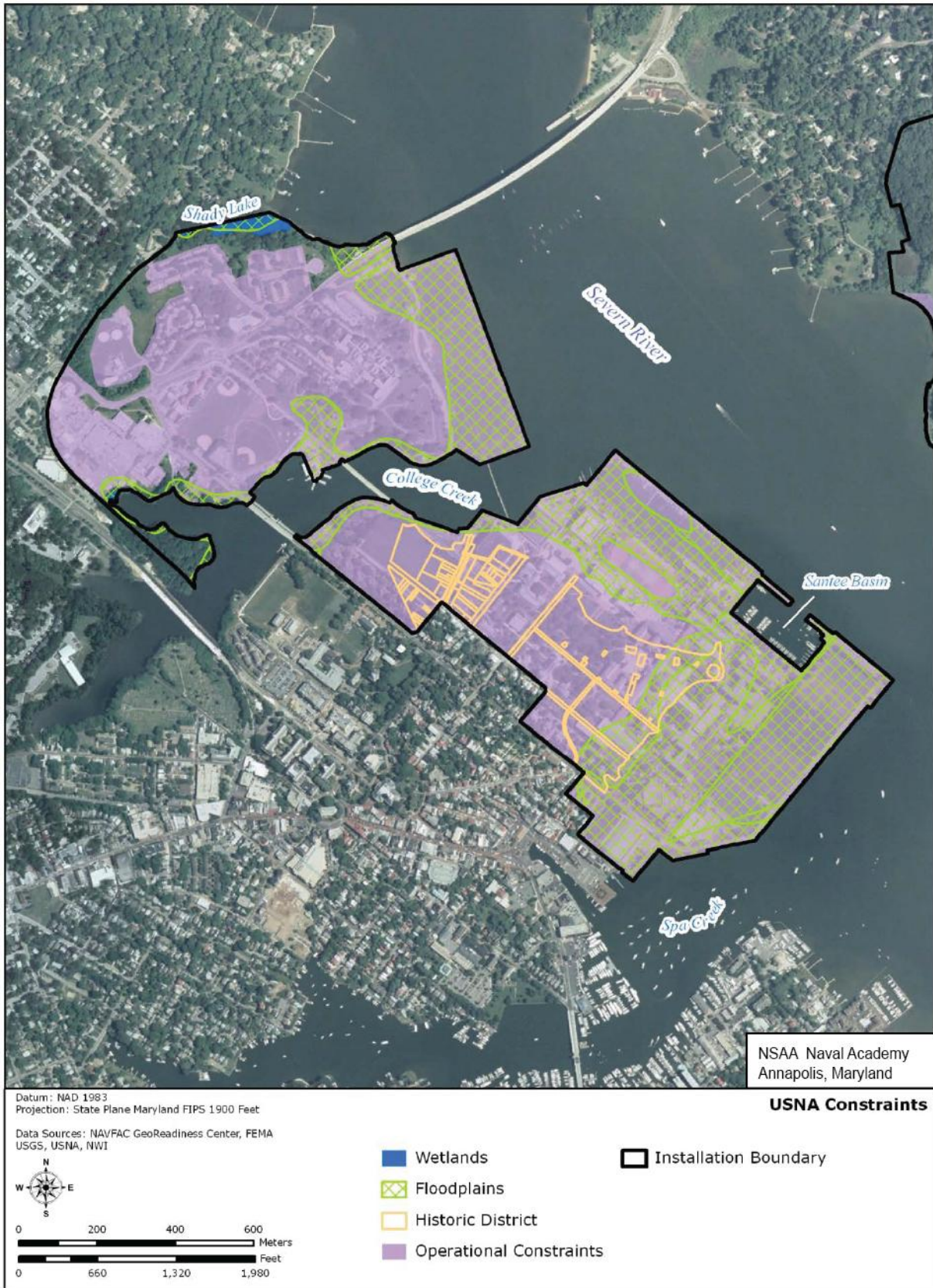


Figure 4-2. USNA Constraints



Figure 4-3. Elevation Contours at USNA

The updated soil survey indicates a large portion of the Academy consists of Udorthents, which are soils in cut and fill areas and other areas where the soil material has been highly disturbed, and Urban land, which are areas on which more than 80 percent of the surface is covered by asphalt, buildings, or other impervious materials (Table 4-1; Figure 4-4). There are six major soil series encompassed by the USNA grounds. Included are the Annapolis, Collington-Wist, Cumberstone-Mattapex, Donlonton, Udorthents, and Urban series. Of these, the Donlonton series is listed as a hydric soil of the United States (USDA, NRCS 2009). Only 4.2 acres (1.2 percent) of the soils at USNA are classified as hydric.

Table 4-1. USNA Soils

Label	Soil Series	Drainage Class	Acres
	Hydric		
DuB	Donlonton-Urban land complex, 0 to 5 percent slopes	Moderately well drained	4.2
	Non-Hydric		
AsA	Annapolis fine sandy loam, 0 to 2 percent slopes	Well drained	2.3
AsE	Annapolis fine sandy loam, 15 to 25 percent slopes	Well drained	3.3
AuB	Annapolis-Urban land complex, 0 to 5 percent slopes	Well drained	50.9
AuD	Annapolis-Urban land complex, 5 to 15 percent slopes	Well drained	9.9
CoC	Collington-Wist complex, 5 to 10 percent slopes	Well drained	6.2
CpB	Collington-Wist-Urban land complex, 0 to 5 percent slopes	Well drained	42.7
CpD	Collington-Wist-Urban land complex, 5 to 15 percent slopes	Well drained	47.5
CSE	Collington, Wist, and Westphalia soils, 15 to 25 percent slopes	Well drained	9.4
CyB	Cumberstone-Mattapex-Urban land complex, 0 to 5 percent slopes	Somewhat poorly drained	4.6
UxB	Udorthents, loamy, sulfidic substratum, 0 to 5 percent slopes	Well drained	87.1
Uz	Urban land	Onsite determination	70.7
Total			338.8

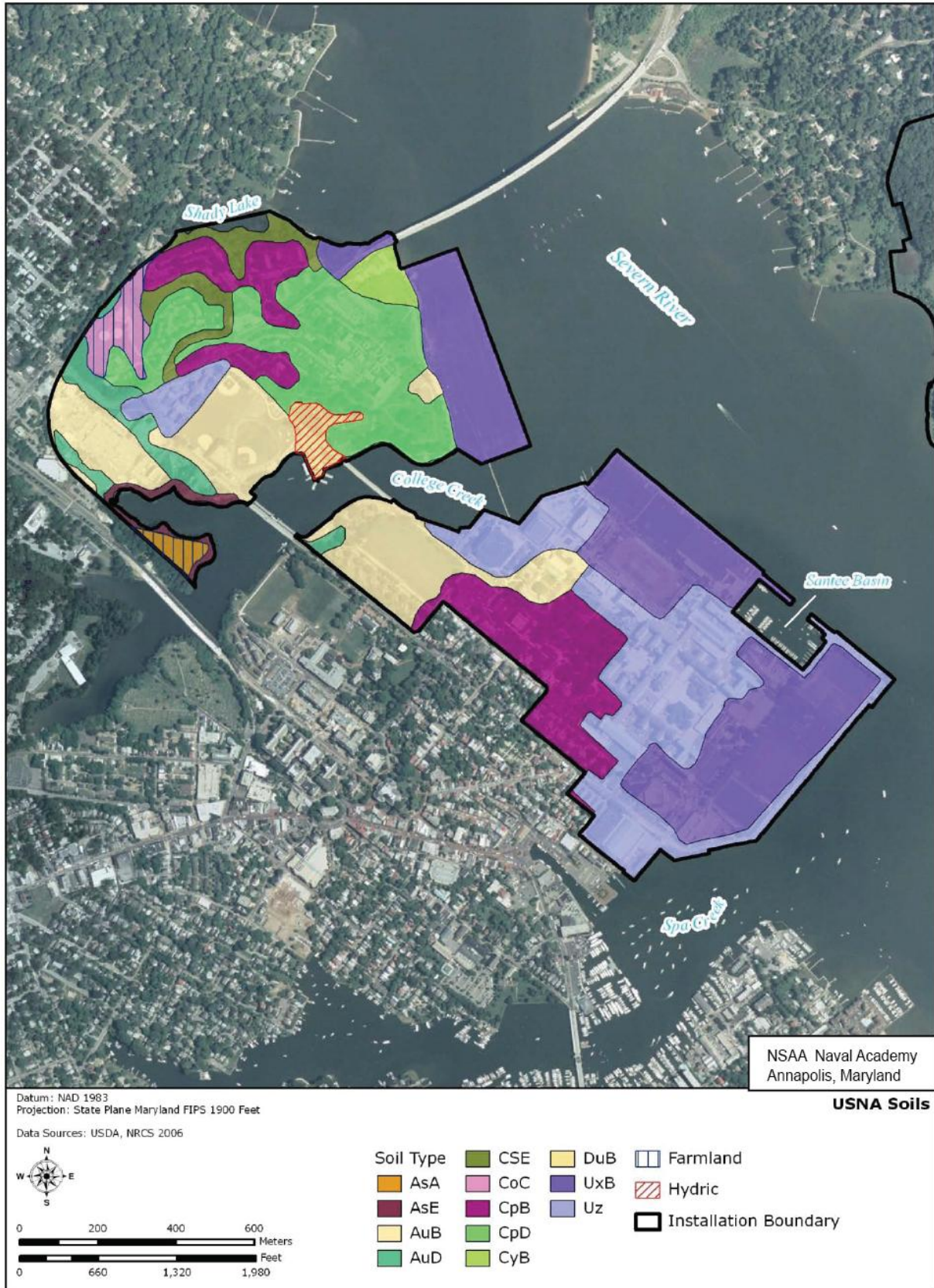


Figure 4-4. USNA Soils

D. PROGRAM ELEMENTS**(1) Threatened and Endangered Species and Species of Special Status*****a. Program Description and Current Conditions***

Threatened and endangered species management at USNA includes both federal and state-listed threatened and endangered species and species proposed for such listing, as well as other species that may be considered rare or sensitive. The NAVFAC PWD Annapolis Natural Resources Manager is responsible for rare, threatened and endangered species management and ensuring compliance with pertinent regulations and coordination with the USFWS and MDNR. The USFWS and MDNR Wildlife and Heritage Division provide guidance on rare species management issues and projects.

A survey for unique natural communities and rare, threatened and endangered species was conducted in 1996 at USNA (U.S. Navy 1997). Survey efforts focused on birds, plants, and butterflies. No state or federally listed threatened, endangered or candidate species were identified. Aquatic surveys of the creeks and rivers adjacent to USNA were not conducted; however, regional data from the Severn River Commission, MDNR Fisheries Services, and local watershed associations are available for these areas. One species of SAV, clasping-leaved pondweed (*Potamogeton perfoliatus*), which is classified as very rare (S2) by the MDNR Wildlife and Heritage Division, has been mapped in College Creek adjacent to USNA (NOAA Chesapeake Bay Office 2008).

Two state rare bird species; the bald eagle (S3.1B; rare to uncommon and extremely rare for breeding populations) and American peregrine falcon (*Falco peregrinus anatum*) (state-rare and in need of conservation), are present within the general area of USNA. Bald eagles are known to inhabit the Chesapeake Bay area, however, they are not known to nest at USNA or close enough for activities at the facility to affect them. The closest bald eagle nest is documented near Moss Pond (Therres 2009), south of the Chesapeake Bay Bridge, approximately two miles east of Greenbury Point. A pair of peregrine falcons has been documented on the Route 50 Bridge over the Severn River (Severn Riverkeeper 2007) less than two miles from USNA. Table 4-2 summarizes the rare species that have been observed near USNA.

b. Management Goals

The overall goal of this program element is to ensure compliance with the ESA, the BAGEPA, and applicable state regulations, and to protect and enhance rare species populations and their habitats where practicable.

Table 4-2. Rare Species Known to Occur at or Near USNA

Common Name	Scientific Name	Global Rank ¹	State Rank ²	State Status ³	Federal Status
Bird Species					
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	G4T4	S2	I	-
Bald Eagle	<i>Haliaeetus leucocephalus</i>	G5	S3.B1	-	-
Plant Species					
Clasping-leaved Pondweed	<i>Potamogeton perfoliatus</i>	G5	S2	-	-

¹G5 = Demonstrably secure globally

G4 = Apparently secure globally

²T = Intraspecific taxon is ranked differently than the full species²S1 = Extremely Rare

S2 = Very Rare

S3 = Rare to Uncommon

S_B = Breeding Status

³E = Endangered

T = Threatened

I = In need of conservation

Sources: MDNR 2010a, 2010b

c. Management Practices

No rare, threatened, or endangered species are known to occur at USNA, nor, because of the lack of suitable habitat, are any expected to occur. However, in order to meet management goals, the natural resources manager must ensure appropriate surveys are undertaken prior to beginning any activity with potential to impact rare, threatened, and endangered species. The action proponent must fill out a NEPA Worksheet/ROD and Project Environmental Permits Record of Decision with assistance of the Asset Management Branch who then forwards them to the Environmental Office. Reviews must be conducted during the early stages of planning for the most effective results. Appropriate consultation with the USFWS will be initiated if it is determined that there is potential to affect any federally listed species.

(2) Wetlands and Watershed Management

a. Program Description and Current Conditions

Wetlands and watershed management address tidal and nontidal wetlands, floodplain, and watershed management at USNA. The Air and Water Programs Manager and natural resources manager have responsibility for managing these resources. When necessary, the natural resources manager coordinates wetlands permitting and management activities with the USACE, USFWS, and MDE. The primary regulations driving this program include the CWA, the CZMA, EO 11990 – Wetland Protection, EO 11988 – Floodplain Management, and various Chesapeake Bay Program agreements and initiatives.

Wetlands

Although detailed wetland mapping has not been conducted, the NWI conducted by the Department of the Interior identified approximately two acres of estuarine emergent and scrub-shrub wetlands adjacent to Shady Lake. The Shady Lake site is comprised of a shallow tidal lagoon connected to the Severn River by a narrow tidal connection. The southern shore owned



Entrance to Shady Lake



Emergent Herbaceous and Woody Wetland Vegetation

by USNA is a low-lying tidal marsh dominated by common reed (*Phragmites australis*), smooth cordgrass (*Spartina alterniflora*), hightide bush (*Baccharis halimifolia*), and marsh elder (*Iva frutescens*). The northern shore is occupied by private properties where much of the historic tidal wetlands have been replaced by structural shoreline stabilization. A portion of the lagoon has been hardened with riprap. Wetland classifications at USNA were assigned using the Cowardin system (Cowardin et al. 1979) and include tidally influenced estuarine wetlands with areas of emergent herbaceous vegetation and woody shrubs (Table 4-3; Figure 4-5).

Table 4-3. Wetland Types at USNA

Code	Cowardin Classification	Acres
E1UBL	Estuarine subtidal unconsolidated bottom	1.38
E2EM1P	Estuarine intertidal emergent persistent, irregularly flooded	0.41
E2EM2P	Estuarine intertidal emergent nonpersistent, irregularly flooded	0.15
E2SS1P	Estuarine intertidal scrub-shrub broad-leaved deciduous, irregularly flooded	0.14
Total		2.08

Watersheds

USNA is in the Severn River watershed, which is a tributary of the Chesapeake Bay watershed. There are a number of minor drainage basins at USNA, which discharge into the Chesapeake Bay via College Creek, Shady Lake, or Spa Creek (Figure 4-6; U.S. Navy 2001b). The largest portion of the academy, approximately 57 percent, is in the College Creek watershed, 19 in the Weems Creek watershed, and 24 percent is in the Spa Creek watershed.



Figure 4-5. USNA Wetlands

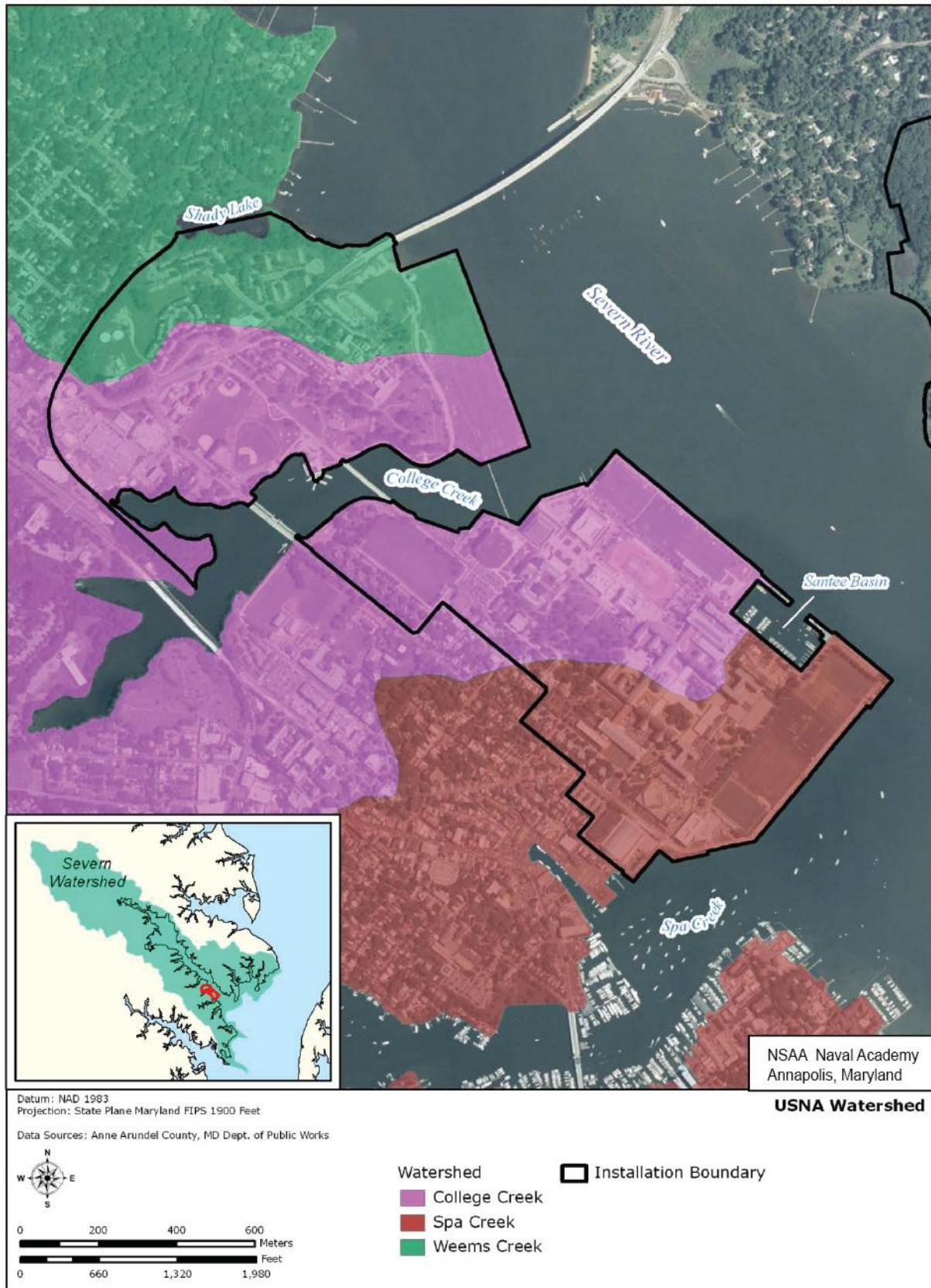


Figure 4-6. USNA Watersheds

Floodplains

Because of its low elevation and proximity to the Severn River, College Creek, Spa Creek, and the Chesapeake Bay, extensive floodplains exist at USNA (Figure 4-7). Historically, much of the development at USNA occurred in floodplains and efforts to prevent flood damage relied on seawalls. Approximately 125 acres (36 percent) of USNA falls within the 100-year floodplain and another 20 acres (6 percent) percent occurs within the 500-year floodplain. In 2003, Hurricane Isabel caused extensive flooding and damage at the academy indicating the need for better planning and flood awareness.

Groundwater

Shallow groundwater in unconfined sediments is susceptible to contamination through discharges of industrial and residential chemicals leaching through soils and erosion of natural deposits of minerals. Deep groundwater aquifers such as the Patapsco formation in the Annapolis area are less susceptible to contamination. USNA obtains water from three groundwater wells owned and maintained by USNA, identified as Well Numbers 15, 16, and 17 (U.S. Navy 2007b). These wells withdraw groundwater from the Patapsco Aquifer, approximately 700 feet below the ground surface.

b. Management Goals

The overall goals of wetlands and watershed management are to ensure compliance with applicable state and federal regulations as well as the protection and enhancement of wetland communities and watersheds at USNA to the greatest extent practicable. Specific management goals for the program include:

- Protect and enhance the biodiversity, function, and value of wetlands, watersheds, and floodplains;
- Maintain no net loss of installation wetlands;
- Support Navy and regional wetland and watershed protection initiatives; and
- Comply with existing state and federal wetland regulations.

c. Management Practices

Wetlands Management

In support of Navy efforts to protect wetlands and in compliance with the CWA, all wetlands at USNA are avoided to the greatest extent practicable during ground disturbing activities and other activities with potential to disturb wetlands. The NWI provides a coarse, planning level wetland

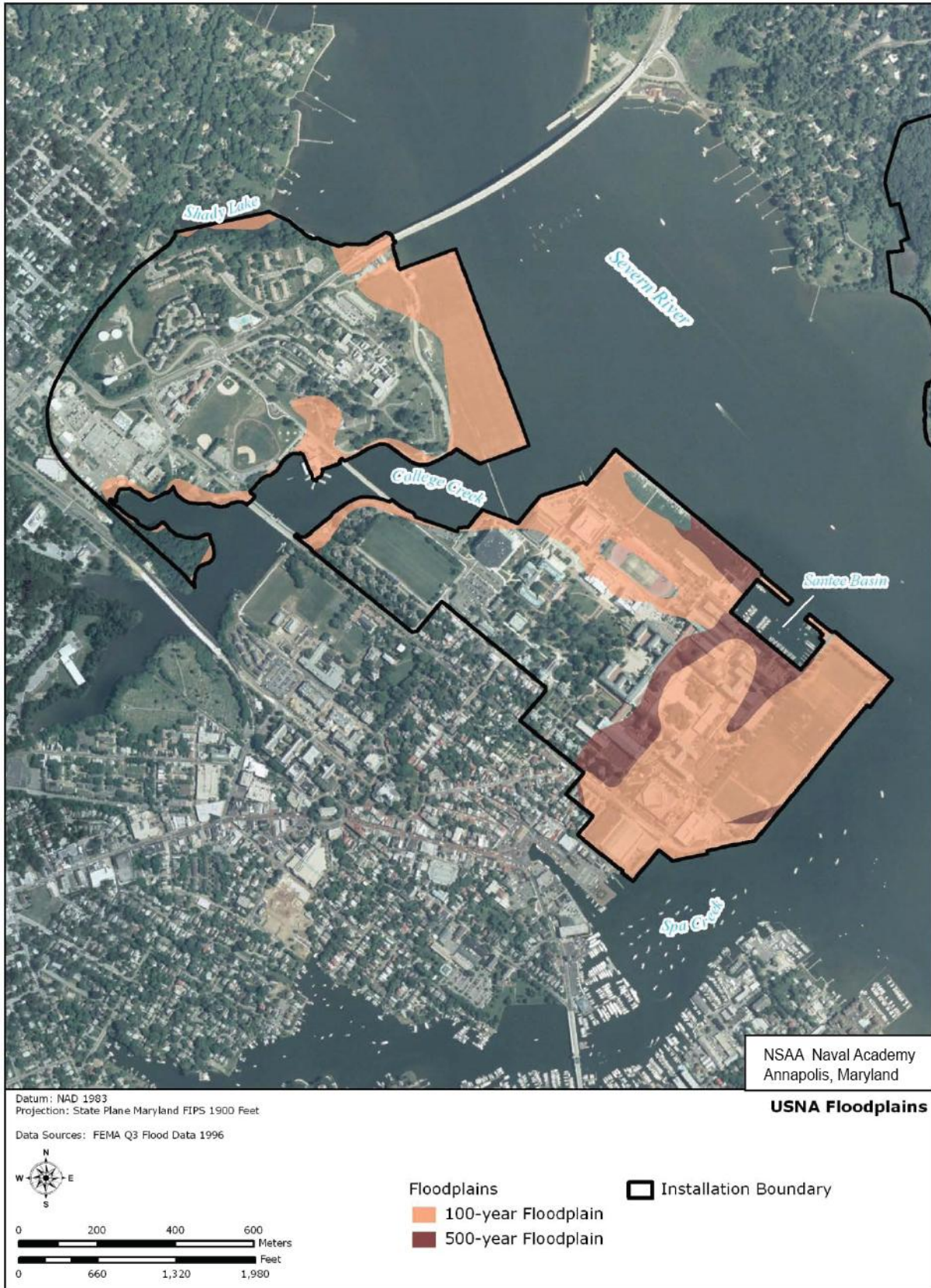


Figure 4-7. USNA Floodplains

delineation that can be used as an approximation of wetland location and extent. Conducting an updated base-wide wetland delineation (using GPS technology or traditional survey methods) would improve planning capabilities and wetlands protection at USNA. Preserving the small remaining area of wetland that occurs on USNA is a natural resources priority. Continuing to control common reed through annual spot treatments and including the site in annual Clean the Bay Day activities would help maintain the integrity of the site improve its wildlife and aesthetic value.

Watershed Management

Because of the highly developed nature of USNA, most watershed protection measures on the Main Campus must be addressed through stormwater management and land use planning. In accordance with LID principals, all new development identified in the 2007 Master Plan (U.S. Navy 2007a) are based on the redevelopment and reutilization within the footprint of existing buildings and impermeable surface.

Additional measures for watershed protection are limited, but could be accomplished through initiatives such as establishing or enhancing riparian buffers along unprotected waterways and enforcing the buffer zones in which disturbance is prohibited. Reducing the frequency of mowing or establishing no mowing zones along wetland edges to increase vegetative filters; and planting appropriate native trees, shrub, and ground cover vegetation as wetland buffers are effective methods of establishing riparian buffers. In 2000, two sites were identified in the Navy's *Chesapeake Bay Riparian Forest Buffer Site Assessment* (U.S. Navy 2000b) as potential site for riparian buffer enhancement. A 300-foot long area adjacent to College Creek at the Lower Yard and a 50-foot long area on the Severn River at the Upper Yard were identified. Planting options, species lists, and site maps were provided for each site. Implementing the riparian buffer planting plans would help the Navy meet its goals of supporting the Chesapeake Bay Agreements as well as contribute to watershed protection at USNA.

Floodplain Management

In order to protect the floodplains at USNA, any changes to the built environment at USNA should be restricted to previously developed sites and all undeveloped areas within floodplains should be preserved. All project proposals are reviewed by Environmental Division personnel to ensure floodplain protection. As floodplains change over time with landscape and climate change, up-to-date FEMA or other floodplain data must be consulted for any development activity.

Groundwater Management

In 2003, the NSA Annapolis water treatment plant underwent a major renovation, replacing filters, aerators, chemical systems, and other associated systems. The levels of all contaminants,

including radium and other substances known to occur in Anne Arundel County, were less than the Maximum Contaminant Levels prescribed by the EPA and MDE (U.S. Navy 2007b).

(3) Coastal/Marine Management

a. Program Description and Current Conditions

Coastal zone resources include the shorelines and the adjacent waterbodies at USNA. USNA has approximately four miles of shoreline (21,198 feet) along the Severn River, College Creek, and Spa Creek. Under the federal CZMA, activities on federal lands that are reasonably likely to affect use of lands or waters, or natural resources of the coastal zone beyond the boundaries of the federal property, must be consistent to the maximum extent practicable with the enforceable policies of the state's Coastal Zone Management Program (CZMP). Maryland's CZMP is a comprehensive program, based on existing laws and authorities including Section 404 of the CWA, the CZMA, and state laws and authorities including the Chesapeake Bay Critical Area Program, the Tidal Wetlands Act, the Non-Tidal Wetlands Protection Act, and the state's authority under Section 401 of the CWA. MDNR is the state's lead agency for the Coastal Zone Program.

The Air and Water Programs Manager and PWD Environmental Division Natural Resources Manager have responsibility for meeting requirements under these authorities. USNA has cooperated with the Friends of College Creek, and the Spa Creek Conservancy, two local coalitions of institutions and citizens interested in protecting and restoring the College Creek and Spa Creek watersheds. From the spring of 2007 through the fall of 2007, the Friends of College Creek conducted surveys assessing SAV, macroinvertebrates, and upland stream conditions (Friends of College Creek 2008). USNA's Center for Chesapeake Bay Observation and Modeling participated in water quality sampling for this assessment. USNA midshipmen have also partnered with the Spa Creek Conservancy during creek cleanups and invasive species removal projects (Spa Creek Conservancy 2009).



**Spa Creek Cleanup by USNA Midshipmen
(Spa Creek Conservancy 2009)**

b. Management Goals

The goals of coastal and marine management at USNA are to preserve, protect, and, where possible, restore and enhance the resources of the coastal zone and to maintain consistency with Maryland's Coastal Zone Program and its associated regulations.

c. Management Practices

Shoreline Stabilization

Shoreline erosion is a major concern at USNA; therefore, nearly all of the facility's shoreline has been hardened by seawall, bulkheads, or revetments. Hardened shorelines however, provide little pollution filtering or habitat function. They also don't dissipate wave action as a natural shore does, which can prevent underwater grasses from taking root. The best opportunity to protect coastal and marine resources is therefore to enhance or restore portions of the USNA shoreline to a natural condition where practicable. Actions such as replacing bulkheads with living shorelines, riparian forest buffer enhancement, and marsh creation are recommended to improve shoreline habitat and benefit SAV, fish, and benthic invertebrates within the area. A site assessment conducted in 2008 by the PWD Environmental Division Natural Resources Manager and NAVFAC Washington Natural Resources Specialist identified one potential restoration sites along USNA shoreline. St. John's College recently completed a shoreline restoration project on approximately 800 feet of College Creek, which can serve as a model for restoration efforts.

Submerged Aquatic Vegetation

Ongoing mapping of SAV by organizations, such as the Chesapeake Bay Foundation, and local watershed groups, such as Friends of College Creek, have mapped SAV in several of the rivers and creeks around NSA Annapolis. Mapping efforts in the Severn River, Spa Creek, and College Creek indicate SAV occurs in the area, but is generally limited to upper portions of the creeks. SAV beds planted during the St. John's College living shoreline restoration have been successfully established (Bergstrom 2009). USNA/NSA Annapolis may consider partnering with the Friends of College Creek to conduct additional restoration in areas that could support SAV. A site assessment that analyses salinity, turbidity, and water depth should be conducted prior to beginning such a project.

Oyster Restoration

USNA has partnered with a number of organizations to restore oyster populations in the bay. An important restoration technique is the creation of oyster reefs. Since 1977, midshipmen have participated in an oyster recovery effort by moving oyster shell bars from a nursery in Mill Creek to an oyster bar at the mouth of the Severn River. NSA Annapolis also provides access to a pier at the MWR Marina. The Chesapeake Bay Foundation, a USNA partner, uses the location to meet local citizens who are dropping off oysters to be placed on nearby bars by the Foundation. In 2007, the Academy signed a MOU with the CBF to provide a planting area adjacent to the rip-rap along Turner Joy Road.

USNA may consider partnering with Friends of College Creek and the Spa Creek Conservancy to construct oyster reefs in appropriate habitat in the waters around the Academy. Site assessments that analyze salinity, turbidity, and water depth should be conducted prior to beginning such a project. Site monitoring should be continued for three to five years to assess the effectiveness of the project.

(4) Fish and Wildlife Management

a. Program Description and Current Conditions

The availability of wildlife habitat and diversity of habitats at USNA is limited by the level of development at the facility and species that occur at USNA are generally those that are well adapted to urban environments. Other than the 1997 rare, threatened, and endangered species habitat survey, few fish or wildlife surveys have been conducted at USNA and species that have been observed are incidental observations by natural resources personnel. Several bird survey points from the annual Christmas Bird Count conducted at NSA Annapolis between 1999 to 2003 were located at the Academy (Anne Arundel Bird Club Observers 1999, Bystrack 2002 and 2003) and one herpetofaunal survey point was surveyed in 2000 (Wood 1998). Only redbacked salamanders were observed during the herpetofaunal survey at USNA. General observations of mammalian species at USNA include whitetail deer, groundhog, raccoon, eastern cottontail, eastern gray squirrel, and Virginia opossum. Although incomplete, wildlife species lists of species known to occur at USNA are in Appendix 2.

The Natural Resources Manager in the PWD Environmental Division has responsibility daily planning, budget controls, and general administrative functions of the program. Temporary Student Conservation Association (SCA) interns and volunteers have, at times, been available to provide technical support. The USFWS and MDNR are cooperating agencies and are available to provide guidance on management issues and projects.

Fish and wildlife management activities at USNA are primarily related to wildlife management in urban settings such as nuisance wildlife control. Recreational fishing is limited and there are no opportunities for hunting or trapping. The facility is kept well manicured to support a formal appearance; therefore there is little opportunity for habitat enhancement for wildlife other than initiating improvements in landscaping and installation of artificial nest boxes.

b. Management Goals

The natural resources program at USNA strives to protect and enhance wildlife resources within the constraints of the installation mission. The basic long-range goals of fish and wildlife management are to:

- Protect, conserve, and manage fish and wildlife populations and their habitats at a level compatible with the facility mission; and

- Ensure that wildlife populations do not conflict with the facility mission.

c. Management Practices

Nuisance Wildlife Management

Currently there are no reports of nuisance animals or wildlife on USNA. Should nuisance animals become an issue, complaints and sightings should be reported to the Natural Resources office. Depending on the nature of the complaint, the Natural Resources Manager may contact other agencies, such as MDNR or APHIS-WS, for assistance in population surveys and other control measures.

Feral Pets

In accordance with Navy policy on feral cats and dogs, the natural resources manager must ensure the humane capture and removal of feral pets when reported. Every effort should be made to find homes for adoptable animals through local animal shelters. Educational notices that serve to increase public awareness on neutering pets, not feeding feral cats, and other issues regarding feral animals can be published periodically on the Natural Resources Website.

Nest Box Program

USNA does not currently have bluebird or other nest boxes or platforms for ospreys. Although there is little available habitat for wildlife, there is some potential to provide additional nesting opportunities for cavity nesting species at the facility. Ideal habitat for bluebirds and tree swallows consists of an open area near water for foraging, such as mowed lawn that is fringed by shrubs and hardwood trees. Wood ducks primarily nest in tree cavities in wooded swamps and marshes at the edges of ponds. One to two wood duck boxes could be installed along the edge of Shady Lake and several bluebird and/or tree swallow boxes could be set up along the wood edge west of the water plant (building 591) or USNA Cemetery. Periodic surveys for the target species should be conducted throughout the breeding season prior to installing nest boxes to ensure the presence of the species. Mapping nest box locations using GPS technology and annual maintenance and monitoring are essential for the success of this program.

*Contact the Anne Arundel Bird Club
(<http://danhaas.com/AABIRDCLUB/>) and
Maryland Bluebird Society
(<http://www.mdbluebirdsociety.org/links.htm>)
for assistance with nest box projects.*

Fisheries Management

Fisheries resources at and in the immediate vicinity of the installation include the brackish/saltwater fisheries of the Severn River, College Creek, and Spa Creek. There is currently no formal fishing program at USNA; however, fishing is permitted at the seawall

below Hospital Point. Enforcing state fishing regulations and implementing proactive measures to prevent the spread of aggressive nonnative species are the primary actions including prohibiting use of all live bait other than night crawlers and bloodworms and prohibiting use of all live nonnative bait will help protect native populations. Posting signs that educate anglers on live and nonnative bait restrictions would help prevent further introduction of nonnative species into the bay and its tributaries.

Wildlife Surveys and Monitoring

Most of the wildlife surveys at USNA were conducted as a minor component of surveys conducted at Greenbury Point on NSAA North Severn. The resulting data for USNA are not readily available as separate species lists. Many of the surveys were conducted in the late 1990s and are in need of updating in order to provide a better understanding of the current conditions at USNA. Baseline surveys and monitoring protocols for breeding and migratory landbirds, waterfowl, aquatic organisms, herpetofauna, and bats and other mammals should be developed and implemented. It is critical to develop written protocols, GPS-located survey points, and a digital database for each survey so that future monitoring can be accomplished.

(5) Migratory Bird Management

a. Program Description and Current Conditions

Limited bird surveys have been conducted at USNA, though it is expected that birds inhabiting the facility are those that are typical of urban environments. Migratory bird management at USNA focuses on the conservation and enhancement of migratory birds in support of the MBTA and EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds. Because of the level of development and lack of diversity of habitats at USNA, enhancements efforts are limited to artificial nest boxes and implementing grounds maintenance and landscaping improvements that benefit a range of migratory bird species.

During annual INRMP reviews, the natural resources manager and cooperating parties must assess 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 NAVFAC PWD Annapolis Natural Resources Manager is responsible for initiating migratory bird enhancement projects, whereas the PWD Facilities Maintenance Branch oversees the facility maintenance contract. Local bird clubs such as the Anne Arundel Bird Club and Maryland Bluebird Society are available to support migratory bird monitoring projects.

b. Management Goals

The goals of migratory bird management at USNA are to support the conservation of migratory birds through habitat conservation and enhancement and to avoid the incidental take of migratory

birds through military readiness actions in accordance with the MBTA to the greatest extent practicable.

c. Management Practices

The installation of nest boxes as described in Section 4.B(4)c would improve habitat for a number of cavity nesting species including eastern bluebirds, various wrens, tree sparrows, and wood ducks at USNA. Monitoring and maintenance of these structures will improve the program's effectiveness and value to migratory bird populations.

Grounds maintenance and landscaping improvements that would benefit migratory birds are described in the Forest Management and Vegetation Management sections of this INRMP. Generally included are preserving existing forested areas, creating structural diversity in vegetation, and providing a wide range of forage and cover species. Implementing an IPM approach to grounds maintenance and minimizing the use of herbicides to the greatest extent practicable, while maintaining the Academy's formal appearance, will also benefit migratory birds.

(6) Forest Management

a. Program Description and Current Conditions

A forest inventory and forest stand assessment was conducted during the summer and autumn of 2000 by a USFWS biologist prior to developing the 2001 INRMP (U.S. Navy 2001c). The primary natural wooded area at USNA is a 4-acre woodland on the peninsula reaching into College Creek south of the Perry Center area and adjacent to Roscoe/Rowe Boulevard (Figure 4-8). This site is dominated by chestnut oak (*Quercus prinus*) with scattered white oak (*Quercus alba*), southern red oak (*Quercus falcata*), and black oak (*Quercus velutina*). The most common species in the understory layer include flowering dogwood (*Cornus florida*), sassafras (*Sassafras albidum*), spicebush (*Lindera benzoin*), privet (*Ligustrum* spp.), and maple-leaf viburnum (*Viburnum acerifolium*). Approximately 6 acres of wooded areas also occur along the western border of the Upper Yard and adjacent to Shady Lake.

Forest management at USNA is largely the responsibility of the NAVFAC PWD Annapolis Natural Resources Manager. The MDNR Forest Services (i.e., the Tree-mendous Program, PLANT Community Awards Program), USDA Forest Service, USFWS, and volunteers such as the Midshipmen Action Group and local Boy Scout and Girl Scout troops also assist with forest enhancement projects undertaken at USNA.

b. Management Goals

The primary objectives of forest management are to:

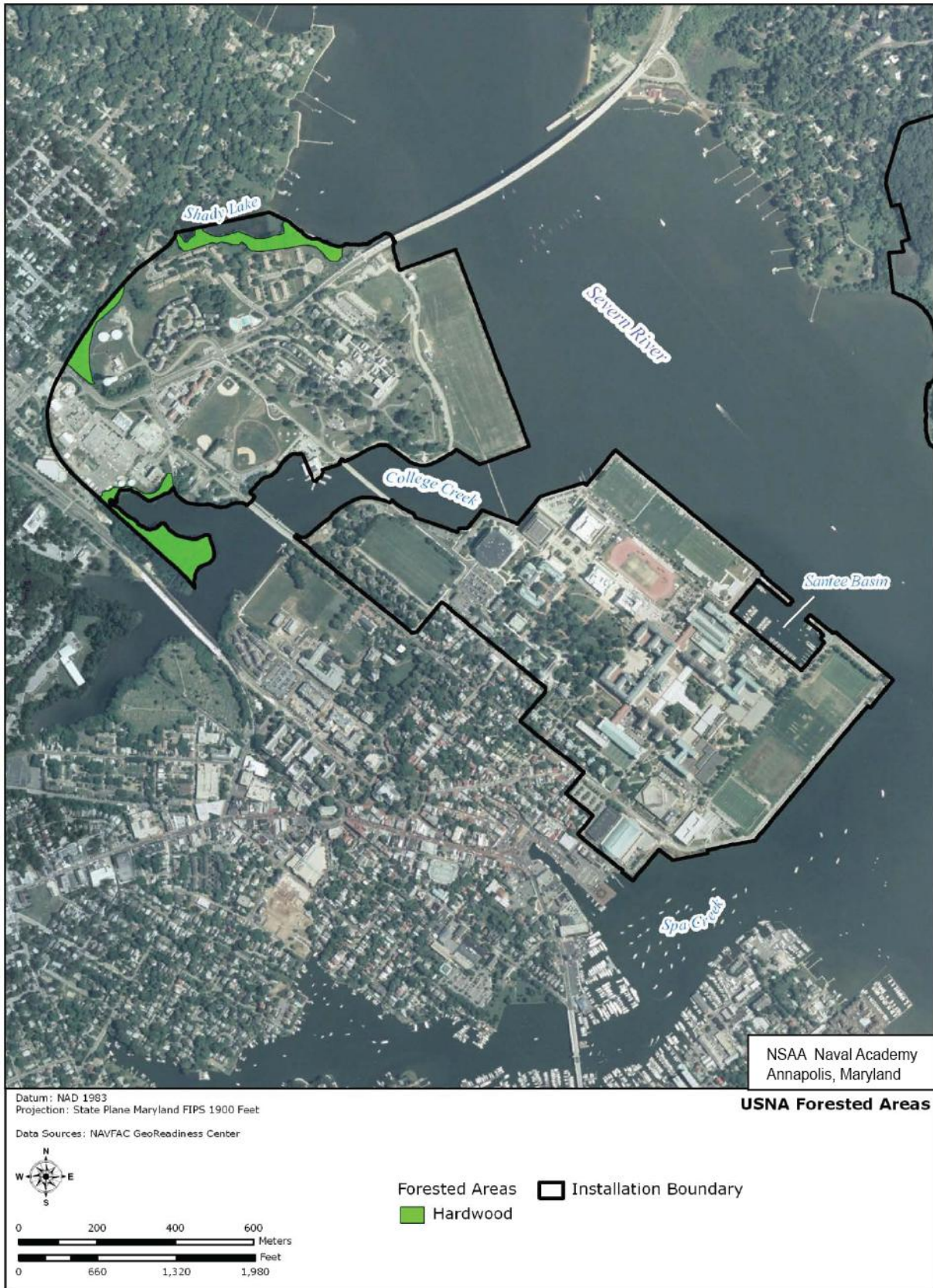


Figure 4-8. USNA Forested Areas

- Conserve and enhance existing forested areas that contribute to overall ecosystem function; and
- Increase forested acreage through reforestation where practicable, within the constraints of the installation mission.

c. Management Practices

Although commercial timber production is not an objective of forest management at USNA; management of the forested area is necessary to maintain this valuable resource. The primary issues concerning the forested areas are land development and invasive plant species. In accordance with the 2007 Base Master Plan, current development plans are based on the redevelopment and reutilization within the footprint of existing buildings and impermeable surface (U.S. Navy 2007a). Future installation plans should continue to conserve the Academy's limited forested area.

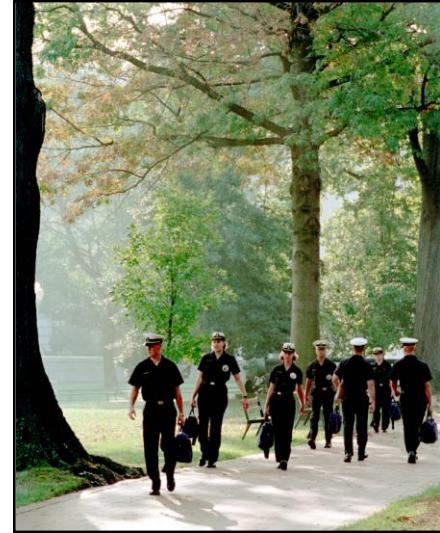
Privet was identified in the 2000 inventory of the forested area at USNA. Privet is a nonnative invasive species that is particularly problematic in lowland forests and can become a dominant understory species if not controlled. Initiating an invasive species mapping and treatment program to control privet and other invasive species that may occur would help restore the biological integrity and function of this resource.

(7) Vegetation Management

a. Program Description and Current Conditions

Vegetative management includes grounds maintenance on improved grounds, landscaped areas, and other non-forested areas at USNA. The management of naturally forested areas was discussed in Section 4D(6) and is excluded from this section. Grounds maintenance is largely the responsibility of the PWD Facilities Engineering and Acquisition Division, which oversees the facility maintenance contract including tree maintenance and pruning in the developed portions of the Academy. The NAVFAC PWD Annapolis Natural Resources Manager supports vegetation management through providing guidance on landscape planting species lists (Appendix 3) as well as initiating habitat improvement projects such as tree plantings, and riparian buffer enhancements. The MDNR Forest Services (i.e., the Tree-mendous Program), USDA Forest Service, USFWS, and volunteers such as the Midshipmen Action Group and local Boy Scout and Girl Scout troops can also assist with habitat enhancement projects undertaken at USNA.

An urban tree inventory, conducted in 2008, *Tree Survey/Management Plan for the United States Naval Academy* (U.S. Navy 2009b), identified and assessed the condition of every tree on the Upper and Lower Yards excluding natural forested areas. The urban forest composition was found to be fairly diverse, with 26 species were accounting for 69 percent of the inventory. Eleven of the 27 species are nonnative with crepe myrtle (*Lagerstroemia indica*) being the most abundant; over 200 individuals were counted. Common diseases and maintenance issues observed were discussed and recommendations to address these issues were made. Typical maintenance problems encountered were that trunks and buttress roots are buried too deeply in soil and/or mulch, there was frequent weedeater damage, and poor pruning practices were common. In addition, a number of sites with soil erosion issues were noted and recommendations made. The inventory was provided in electronic format and can be put into the Regional Navy GIS.



USNA Shade Trees

b. Management Goals

The overall goal of vegetation management is to improve the appearance of the installation through the preservation of existing natural and landscaped areas and through developing appropriate new urban forest and landscape plantings. Urban forest and grounds maintenance practices must also prevent the station from contributing to pollution from vegetative debris, sedimentation, and excess nutrients and pesticides. The goals of vegetative management and grounds maintenance are to:

- Provide an attractive, well-maintained working environment using beneficial landscaping practices, and
- Enhance landscaped areas to better contribute to overall ecosystem function.

c. Management Practices

Ensuring that tree care practices including pruning, maintenance, and planting recommendations provided in the USNA tree survey and management plan are implemented under the grounds maintenance contract or a separate tree care contract would greatly improve the condition and longevity of the urban forest at USNA. Tree care including should be overseen by qualified tree care professionals. Tree planting and tree care that meet International Society of Arboriculture standards are provided in Appendix 3.

Maintaining a diversity of native trees and shrubs that include evergreens for winter cover, mast bearing species such as oaks, and fruit bearing species such as dogwoods, native cherries, and viburnums would enhance the value of landscaped areas for wildlife. The NAVFAC PWD Annapolis Natural Resources Manager can support the Facilities Engineering and Acquisition Division in identifying additional areas to be planted and should review tree and shrub selections to ensure appropriate native species are used.

Implementing beneficial landscaping practices, as outlined in Section 2.B(7), throughout the Academy is another important aspect of vegetation management. In particular, the amount of fertilizers and pesticides should be reduced to the minimum amount necessary to maintain the Academy's formal appearance. Conducting an annual review of the grounds maintenance contract and basing applications on site assessments rather than prescheduled treatments would help reduce unnecessary chemical use. A pesticide approval form must be submitted to the IPM Coordinator and Environmental Office prior to any pesticide application and a pest management record form must be submitted following application to track pesticide usage.

(8) Invasive Species Management

a. Program Description and Current Conditions

Invasive plant species were identified at USNA during the forest survey conducted prior to developing the 2001 INRMP (U.S. Navy 2001c) and during field studies for the urban forest inventory in 2008 (U.S. Navy 2009b). A large percentage of species occurring in the natural areas and urban forest was identified as nonnative, though a smaller number of these are considered invasive. The most problematic invasive species identified at USNA include privet, common reed, English ivy (*Herdera helix*), tree of heaven (*Ailanthus altissima*), and wintercreeper (*Euonymus fortunei*). The locations and extents of these species have not been mapped. No surveys have been conducted for nonnative or invasive animal species, though there is potential for Asiatic clam (*Corbicula fluminea*), northern snakehead fish (*Channa argus*), and other invasive aquatic species to occur (Invasive Species Specialist Group 2009).

The NAVFAC PWD Annapolis Natural Resources Manager and the PWD Facilities Maintenance Branch share responsibility for invasive species control at USNA. The natural resources manager can initiate invasive species control projects (particularly in natural areas) through the INRMP whereas Facilities Maintenance can include invasive species treatments (particularly in landscaped areas) in the facility maintenance contract. The Federal Interagency Committee for the Management of Noxious and Exotic Weeds, The Nature Conservancy, and the Maryland Natural Heritage Program may provide guidance on invasive species management issues and projects. Volunteers such as the Midshipmen Action Group and local Boy Scout and Girl Scout troops can support for invasive species control projects undertaken at USNA.

b. Management Goals

The overall goal of invasive species management is to protect ecosystems and native plant and animal species from invasive species through compliance with EO 13112. Specific objectives include developing a facility-wide invasive species survey, site specific assessments and recommendations, and implementing a control program.

c. Management Practices

A thorough inventory of invasive species has not been conducted at USNA to date. USNA is highly developed with a large proportion of disturbed area, making the site vulnerable to invasion by exotic species. To comply with EO 13112, a formal survey for invasive species should be conducted and the location and extent of invasive species mapped. Regularly monitoring for new populations of invasive species allows for early control of infestations, since management efforts are more effective when population sizes are small.

Invasive species treatment may be conducted as part of routine grounds maintenance, as recommended in the urban forest management plan (U.S. Navy 2009b) and through special projects initiated by the natural resources office. Volunteers can be used to cut and pull vegetation, however, for effective eradication; herbicides may be needed, which will require the use of a certified pesticide applicator. A pesticide approval form must be submitted to the IPM Coordinator and Environmental Office prior to any pesticide application and a pest management record form must be submitted following application to track pesticide usage. Following treatment, annual monitoring should be conducted to identify the presence of exotic or invasive species and to recommend control actions. Early control of these species would minimize maintenance costs and adverse effects on native species.

(9) Outdoor Recreation and Environmental Awareness**a. Program Description and Current Conditions**

Because of the urban nature and relatively small size of the installations, there are few natural resource-based outdoor recreational opportunities available at USNA. Picnicking at USNA is authorized at the Hospital Point recreation area site (Price Memorial). Consumptive uses of the natural resources is limited to fishing and is permitted from the seawall below Hospital Point. Access is restricted to active and retired military and their dependents and civilian personnel. Fishing and crabbing restrictions were identified in USNAINST 1700.9A, which was developed in 1995 and may need to be updated to reflect the realignment of NSA Annapolis.

b. Management Goals

The primary goals of outdoor recreation and environmental awareness management at USNA are to:

- Provide outdoor recreational opportunities for station personnel, their dependents, and the military community to the maximum extent possible within the constraints of the installation mission and capability of the natural resources; and
- Foster understanding and awareness of the environment through educational conservation programs.

c. Management Practices

Environmental Awareness

Organizing activities for Earth Day, National Public Lands Day, and Arbor Day that are open to midshipmen, Navy personnel, and the general public is an effective method of increasing environmental awareness at USNA. Events that promote active participation are particularly effective in developing environmental values and developing a sense of responsibility.

Participating in volunteer programs such as the Midshipmen Action Group and partnerships with local environmental groups such as the Chesapeake Bay Foundation, the Alliance for the Chesapeake Bay, Friends of College Creek, and the Spa Creek Conservancy provides other opportunities for midshipmen, Academy staff, and other Navy personnel to become engaged in environmental awareness activities. Environmental personnel actively seek opportunities to partner with these organizations, which benefits the USNA community as well as the environment.

Fishing

All active duty and retired military members and their dependents and non-temporary civilian employees assigned to NSA Annapolis are eligible to fish and crab within the confines of the USNA. Fishing and crabbing are restricted to Hospital Point seawall areas and College Creek (Hill Bridge to Hubbard Hall west boundary) (subject to limitations stated in USNAINST 1700.9A). Posting signs that educate anglers on live and nonnative bait restrictions would help prevent further introduction of nonnative species into the bay and its tributaries.

(10) Agricultural Outleasing

There are no lands suitable for agricultural use at USNA.

(11) Wildland Fire Management

The urban environment of USNA precludes the occurrence of wildland fire; all fire and emergency services at USNA are handled by the USNA Fire Department.

(12) Conservation Law Enforcement

There is no requirement for a separate conservation law enforcement program at USNA; all law enforcement is accomplished through the USNA Security Department.

(13) Cultural Resources Management

a. Program Description and Current Conditions

The NSA Annapolis ICRMP (U.S. Navy 2000c) provides an inventory of known prehistoric, historic, archeological, and architectural resources and provides recommendations for their management of cultural resources at USNA. Most significantly, USNA was designated a National Historic Landmark in 1961 (Figure 4-9). This historic district includes over 100 contributing elements including buildings, monuments, structures, and open spaces that define the character of the Academy (U.S. Navy 2000c). The PWD Cultural Resources Coordinator at NSA Annapolis oversees all cultural resources issues. Cultural resources maps will be consulted and any proposed activity with potential to impact these resources at NSA Annapolis must be coordinated through the SHPO.

b. Management Goals

The goals of cultural resources management are to protect all significant cultural resources to the greatest extent practicable and meet the compliance requirements of federal laws.

c. Management Practices

To avoid disturbing cultural resources at USNA, planning and consultation with the cultural resources staff is necessary before any potentially ground-disturbing activities are carried out. The NSA Annapolis ICRMP has detailed maps of known site locations and should be consulted prior to project planning. It is possible that currently buried and unknown archeological resources may be uncovered during ground-disturbing activities. If any archeological resources are encountered during ground disturbing activities, the ICRMP provides standard operating procedures to follow. The Cultural Resources Coordinator and NAVFAC Regional Historic Preservation Officer must be notified to ensure compliance with the NHPA. All construction work would be suspended until a qualified archaeologist could determine the significance of the encountered resource(s). In addition, new structures or buildings with architectural design elements that are incompatible with surrounding historic properties would impact the integrity, character, and/or feeling of the historic property. Therefore, any plans for construction at USNA would require consultation with the SHPO prior to construction.

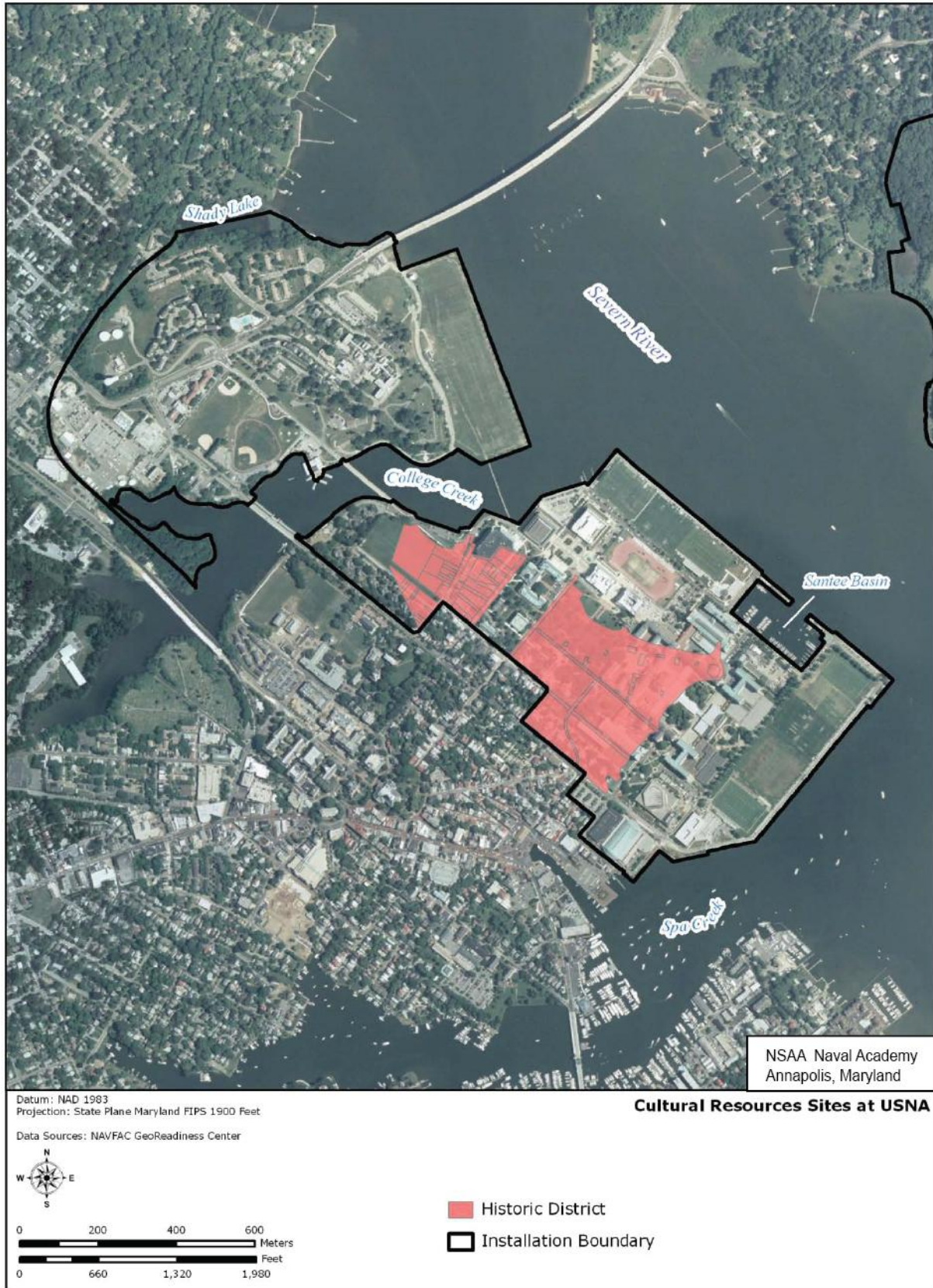


Figure 4-9. Cultural Resources Sites at USNA

5. NSAA NORTH SEVERN

A. INSTALLATION INFORMATION

(1) General Location

The NSAA North Severn site, including NSA Annapolis, the USNA Golf Course, and Greenbury Point, encompasses 827 acres and is located across the Severn River from USNA on Broadneck Peninsula. The David Taylor Research Center is a 46-acre waterfront site located at NSAA North Severn that was decommissioned in 1999 and is now owned by Anne Arundel County.

(2) Military Mission

The primary mission of the activity is to provide base operations support.

(3) Installation History

Much of NSAA North Severn was purchased by the Navy in 1909 for use as a dairy farm in order to provide safe dairy products to midshipmen during a time when tuberculosis was common. From 1911 to 1917, part of the site was also used for the first Naval Air Station. From 1918 to 1996, Greenbury Point was used as a radio research and transmission site. During the Cold War, Greenbury Point was a key communications center for the Navy's submarine fleet. The antennas transmitted Very Low Frequency signals capable of penetrating the ocean, allowing communications with submerged submarines. By the early 1990s, however with advances in satellite communications, the antennas became obsolete. A 1991 base realignment and closure (BRAC) decision lead to the decommissioning of the radio towers. The final demolition of 16 of the 19 former Navy radio towers on Greenbury Point took place in 1999 (though the concrete footings are still on-site). Three towers remain and were turned over to Anne Arundel County for telecommunications or training purposes. Since 1999, much of Greenbury Point has been managed as the Greenbury Point Conservation Area.

(4) Operations and Activities

Operations and activities at NSAA North Severn include providing administrative, technical, and procedural support services to USNA; housing and community support; port operations; public works functions; and natural resources conservation (Figure 5-1). The USNA maintains a fleet of more than 250 Yard Patrol and sail craft; operates an Industrial Repair Department; employs divers to ensure the underwater integrity of all operations; and provides various competitive, combat, and general use pistol and rifle ranges (DoN 2007).

The major facilities located at NSAA North Severn include the Navy Exchange, Commissary, Child Development Center, Family Service Center, MWR family camp grounds, PPV housing,

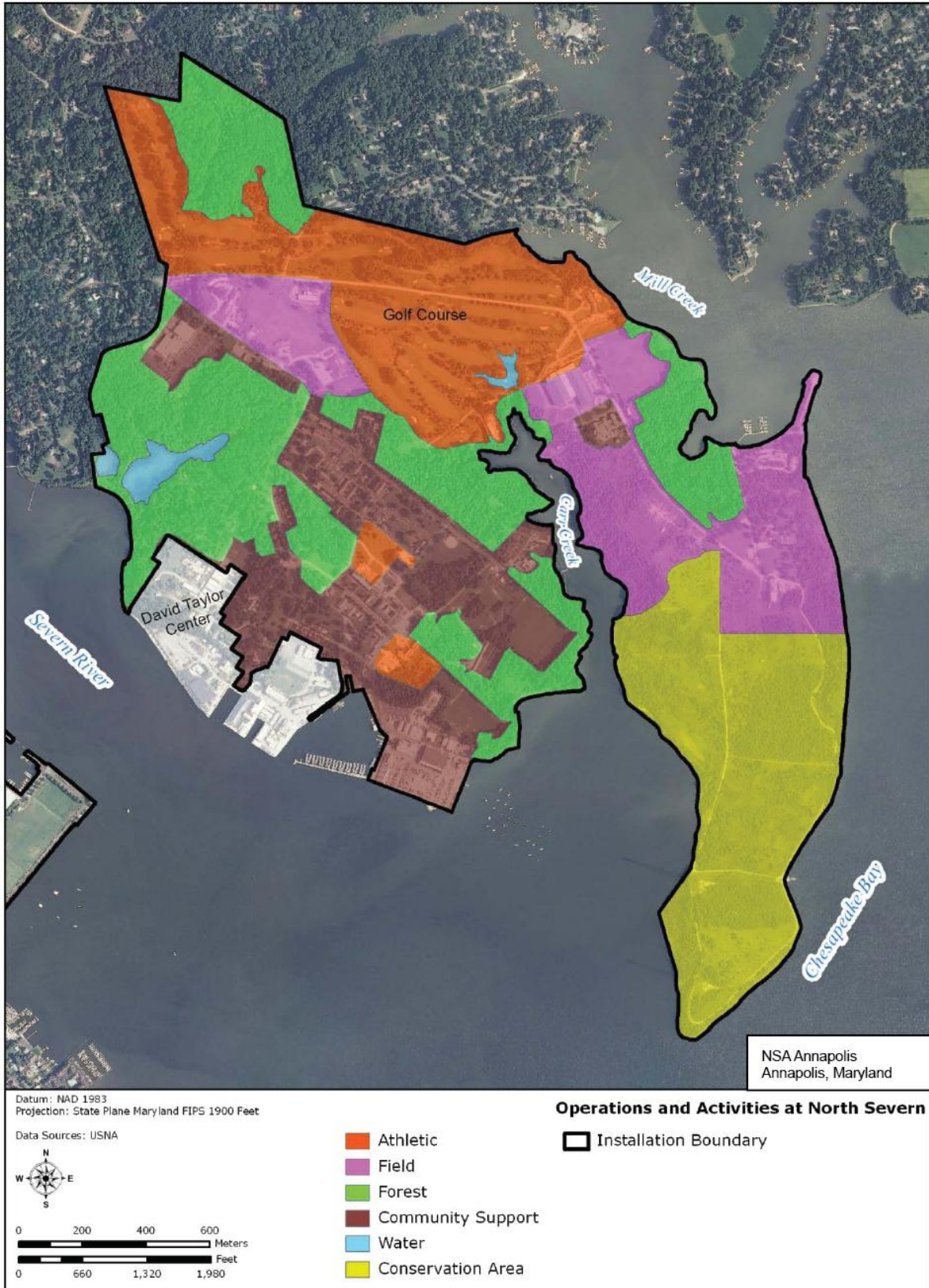


Figure 5-1. Operations and Activities at NSAA North Severn

Bachelor Enlisted Quarters, USNA Golf Course, athletic (rugby) field, marinas, firing range, and the Greenbury Point Nature Center.

(5) Constraints and Opportunities

Current and future land uses at NSAA North Severn have several constraining factors. Natural and cultural resources related constraints include wetlands, Chesapeake Bay Critical Area, and sites on which significant cultural resources occur. Approximately 584 acres are constrained by natural resources such as wetlands, floodplains, and the Chesapeake Bay Critical Area; and 8 acres are constrained by cultural resources. Any future land development should attempt to avoid impacts to these resources and if avoidance is not possible, all impacts must be mitigated. Recreational development is compatible with goals of the Critical Area Law and water-dependent facilities are permissible in the Chesapeake Bay Critical Area. Other restrictions on mission and land use are due to operational, existing development, and safety constraints. Currently approximately 460 acres (55 percent) of NSAA North Severn are constrained by operations and activities. Included are 42 acres that are constrained by potential environmental concerns related to site contamination and 106 acres that fall within firing fans from the pistol and rifle ranges. A total of 740 acres (65 percent) of NSAA North Severn are constrained from future land use changes and development (Figure 5-2). The remaining tower footings may create a constraint for some land use purposes and could be GPS-located and added to these constraint maps. The NSAA North Severn development plan (U.S. Navy 2009a) also identifies several additional sites with planned development.

Areas with few or no constraints provide the best opportunities for mission growth and change. Approximately 86 acres (less than 10 percent) of NSAA North Severn are unconstrained and provide opportunity for land use change (Figure 5-3).

B. GENERAL PHYSICAL ENVIRONMENT

(1) Physiography, Topography, and Soils

NSAA North Severn is in part in the Western Shore Lowlands Region and Western Shore Uplands Region of the Coastal Plain physiographic provinces ((Maryland Geological Survey 2008). The NSAA North Severn site occupies a relatively low profile adjacent to the Severn River and the Chesapeake Bay. The highest elevation on Greenbury Point peninsula is slightly more than 20 feet above mean sea level and the lowest elevation is at sea level. Consequently, the point is relatively flat with only small isolated areas along the shoreline of the Chesapeake Bay and the Severn River that have a greater than 10 percent slope. The elevation on the eastern and southern shoreline is significantly higher than sea level due to extensive bulkheading and backfill. The northern portion of the site, including the golf course exhibits a more rolling terrain, rising to a high point of 80 feet above mean sea level at the USNA Family Services Center and Clipper Recreation Center adjacent to Kinkaid Road at the station (Figure 5-4).

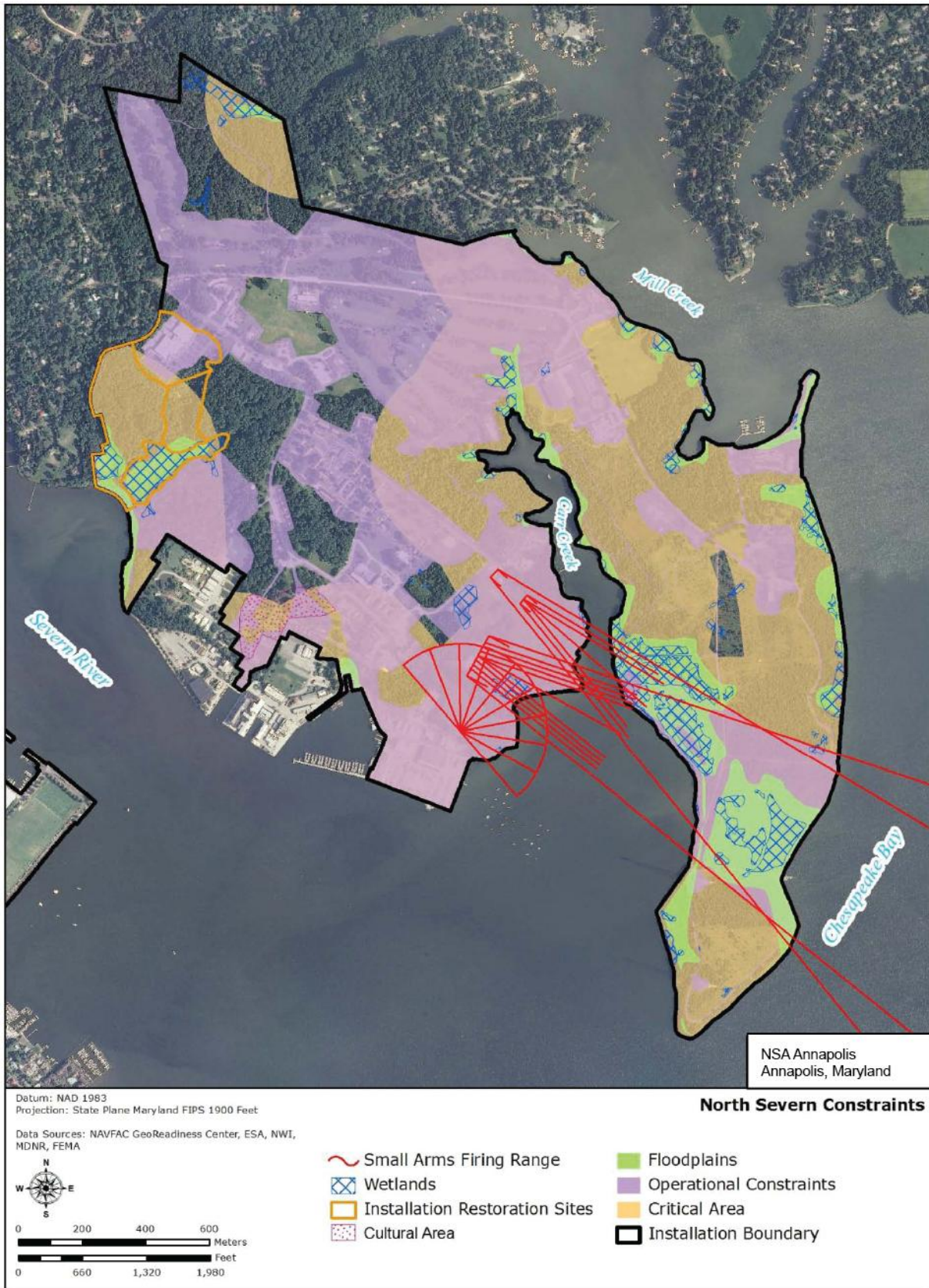


Figure 5-2. NSAA North Severn Constraints

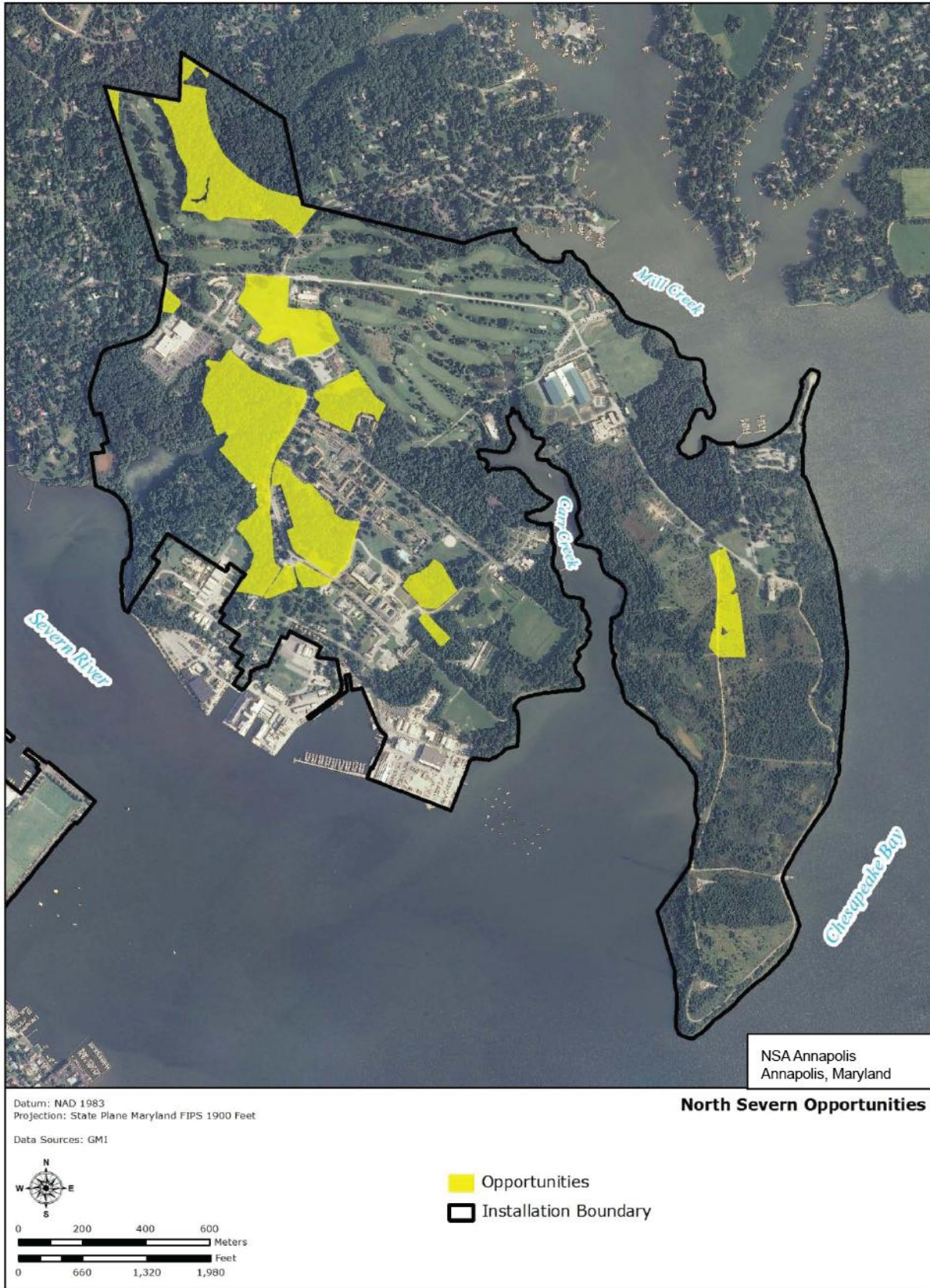


Figure 5-3. NSAA North Severn Opportunities



Figure 5-4. Elevation Contours at NSAA North Severn

The 2002 USDA, NRCS soil survey for Anne Arundel County indicates there are 14 major soil series at NSAA North Severn (USDA, NRCS 2008). Of these, the Colemantown, Deale-Shadyoak complexes, Donlonton, Mispillion and Transquaking, and Widewater and Issue soils are hydric and are prone to flooding (Table 5-1). With the exception of previously built areas, several of the Annapolis, Collington-Wist, Cumberstone-Mattapex, Downer-Phalanx, Patapsco-Evesboro, Russett, and Sassafras soils, are classified as prime farmland or farmland of statewide importance (USDA, NRCS 2006). Approximately 13 percent of the soils are classified as hydric and 44 percent are prime farmland or farmland of statewide importance (Figure 5-5).

C. PROGRAM ELEMENTS

(1) Rare, Threatened, and Endangered Species Management

a. Program Description and Current Conditions

Rare, threatened, and endangered species management at the NSAA North Severn site includes both federal and state-listed threatened and endangered species and species proposed for such listing, as well as other species that may be considered rare or sensitive. A survey for unique natural communities and rare, threatened and endangered species was conducted in 1996 at Greenbury Point, but no other portion of NSAA North Severn (U.S. Navy 1997). Survey efforts focused on birds, plants, and butterflies. No federally listed threatened, endangered, or candidate species have been identified at Greenbury Point. A number of state-listed bird species, however, were documented. Included are three state-endangered species, mourning warbler (*Oporornis philadelphia*), royal tern (*Thalasseus maximus*), and short-eared owl (*Asio flammeus*); one state-threatened species, least tern (*Sternula antillarum*); and two species listed as in need of conservation, American peregrine falcon (*Falco peregrinus anatum*) and Nashville warbler (*Vermivora ruficapilla*). The bald eagle and a number of other species that are considered rare in the state (S1, S2, or S3) have also been observed at Greenbury Point (Table 5-2).

None of the state-listed species are confirmed breeders at Greenbury Point. Although not known to nest on the facility, two of the state-listed rare bird species; the bald eagle (S3.B1) and American peregrine falcon (state-rare and in need of conservation), are known to nest in the area. A pair of peregrine falcons has been documented on the Route 50 Bridge over the Severn River (Severn Riverkeeper 2007), whereas eagles have been documented on the banks of Moss Pond, south of the Chesapeake Bay Bridge, approximately two miles east of Greenbury Point (Therres 2009).

In the 1996 survey also identified three state-rare plant species; fall witchgrass (*Digitaria cognata* syn. *Leptoloma cognatum*), honeyvine (*Cynanchum laeve*) and Lancaster's sedge (*Cyperus lancastriensis*), were documented on several sites. Of the plant species observed at

Table 5-1. NSAA North Severn Soils

Label	Soil Series	Drainage Class	Acres
	Hydric		
CmA	Colemantown silt loam, 0 to 2 percent slopes	Poorly drained	0.6
DcA	Deale-Shadyoak complex, 0 to 2 percent slopes	Somewhat poorly drained	9.9
DeA	Deale-Shadyoak-Urban land complex, 0 to 2 percent slopes	Somewhat poorly drained	29.6
DnA	Donlonton fine sandy loam, 0 to 2 percent slopes	Moderately well drained	7.6
MZA	Mispollion and Transquaking soils, 0 to 1 percent slopes, tidally flooded	Very poorly drained	51.1
WBA	Widewater and Issue soils, 0 to 2 percent slopes, frequently flooded	Poorly drained	7.1
	Non-Hydric		
AoB	Annapolis loamy sand, 2 to 5 percent slopes	Well drained	9.7
AsA	Annapolis fine sandy loam, 0 to 2 percent slopes	Well drained	18.1
AsB	Annapolis fine sandy loam, 2 to 5 percent slopes	Well drained	21.2
AsC	Annapolis fine sandy loam, 5 to 10 percent slopes	Well drained	54.3
AsE	Annapolis fine sandy loam, 15 to 25 percent slopes	Well drained	82.9
AuB	Annapolis-Urban land complex, 0 to 5 percent slopes	Well drained	23.6
AuD	Annapolis-Urban land complex, 5 to 15 percent slopes	Well drained	2.9
CoA	Collington-Wist complex, 0 to 2 percent slopes	Well drained	2.2
CoB	Collington-Wist complex, 2 to 5 percent slopes	Well drained	20.1
CoC	Collington-Wist complex, 5 to 10 percent slopes	Well drained	13.3
CpB	Collington-Wist-Urban land complex, 0 to 5 percent slopes	Well drained	8.9
CpD	Collington-Wist-Urban land complex, 5 to 15 percent slopes	Well drained	21.4
CRD	Collington and Annapolis soils, 10 to 15 percent slopes	Well drained	34.6
CSE	Collington, Wist, and Westphalia soils, 15 to 25 percent slopes	Well drained	46.3
CxA	Cumberstone-Mattapex complex, 0 to 2 percent slopes	Somewhat poorly drained	86.2
CxB	Cumberstone-Mattapex complex, 2 to 5 percent slopes	Somewhat poorly drained	27.4
DxC	Downer-Phalanx complex, 5 to 10 percent slopes	Well drained	39.1
PeB	Patapsco-Evesboro-Fort Mott complex, 0 to 5 percent slopes	Somewhat excessively drained	11.1
PgB	Patapsco-Fort Mott-Urban land complex, 0 to 5 percent slopes	Somewhat excessively drained	2.5
RfB	Russett fine sandy loam, 2 to 5 percent slopes	Moderately well drained	1.4
SaB	Sassafras fine sandy loam, 2 to 5 percent slopes	Well drained	20.2
SaD	Sassafras fine sandy loam, 10 to 15 percent slopes	Well drained	14.0

Table 5-1. NSAA North Severn Soils (cont'd)

Label	Soil Series	Drainage Class	Acres
	Non-Hydric (cont'd)		
SfB	Sassafras loam, 2 to 5 percent slopes	Well drained	18.0
ShA	Sassafras-Hambrook complex, 0 to 2 percent slopes	Well drained	1.0
SME	Sassafras and Croom soils, 15 to 25 percent slopes	Well drained	20.0
SnB	Sassafras-Urban land complex, 0 to 5 percent slopes	Well drained	18.9
SnD	Sassafras-Urban land complex, 5 to 15 percent slopes	Well drained	19.2
UxB	Udorthents, loamy, sulfidic substratum, 0 to 5 percent slopes	Well drained	43.1
Uz	Urban land	Onsite determination	24.3
Total			811.8

Sources: USDA, NRCS 2006 and 2008

Greenbury Point, only Lancaster's Sedge is currently tracked by the MDNR Wildlife and Heritage Services, Natural Heritage Program. It is classified as SU; possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the state (MDNR 2007c, 2007d). Subsequent surveys identified grass-leaved arrowhead (*Sagittaria graminea*), also listed as SU, and broad-fruited bur-reed (*Sparganium eurycarpum*), classified as S3; rare to uncommon in the state.

b. Management Goals

The overall goal of this program element is to ensure compliance with the ESA, the BAGEPA and to protect and enhance rare species populations and their habitats where practicable.

c. Management Practices

In order to meet management goals, the natural resources manager must ensure appropriate surveys and analyses are undertaken prior to the Navy's conducting any activity with potential to impact rare, threatened, and endangered species. The action proponent must submit the NEPA Worksheet/ROD and Project Environmental Permits Record of Decision for review during the early stages of planning. Appropriate consultation with the USFWS will be initiated if there is potential to affect any federally listed species.

As potential habitat does occur on Greenbury Point, eagle nest surveys may be required to ensure compliance with the BAGEPA prior to any activity that could result in take or harassment of bald eagles.

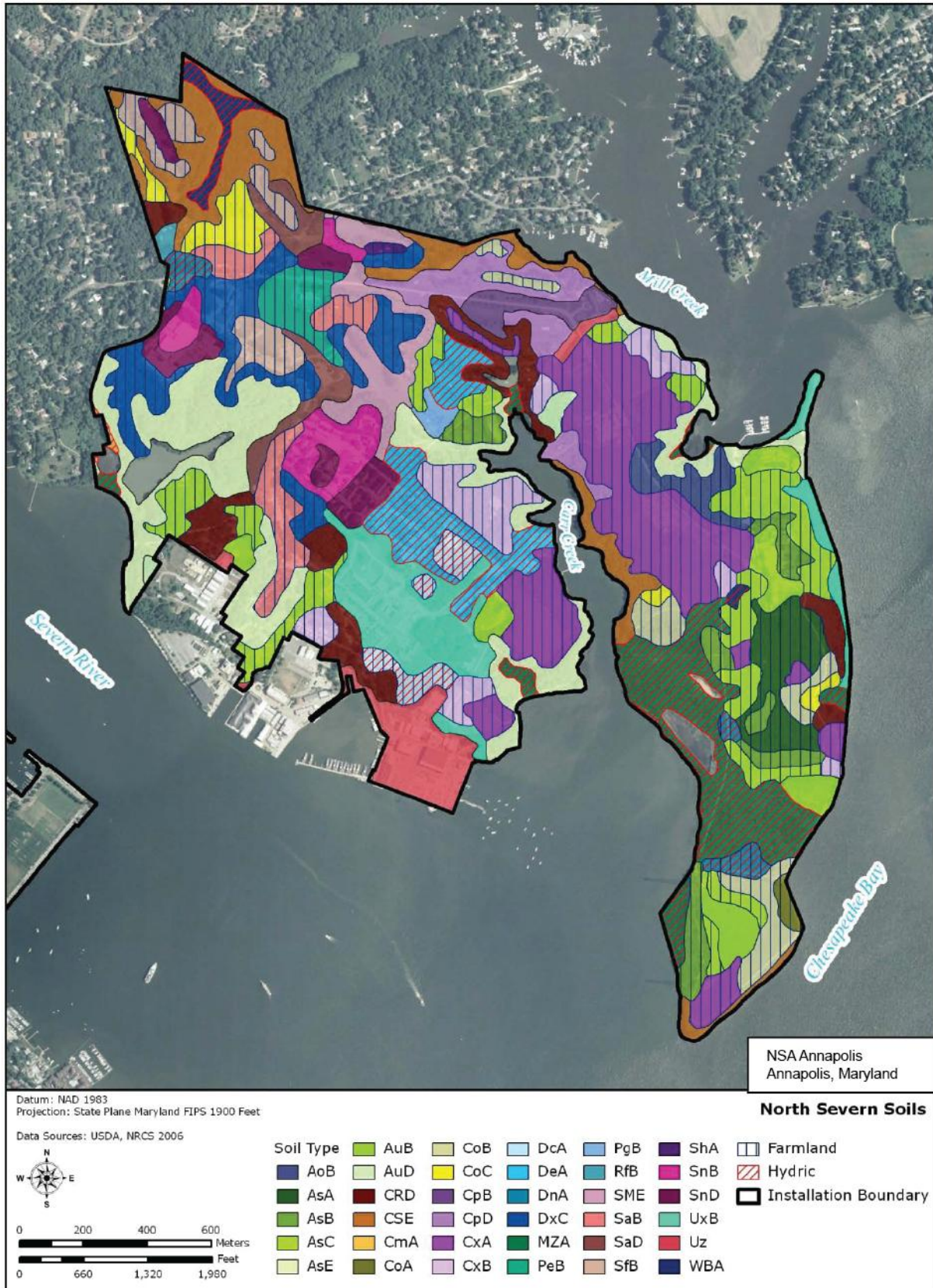


Figure 5-5. NSAA North Severn Soils

Table 5-2. Rare Species Known to Occur at NSAA North Severn

Common Name	Scientific Name	Global Rank ¹	State Rank ²	State Status ³	Federal Status
Bird Species					
Sharp-shinned Hawk	<i>Accipiter striatus</i>	G5	S1S2B		
Spotted Sandpiper	<i>Actitis macularius</i>	G5	S3S4B		
Gadwall	<i>Anas strepera</i>	G5	S2B		
Short-eared Owl	<i>Asio flammeus</i>	G5	S1B	E	
Hermit Thrush	<i>Catharus guttatus</i>	G5	S3S4B		
Northern Harrier	<i>Circus cyaneus</i>	G5	S2B		
Magnolia Warbler	<i>Dendroica magnolia</i>	G5	S3S4B		
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	G4T4	S2	I	
Bald Eagle	<i>Haliaeetus leucocephalus</i>	G5	S3S1B		
Dark-eyed Junco	<i>Junco hyemalis</i>	G5	S2B		
Laughing Gull	<i>Larus atricilla</i>	G5	S1B		
Hooded Merganser	<i>Lophodytes cucullatus</i>	G5	S1B		
Mourning Warbler	<i>Oporornis philadelphia</i>	G5	S1B	E	
Savannah Sparrow	<i>Passerculus sandwichensis</i>	G5	S3S4B		
Pied-billed Grebe	<i>Podilymbus podiceps</i>	G5	S2B		
Golden-crowned Kinglet	<i>Regulus satrapa</i>	G5	S2B		
Red-breasted Nuthatch	<i>Sitta canadensis</i>	G5	S1B		
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	G5	SHB		
Least Tern	<i>Sternula antillarum</i>	G4	S2B	T	
Royal Tern	<i>Thalasseus maximus</i>	G5	S1B	E	
Winter Wren	<i>Troglodytes troglodytes</i>	G5	S2B		
Nashville Warbler	<i>Vermivora ruficapilla</i>	G5	S1S2B	I	
Canada Warbler	<i>Wilsonia canadensis</i>	G5	S3B		
Plant Species					
Lancaster's Sedge	<i>Cyperus lancastricensis</i>	G5	SU		
Grass-leaved Arrowhead	<i>Sagittaria graminea</i>	G5	SU		
Broad-fruited Bur-reed	<i>Sparganium eurycarpum</i>	G5	S3		

¹G5 = Demonstrably secure globally
G4 = Apparently secure globally
_T = Intraspecific taxon is ranked differently than the full species

²S1 = Extremely Rare
S2 = Very Rare
S3 = Rare to Uncommon
S4 = Apparently Secure
S5 = Demonstrably Secure
S_B = Breeding Status
S_N = Non-breeding Status
SU = Possibly rare in Maryland

³E = Endangered
T = Threatened
I = In need of conservation
Sources: MDNR 2007c, 2007d

(2) Wetlands and Watershed Management

a. Program Description and Current Conditions

Wetlands and watershed management address tidal and nontidal wetlands, floodplain, and watershed management at NSAA North Severn. The Air and Water Programs Manager and PWD Environmental Division Natural Resources Manager have responsibility for managing these resources. When necessary, the natural resources manager coordinates wetlands permitting and management activities with the USACE, USFWS, and MDE. The primary regulations driving this program include the CWA, the CZMA, EO 11990 – Wetland Protection, EO 11988 – Floodplain Management, and various Chesapeake Bay Program agreements and initiatives.

Wetlands

Historically, areas of wetlands on NSAA North Severn were extensive. In early to mid 1900s, however, the use of wetland areas in the vicinity of Greenbury Point and Carr Creek as a repository for dredge and fill material was commonplace. A number of areas including a tributary to Carr Creek, Little Carr Creek; a tidal lagoon to the east of Carr Creek; and large areas of freshwater pond were largely filled by the 1950s.

Approximately 54 acres of wetlands have been identified on NSAA North Severn (Table 5-3, Figure 5-6). The NWI wetlands inventory, conducted by the Department of the Interior, identified approximately 41 acres of wetlands including estuarine emergent marsh, estuarine scrub-shrub, palustrine emergent marsh, and palustrine forested wetlands at NSAA North Severn. In addition to the NWI wetland mapping effort, several site-specific delineations have been conducted at NSAA North Severn. In 2002, a nontidal wetland delineation was conducted on approximately 230 acres at Greenbury Point (U.S. Navy 2003). In addition, a small area of wetland (0.85 acre) was delineated at the head of Carr Creek (Environmental Systems Analysis Inc. 2003). A site-specific wetland assessment was also conducted on the proposed site and an alternative site prior to beginning construction of the USNA Brigade Sports Complex, during which, no wetlands were found on site (Environmental Systems Analysis Inc. 2005). No jurisdictional determinations have been made for these delineations by the USACE; therefore they should be used for preliminary planning purposes only.

Watersheds

NSAA North Severn lies within the Severn River and Chesapeake Bay watersheds. A number of subbasins are within the NSAA North Severn boundary. Approximately 48 percent of the station is in the Carr Creek watershed, 18 percent in the Mill Creek watershed, 23 percent is in the Woolchurch Cove watershed, and 10 percent is in the Severn River Tidal watershed (Figure 5-7).

Table 5-3. Wetland Types at NSAA North Severn

Code	Cowardin Classification	Acres
E1UBL	Estuarine Subtidal unconsolidated bottom	0.17
E2EM1J	Estuarine Intertidal emergent persistent, intermittantly flooded	0.54
E2EM1P	Estuarine Intertidal emergent persistent, irregularly flooded	10.46
E2SS1P	Estuarine Intertidal scrub-shrub broad-leaved deciduous, irregularly flooded	1.97
E2USN	Estuarine Intertidal Unconsolidate Shore, regularly flooded	0.62
E2USP	Estuarine Intertidal Unconsolidated Shore, irregularly fooded	0.11
PEM	Palustrine emergent	15.59
PEM1A	Palustrine Emergent Persistent, temporarily flooded	1.97
PEM1C	Palustrine Emergent Persistent, seasonally flooded	1.60
PEM1Fh	Palustrine Emergent Persistent, semipermanently flooded,diked/impounded	0.36
PFO1/SS1A	Palustine Forested Broad-leaved Deciduous/Scrub/Shrub Broad-leaved Deciduous, temporarily flooded	0.70
PFO1/3Ch	Palustine Forested Broad-leaved Deciduous/Broad-leaved Evergreen, seasonally flooded, diked/impounded	0.14
PFO1/4R	Palustrine Forested Broad-leaved Deciduous/Needle-leaved Evergreen, seasonally tidal	0.22
PFO1A	Palustrine Forested Broad-leaved Deciduous, temporarily flooded	2.75
PFO1C	Palustrine Forested Broad-leaved Deciduous, seasonally flooded	1.19
PFO1Ch	Palustrine Forested Broad-leaved Deciduous, seasonally flooded, diked/impounded	0.12
PFO1R	Palustrine Forested Broad-leaved Deciduous, seasonally tidal	0.93
PFO4R	Palustrine Forested Needle-leaved Evergreen, seasonally tidal	0.16
POW	Palustrine Open Water	2.68
PSS1C	Palustrine Scrub/Shrub Broad-leaved Deciduous, seasonally flooded	0.37
PUBHh	Palustrine Unconsolidated Bottom, permanently flooded, diked/impounded	9.53
PUBHx	Palustrine Unconsolidated Bottom, permanently flooded, excavated	1.44
PUSC	Palustrine Unconsolidated Shore, seasonally flooded	0.23
Total		53.85

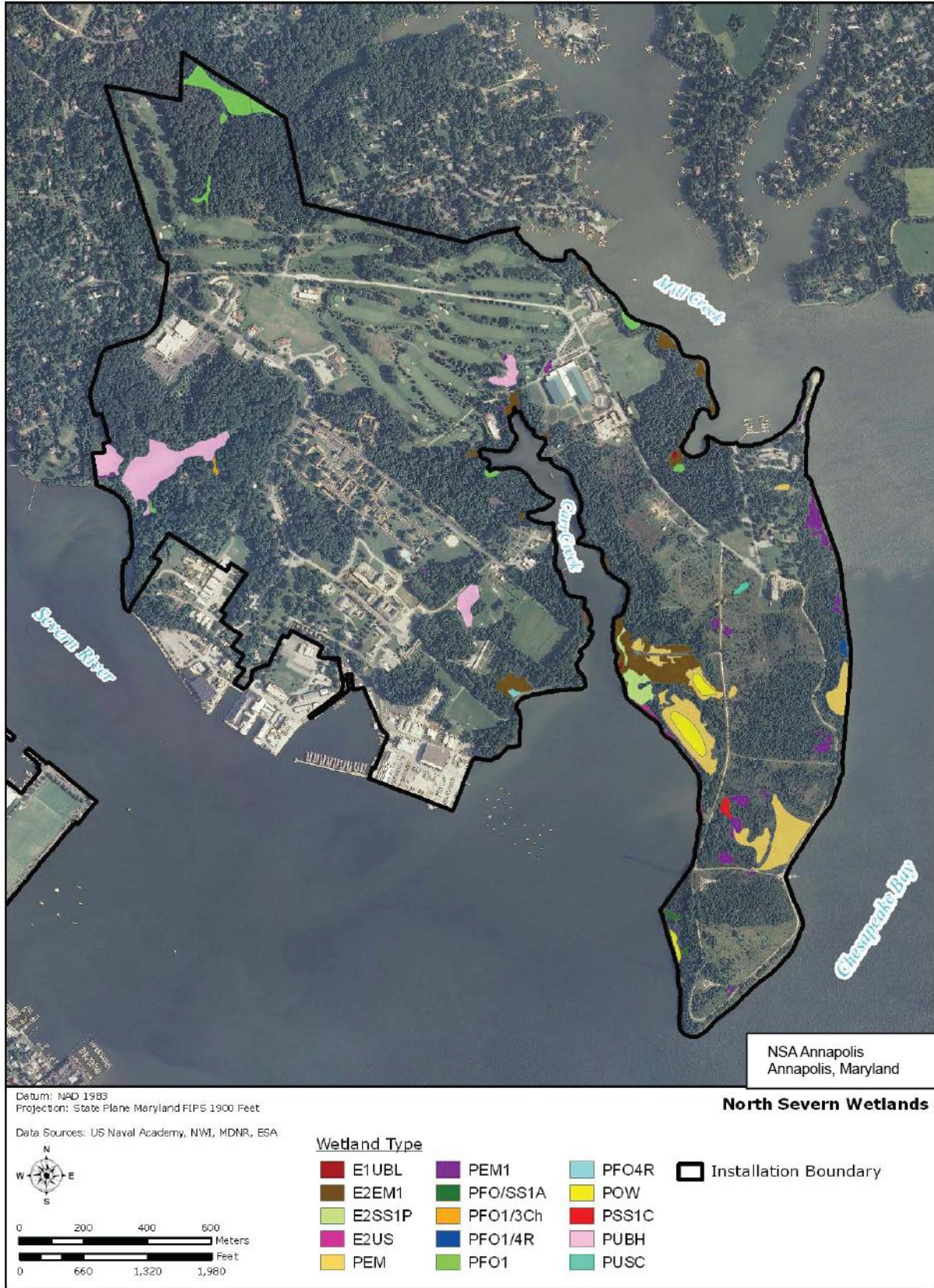


Figure 5-6. NSAA North Severn Wetlands

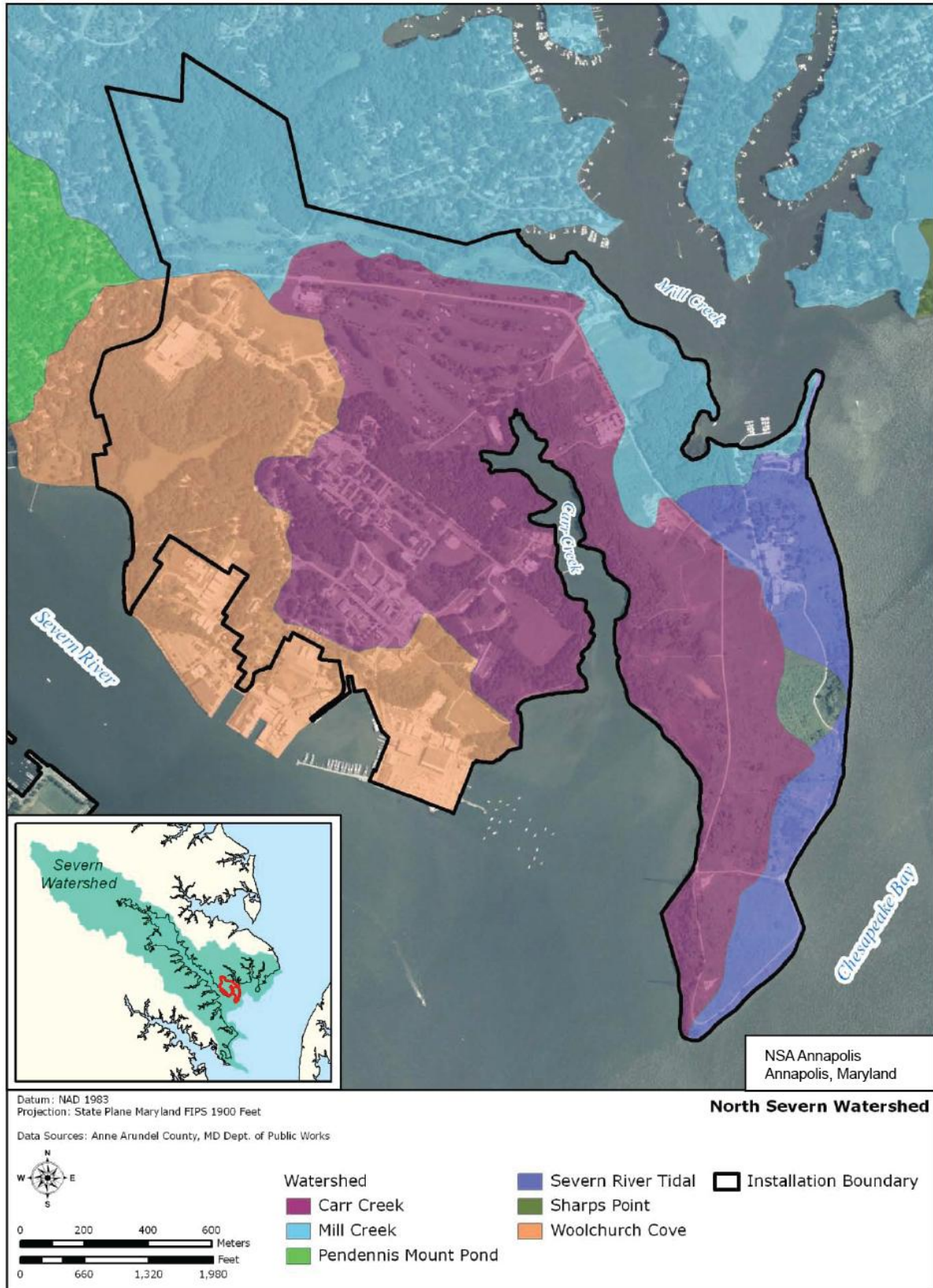


Figure 5-7. NSAA North Severn Watersheds

Floodplains

Although much of the wetlands and low lying areas at NSAA North Severn were filled prior to the 1950s, floodplains are associated with Carr Creek, Mill Creek, and the Chesapeake Bay. Approximately 73 acres (9 percent) of NSAA North Severn lies within the 100-year floodplain and another 23 acres (3 percent) occurs within the 500-year floodplain (Figure 5-8).

Groundwater

Drinking water for NSAA North Severn has been supplied by Anne Arundel County since December 1999 when the former David Taylor Research Center's water treatment plant was closed.

b. Management Goals

The overall goals of wetlands and watershed management are to ensure compliance with applicable state and federal regulations as well as the protection and enhancement of wetland communities and watersheds at NSAA North Severn to the greatest extent practicable. Specific management goals for the program include:

- Protect and enhance the biodiversity, function, and value of wetlands, watersheds, and floodplains;
- Maintain no net loss of wetlands on Navy property;
- Support Navy and regional wetland and watershed protection initiatives; and
- Comply with existing state and federal wetland regulations.

c. Management Practices

Wetlands Management

In support of Navy efforts to protect wetlands and in compliance with the CWA, all wetlands at NSAA North Severn are avoided to the greatest extent practicable during ground disturbing activities and other actions with potential to disturb wetlands. In addition to the planning level delineations that have been conducted, site-specific jurisdictional delineations would be required prior to conducting any activities with potential to impact base wetlands.

Beginning in the 1980s, a number of wetland enhancements and shoreline stabilization projects were conducted in wetland areas used to store dredge spoil to restore wetland function and avoid potential degradation of the adjacent Carr Creek, Mill Creek, and the Chesapeake Bay. Many of the accomplishments were achieved through a cooperative program between the Navy, regulatory agencies, and Anne Arundel Community College. Treatments were conducted at five areas shown in Figure 5-9.

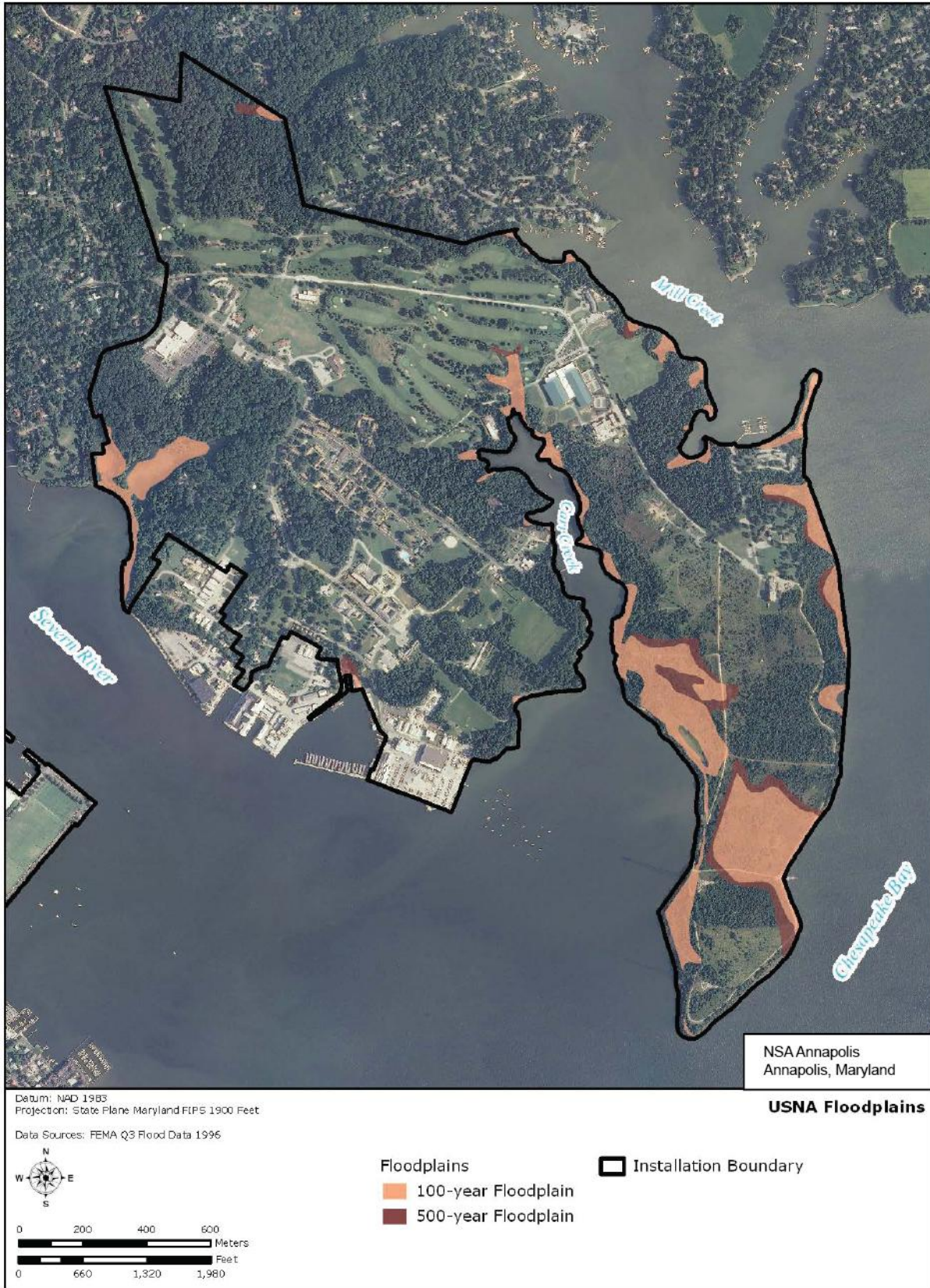


Figure 5-8. NSAA North Severn Floodplains

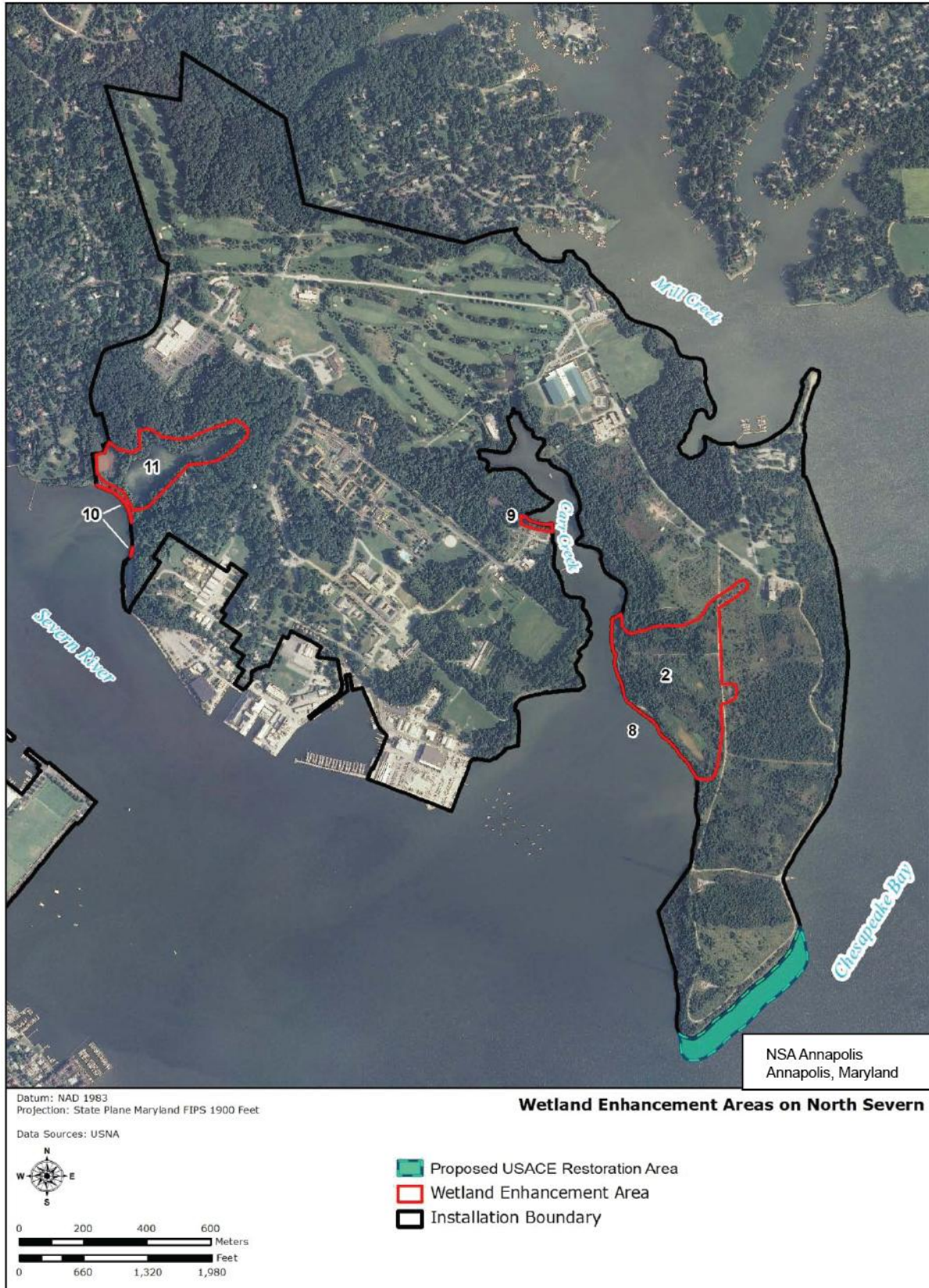


Figure 5-9. Wetland Enhancement Areas on NSAA North Severn Areas

Wetland enhancements and shoreline stabilization projects conducted at NSAA North Severn to date include:

- Removal of hazardous interred debris
- Excavation of dredged material on portions of the site to create summer and winter pools of standing water
- Installation and replacement of water control structures to create seasonal impoundments
- Shoreline stabilization of dredge spoil berms via breakwaters and intertidal marsh plantings
- Common reed and other invasive plant control
- Revegetation with native wetland plants

Future wetland enhancements are also being considered by the USACE to restore an area of tidal marsh at the south east tip of Greenbury Point to its original footprint by adding dredge materials from Chesapeake Bay channels (see Figure 5-9). Approximately 9 acres of tidal marsh would be created by this project.

Preserving all remaining wetlands that occur on NSAA North Severn is a natural resources priority. In addition, continued monitoring and treatment of common reed and other invasive species, and monitoring erosion and structural integrity of the berms are ongoing management needs for these wetland areas. Additional wetland plantings may be required once invasive species control is achieved.

Watershed Management

In order to help achieve nutrient reduction and habitat restoration goals of the Chesapeake Bay Agreements, the Navy has focused on the creation of riparian buffers along streams at NSAA North Severn. Nearly 800 trees have been planted along the Chesapeake Bay and its tributaries since 1996. In addition, 12 acres have been planted at the southern tip of Greenbury Point as required forest mitigation for approximately 8 to 9 acres of land clearing vegetation within the Chesapeake Bay Critical Area at the Brigade Sports Complex. Maintenance of the forest mitigation site is required under permit terms.

Additional riparian buffer enhancement sites were identified in the 2000 *Chesapeake Bay Riparian Forest Buffer Site Assessment* (U.S. Navy 2000b). Of the five sites identified as potential enhancement sites, only one site has been planted,



Riparian Forest Buffer Planting

though natural regeneration is occurring on several other sites. Reassessing the remaining sites and implementing the riparian buffer planting plans would help the Navy meet its goals of supporting the Chesapeake Bay Agreements as well as contribute to watershed protection at NSAA North Severn.

Floodplain Management

In order to protect the floodplains at NSAA North Severn, any changes to the built environment should be restricted to previously developed sites and all undeveloped areas within floodplains should be preserved. All project proposals are reviewed by Environmental Division personnel to ensure floodplain protection. As floodplains change over time with landscape and climate change, up-to-date FEMA or other floodplain data must be consulted for any development activity.

(3) Coastal/Marine Management

a. Program Description and Current Conditions

Under the federal CZMA, activities on federal lands that are reasonably likely to affect use of lands or waters, or natural resources of the coastal zone beyond the boundaries of the federal property, must be consistent to the maximum extent practicable with the enforceable policies of the state's CZMP. Coastal zone resources include the shorelines and the adjacent waterbodies at NSAA North Severn. NSAA North Severn has approximately 12 miles of shoreline along the Severn River, Carr Creek, and Mill Creek. Additionally, 582 acres (70 percent) of NSAA North Severn is included in the state's Chesapeake Bay Critical Area (Figure 5-10). NSAA North Severn is required to demonstrate consistency with the Critical Area Law requirements as part of its compliance with the CZMA through Maryland's CZMP and Enforceable Policies. The Critical Area Law requires that each local jurisdiction identify and provide for the establishment, preservation, and maintenance of Habitat Protection Areas. These areas include: naturally vegetated buffers, nontidal wetlands; the habitats of threatened and endangered species, and species in need of conservation, and their habitat; significant plant and wildlife habitat; and, anadromous fish spawning areas. Specific coastal and marine management initiatives in which Navy personnel have participated in and around NSAA North Severn include oyster reef restoration, shoreline stabilization, SAV establishment, and nutrient and sediment reduction programs.

b. Management Goals

The goals of coastal and marine management at NSAA North Severn are to preserve, protect, and, where possible, restore and enhance the resources of the coastal zone and to maintain consistency with Maryland's Coastal Zone Program and its associated regulations.

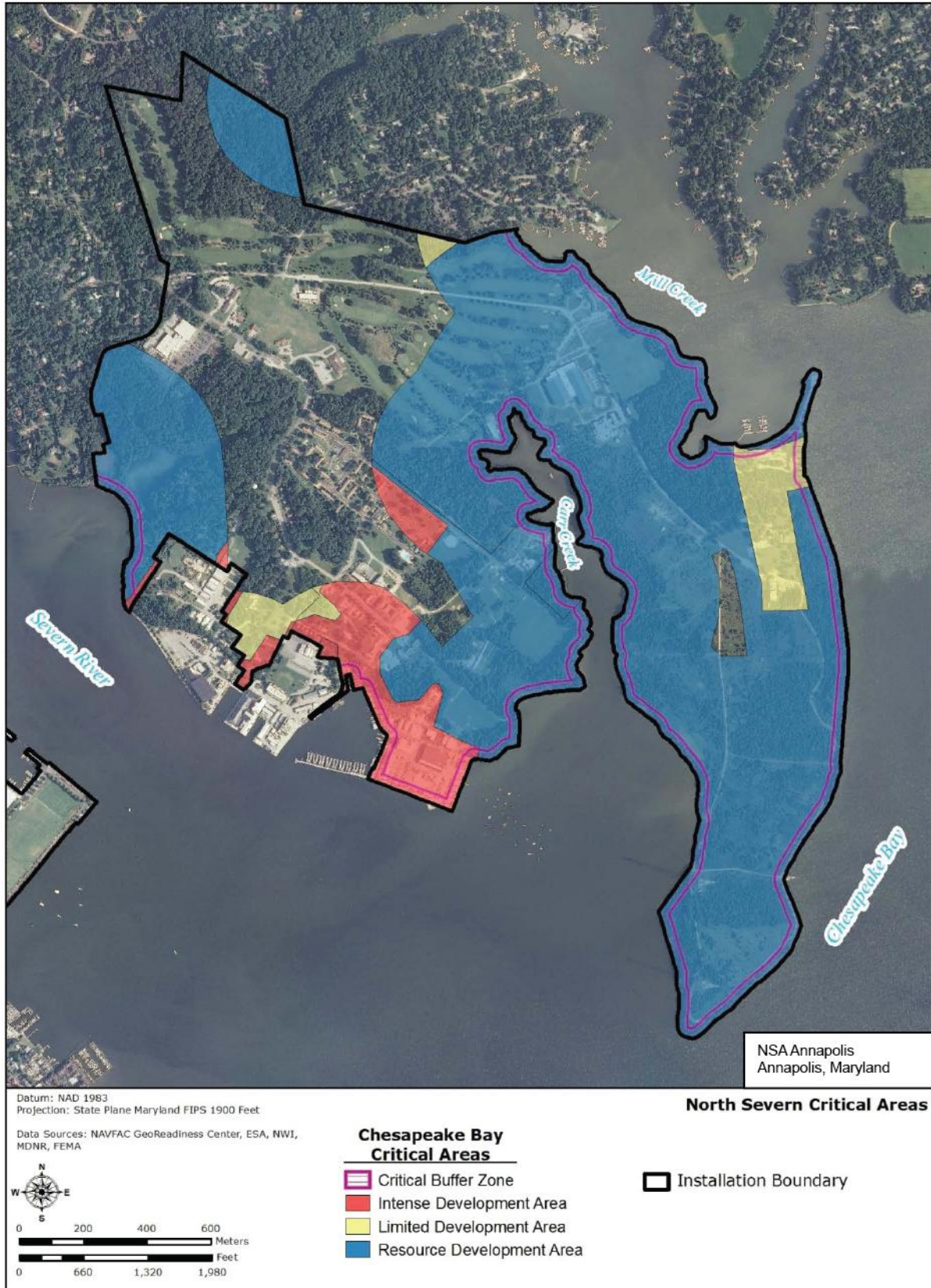


Figure 5-10. Chesapeake Bay Critical Areas at NSAA North Severn

c. Management Practices

Shoreline Stabilization

Beginning in the 1930s, extensive shoreline protection efforts including the construction of rock seawalls, wooden bulkheads, and earthen berms have resulted in the hardening on most of the shoreline at NSAA North Severn and only about 12,500 feet of the shoreline remains in a natural condition. In an effort to improve shoreline condition and enhance shoreline habitat, approximately 3,300 feet of shoreline have been protected through a combination of nonstructural and structural methods. In areas, smooth cordgrass (*Spartina alterniflora*) has been planted behind rock breakwaters, creating small marshlands. Continued monitoring and evaluation of shoreline condition are required to ensure shoreline stability.

Because of the long reaches and high-energy waves impacting most of the NSAA North Severn shoreline, there are limited areas that would be appropriate to convert from the existing hardened shoreline to living shoreline. Enhancing the existing shoreline with a combination of nonstructural methods such as installing biologs with toe boulders, (narrow bands of rock that hold sand-fill and biologs in place); and structural methods such as segmented sills, jetties, or groins, using sand backfill planted with native grasses, rushes, and sedges would be appropriate along portions of Carr Creek and Mill Creek. The use of structural methods such as offshore breakwaters and creating oyster reefs and backfill followed by planting beach grasses and other emergent aquatic vegetation is recommended for shoreline stabilization in high energy wave areas.

Early coordination with the USACE, MDE, and USFWS would be required for any alteration of shorelines in tidal areas, as well as wetlands including removal of vegetation, grading and introducing fill material, installation of nonstructural materials like biologs with toe boulders, and installation of hard structures like bulkheads, sills, and revetments. NSA Annapolis should consider partnering with local watershed protection groups such as the Friends of College Creek and the Spa Creek Conservancy to initiate further shoreline stabilization projects. The Navy Coordinator for the DoD Chesapeake Bay Program can provide assistance developing projects like this that benefit the Chesapeake Bay.

Submerged Aquatic Vegetation

Ongoing mapping of SAV by the Chesapeake Bay Foundation have mapped SAV in several of the rivers and creeks around NSA Annapolis. Mapping efforts in the Severn River, Carr Creek, and Mill Creek indicate a small amount of SAV occurs in the area, but is generally limited to upper portions of the creeks (NOAA 2008). NSA Annapolis will continue partnering with the Chesapeake Bay Foundation to conduct additional restoration in areas that can support SAV. A site assessment that analyses salinity, turbidity, and water depth should be conducted prior to beginning such a project.

Oyster Restoration

Since 1977, midshipmen have participated in an oyster recovery effort by moving oyster shell bars from a nursery in Mill Creek to an oyster bar at the mouth of the Severn River. The Station also provides access to a pier at the MWR Marina. The Chesapeake Bay Foundation, a USNA partner, uses the location to meet local citizens who are dropping off oysters to be placed on nearby bars by the Foundation.

USNA will continue partnering with Chesapeake Bay Foundation to construct oyster reefs in appropriate habitat in the waters around NSAA North Severn. Site assessments that analyze salinity, turbidity, and water depth should be conducted prior to beginning such a project. Site monitoring should be continued for three to five years to assess the effectiveness of the project.



Midshipmen Helping with Oyster Restoration

(4) Fish and Wildlife Management

a. Program Description and Current Conditions

Because of the availability of habitat and the relatively natural state of the site, most fish and wildlife surveys that have been conducted by the NSA Annapolis Natural Resources Program have focused on Greenbury Point. In 1997, the rare, threatened, and endangered species habitat survey identified a number of bird and wildlife species at Greenbury Point (U.S. Navy 1997). Extensive bird surveys including breeding bird surveys from 1996 to 1998, Christmas bird count and May bird count from 1989 to about 2003, a quail call survey in 2002, and Monitoring Avian Productivity and Survivorship (MAPS) stations in 2005 and 2006 have been conducted at Greenbury Point. Other wildlife surveys include butterfly surveys conducted in 1997 and 1998 and herpetofaunal surveys conducted between 1997 and 2001.

Over 150 bird species have been documented at Greenbury Point and the adjacent waterbodies. Birds that frequently utilize the installation's open areas and urban settings include eastern meadowlark (*Sturnella magna*), northern mockingbird, American robin, northern cardinal, brown-headed cowbird, house sparrow, house finch, purple martin, and European starling. Forested areas support a number of warblers, vireos, flycatchers including yellow-rumped warbler (*Dendroica coronata*), magnolia warbler (*Dendroica magnolia*), yellow warbler (*Dendroica petechia*), and pine warbler (*Dendroica pinus*), white-eyed vireo (*Vireo griseus*), eastern wood pewee (*Contopus virens*), and yellow-bellied flycatcher (*Empidonax flaviventris*).

The marshes and shoreline also provide habitat for a number of shorebirds and wading birds including a number of gull, great blue heron, snowy egret (*Egretta thula*), and green heron (*Butorides virescens*), as well as numerous red-winged blackbirds. The waters of Mill Creek and Carr Creek, adjacent to Greenbury Point are historic waterfowl concentration areas and a variety of waterfowl including Canada geese, canvasbacks (*Aythya valisineria*), buffleheads (*Bucephala albeola*), common goldeneyes (*Bucephala clangula*), ruddy ducks (*Oxyura jamaicensis*), scaup (*Aythya* spp.), pie-billed grebe and horned grebe (*Podilymbus podiceps* and *Podiceps auritus*), loons (*Gavia* spp.), and mergansers (*Mergus* spp.) overwinter in the area. Ospreys are also known to nest on the remnant tower structures on the facility.

Although not listed as state or federally protected species, a number of species occurring at NSAA North Severn are considered birds of conservation concern by the USFWS (2008). Included are pied-billed grebe, horned-grebe, red-throated loon (*Gavia stellata*), snowy egret (*Egretta thula*), lesser yellowlegs (*Tringa flavipes*), short-eared owl (*Asio flammeus*), and wood thrush (*Hylocichla mustelina*).

Mammal species that have been documented at Greenbury Point include large mammals such as white-tailed deer, gray fox and red fox; medium-sized mammals such as woodchuck, eastern cottontail, eastern gray squirrel, and Virginia opossum; and small mammals such as short-tailed shrew, eastern mole, meadow vole (*Microtis pennsylvanicus*), house mouse, and little brown bat.

Reptiles and amphibians noted in the area include spring peeper, gray treefrog, redback salamander, diamond-back terrapin (*Malaclemys terrapin*), painted turtle, eastern rat snake, northern water snake, eastern worm snake, box turtle.

The PWD Environmental Division Natural Resources Manager has responsibility daily planning, budget controls, and general administrative functions of the program. Temporary SCA interns and volunteers have, at times, been available to provide technical support. The USFWS and MDNR are cooperating agencies and are available to provide guidance on management issues and projects.

b. Management Goals

The natural resources program strives to protect and enhance wildlife resources within the constraints of the installation mission at NSAA North Severn. The basic long-range goals of fish and wildlife management are to:

- Protect, conserve, and manage fish and wildlife populations and their habitats at a level compatible with the installation mission; and
- Ensure that wildlife populations do not conflict with the installation mission.

c. Management Practices

Nuisance Animal Management

Whitetail deer, ticks, and Canada geese are the primary nuisance wildlife species at NSAA North Severn, although feral cats have also been reported. Canada geese are a management problem at the golf course because of the damage they can cause by overgrazing and through their excrement, which soils the green and, because of its high nitrogen content, can burn holes in the turf. Canada geese populations are currently controlled through an Interagency Agreement between the Naval Academy Athletic Association (NAAA) and APHIS-WS.

In 2008, a spotlight survey conducted at NSAA North Severn with support of APHIS-WS identified 200 deer on the 827-acre property. Considering the availability and quality of habitat, a population of 20 to 30 deer is recommended for the site (Healy 2008). Although hunting on DoD facilities is authorized and promoted by the Sikes Act, DoDI 4715.3, OPNAVINST 5090.1C, and NAVFAC MO 100.3 – Fish and Wildlife Management Manual, there is no hunting program at NSAA North Severn. The most feasible deer population management option available at NSAA North Severn is to increase deer control efforts under an Interagency Agreement with APHIS-WS.

In coordination with the USNA APHIS-WS two additional infrared surveys and two cullings were conducted in 2009. During 2009 the deer population at NSAA North Severn, including Greenbury Point and NSA Annapolis, was reduced by 270 (Table 5-4). A total 86 bucks and 184 does were culled. All recoverable deer carcasses were sent to a local processor and subsequently sent to local homeless shelters for consumption.

Table 5-4. Culled Deer, 2009

Date	Greenbury Point		NSAA North Severn NSA Annapolis		Total
	Bucks	Does	Bucks	Does	
4-28-09	11	25	9	14	
4-29-09	4	28	10	18	
12-9-09	16	29	12	24	
12-10-09	3	14	12	21	
12-15-09	9	11	-	-	
2009 Total	43	107	43	77	270

Reducing the deer population at NSAA North Severn should help control tick populations as well. Additional measures to control ticks could include installing several a 4-poster deer treatment bait stations to treat ticks on the remaining deer population. Appropriate locations for

the devices should be determined through evening or spotlight surveys to assess deer congregation areas.

Feral cats are another potential nuisance animal issue at NSAA North Severn. Because of the devastating impacts feral cats can have on native bird and small mammal populations, a pilot cat survey and, if necessary, trapping program should be initiated to assess the extent of the problem of feral cats at NSAA North Severn. Evidence from the USDA-WS coordinator for the raccoon trapping and vaccination program indicates the potential need for a feral cat capture program. Baited stations and infrared motion-activated cameras placed in areas likely to attract feral cats (abandoned buildings, shacks, etc.) can be used to further detect the presence of cats. Trapping feral cats should be accomplished through the use of humane feral cat traps baited with fish, meats, oil of catnip, sardines, canned tuna, or chicken. Captured cats will be brought to a local animal shelter for assessment of adoptability, and euthanized if considered unadoptable. Navy policy prohibits trap, neuter, release programs.

Osprey can also be a nuisance when nesting activities disrupt mission activities. Because ospreys are protected by the MBTA, only nonlethal methods of discouraging nesting in unwanted areas can be used. Placing decoy owls on potential nesting areas to deter unwanted osprey pairs is currently used by the NR program manager. Osprey nesting platforms have been placed in appropriate locations to ensure adequate nesting locations are available.

Northern Bobwhite

Once common throughout Maryland, northern bobwhite populations have declined by more than 90 percent in the past 40 years (MDNR 2008e). As one of Anne Arundel County's few remaining areas that may support a population of northern bobwhite, Greenbury Point provides important habitat for this species. The bobwhite is primarily an edge species and a species of early successional plant communities. Urbanization, changes in farming practices, lack of prescribed burning, and the use of agricultural chemicals are, in part, responsible for the decrease in quail populations. Past maintenance practices that kept mowed grass areas and bare ground around the base of radio towers at NSAA North Severn have benefitted northern bobwhite. Currently, large areas of early successional habitat are available, although much of the habitat is succeeding to forest. Continuing to maintain areas of open, early successional habitat on a rotating basis on Greenbury Point will help ensure the continued existence of northern bobwhite.

A guide for bobwhite quail management is available from the USDA NRCS via their website:

<http://www.whmi.nrcs.usda.gov/technical/TheQuailReport.htm>

Mowing and/or prescribed fire can be used to control woody vegetation. Treatments should be conducted on a rotational basis, with no more than one-third of the area being treated in a given year. Seeding in rows of partridge pea (*Cassia fasciculata*) or other native legume species can

also improve habitat value for quail. Annual quail surveys would be required to assess the effectiveness of management practices at NSAA North Severn. Annual surveys should be coordinated with the MDNR upland game bird biologist, who can advise the natural resources manager on an appropriate survey route and survey protocol.

Nesting cover for quail is best provided by warm season grass clumps left from the previous growing season. Interspersion of cover types, including sparse ground cover and brushy thickets for escape cover, is an extremely important feature of good quail habitat.

Nest Box Program

A number nest boxes and roosting structures have been installed and monitored on the golf course and Greenbury Point since the 1990s. As of 2000, there were 79 bluebird boxes, 16 osprey platforms, 15 purple martin houses, 4 raptor and owl boxes, and 3 or more bat boxes. Until 2002 volunteers and Anne Arundel Bird Club members monitored and maintained the boxes. Currently, box usage and nest success are recorded and house sparrow nest removed as required throughout the nesting season, a migratory bird biologist with the USFWS located at the Chesapeake Bay Field Office. The responsibility for monitoring the nest boxes will be transferred to the Annapolis NR program manager in 2011. Mapping nest box locations using GPS technology and annual maintenance and monitoring would improve the effectiveness of this program.

Fisheries Management

Fishing at NSAA North Severn is limited to recreational use (fishing and crabbing) and is permitted at Possum Point and the south end of Seabee Beach. A valid Maryland fishing license is required. Enforcing state fishing regulations and implementing proactive measures to prevent the spread of aggressive nonnative species are the primary actions including prohibiting use of all live bait other than night crawlers and bloodworms and prohibiting use of all live nonnative bait will help protect native populations. Posting signs that educate anglers on live and nonnative bait restrictions would help prevent further introduction of nonnative species into the bay and its tributaries.

Wildlife Surveys and Monitoring

Most of the wildlife surveys conducted at NSAA North Severn were conducted in conjunction with surveys being conducted at USNA. The resulting data for NSAA North Severn are not readily available as separate species lists. Many of the surveys were conducted in the late 1990s and are in need of updating in order to provide a better understanding of the current conditions at NSAA North Severn. Baseline surveys and monitoring protocols for breeding and migratory landbirds, waterfowl, aquatic organisms, herpetofauna, and bats and other mammals should be

developed and implemented. It is critical to develop written protocols, GPS-located survey points, and a digital database for each survey so that future monitoring can be accomplished.

(5) Migratory Bird Management

Migratory bird management at NSAA North Severn focuses on the conservation and enhancement of migratory bird habitat in support of the MBTA and EO 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds. Breeding and/or migratory bird surveys, which primarily focused on Greenbury Point, were conducted annually from 1989 to about 2003. The diversity of habitats supports a wide variety of migratory birds. Habitat conservation and enhancement are the primary management activities that are conducted at NSAA North Severn to migratory bird species.

The NAVFAC PWD Annapolis Natural Resources Manager is responsible for initiating migratory bird enhancement projects. Local bird clubs such as the Anne Arundel Bird Club and Maryland Bluebird Society are available to support migratory bird monitoring projects. The USFWS and MDNR are cooperating agencies and are available to provide guidance on management issues and projects concerning migratory birds. During annual INRMP reviews, the natural resources manager and cooperating parties must assess migratory bird conservation measures that have been implemented and the effectiveness of the conservation measures in avoiding, minimizing, or mitigating take of migratory birds.

a. Management Goals

The goals of migratory bird management at NSAA North Severn are to support the conservation of migratory birds through habitat conservation and enhancement and to avoid the incidental take of migratory birds through military readiness actions in accordance with the MBTA to the greatest extent practicable.

b. Management Practices

The natural resources program has enhanced migratory bird nesting habitat by installing nesting boxes for eastern bluebirds, owls, and wood ducks, and nesting platforms for osprey. Additional monitoring and maintenance of existing structures and the installation of additional nesting boxes as described in Section 5.D(4)c would improve the program's effectiveness and value to migratory bird populations.

The few remaining large tracts of forested areas at NSAA North Severn provide habitat for a number of species such as wood thrushes (*Hylocichla mustelina*), veerys (*Catharus fuscescens*), ovenbirds (*Seiurus aurocapillus*), and barred and screech owls (*Strix varia* and *Otus asio*), which are all forest interior dwelling species. The value of these habitats should be taken into consideration in the development of future land management plans and preserved to the greatest

extent possible. Controlling invasive species in these areas should also be a priority for the natural resources program.

Maintaining high value grasslands and early successional fields also benefits a large number of migratory bird species that rely on open habitats. To maximize benefits, management of early successional habitats greater than 20 acres should be shifted to grassland and smaller early successional parcels to shrubland. Monitoring and controlling infestations of common reed in salt, freshwater, and brackish marshes is also important to migratory waterfowl.

In the spring of 2009, 10 osprey nesting platforms were erected around Greenbury Point. The poles were set 100 feet offshore and at approximately 300-foot intervals. Pole usage will be monitored by the NAVFAC PWD Annapolis Natural Resources Manager and volunteers, when available.



Osprey at New Nesting Platform, April 2009

(6) Forest Management

a. Program Description and Current Conditions

NSAA North Severn is a considerably less developed than USNA and consists of developed and mowed areas, extensive early successional habitat, and forested areas. Over 225 acres at NSAA North Severn consists of forests, woodlands, or semi-natural areas with trees and shrubs (Figure 5-11). Forested areas range in size from isolated stands of trees to stands up to 80 acres.

Because of the small size and relative isolation of the forested areas at NSAA North Severn, there is little potential for commercial forest management on the installation. Forest resources do, however, provide a number of social, environmental, and economic benefits including aesthetic enhancement, water quality improvement, and wildlife habitat. Forest management is largely the responsibility of the NAVFAC PWD Annapolis Natural Resources Manager. The MDNR Forest Services (i.e., the Tree-mendous Program, PLANT Community Awards Program), USDA Forest Service, USFWS, and volunteers such as the Midshipmen Action Group and local Boy Scout and Girl Scout troops could also assist with forest enhancement projects undertaken at NSAA North Severn.

A forest inventory and forest stand assessment was conducted during the summer and autumn of 2000 by a USFWS biologist prior to developing the 2001 INRMP (U.S. Navy 2001c). Several of the largest tracts of contiguous forested areas located at NSAA North Severn were assessed. Additional forested land, much of which consists of immature stands of saplings, occurs but has not been assessed beyond classification as hardwood, mixed hardwood/pine, or pine (Table 5-5). Approximately 63 percent (142 acres) of the forested area is hardwood; 32 percent (74 acres) is mixed hardwood pine; and about 5 percent (10 acres) is pine. A 12-acre site was planted in 2009



Figure 5-11. NSAA North Severn Forested Areas

Table 5-5. Forest Cover Types at NSAA North Severn

Type	Acres	% Forested Area
Hardwood	142	63
Hardwood/Pine	74	33
Pine	10	4
Total	226	100

with a variety of native tree species as a required Chesapeake Bay Critical Area forest mitigation site. This area will be included as a forest cover type as it matures and canopy closure is reached. More detailed descriptions of the primary forested areas at NSAA North Severn are presented below.

Forest Area A1

Forest Area A1 contains some of the oldest and largest trees at NSA Annapolis. This forest consists of a mature hardwood stand approximately 100 feet in height that is dominated by tulip poplar (*Liriodendron tulipifera*), southern red oak, and chestnut oak from 20 to 40 inches diameter at breast height (dbh). Other canopy tree species scattered throughout this forest include shagbark hickory (*Carya ovata*), white oak, willow oak (*Quercus phellos*), and red maple (*Acer rubrum*). American beech (*Fagus grandifolia*) comprises the dominant subcanopy species. A wetland dominated by red maple flows north along the central part of the hardwood forest and forms the headwaters of a tributary to Martins Cove. Winterberry (*Ilex verticillata*), red maple, and spicebush (*Lindera benzoin*) are the major species in the shrub layer of this wetland.

Forest Area A2

Forest Area A2 consists of a loblolly pine (*Pinus taeda*) plantation averaging 40 feet in height with diameters from 7 to 12 inches. This plantation is bordered by hardwood forest on the north and west and a meadow that is succeeding into forested habitat forms the western perimeter. The golf course forms the south and east boundaries of this plantation. Black cherry (*Prunus serotina*) and tulip poplar are minor forest components in this loblolly pine plantation. Japanese honeysuckle (*Lonicera japonica*), blackberry (*Rubus pensilvanicus*), and trumpet creeper (*Campsis radicans*) form a sparse ground cover.

Forest Area B

Forest Area B is located on Greenbury Point north of West Road and is across the street from the Greenbury Point Nature Center. This forest stand is comprised of areas of loblolly pines that are 30 to 35 feet in height and from 7 to 14 inches dbh. Other tree and shrub species that occur along stream corridors and the edges of the unit include black locust (*Robinia pseudoacacia*),

winged sumac (*Rhus copallina*), sawtooth oak (*Quercus acutissima*), persimmon (*Diospyros virginiana*), and red mulberry (*Morus rubra*). Ground cover is sparse in areas of 100 percent pine closure. The edges and openings are covered with a ground cover of unidentified grasses, blackberry, Japanese honeysuckle, multiflora rose, and goldenrod (*Solidago* spp.).

Forest Area C

Forest Area C is located in the central portion of NSAA North Severn, between Alder Road and Carr Creek. Most of this area was highly disturbed in the last 10 to 20 years. The area consists of a mosaic of forest patches that vary from 10 to 50 feet in height. The majority of this highly disturbed forest is dominated by black locust, black cherry, and American elm (*Ulmus americana*) that are 20 to 50 feet in height. Scattered loblolly pines also occur throughout the stand. In addition, one small hillside, adjacent to Sycamore Court, contains tulip poplar and southern red oak over 80 feet in height. Because of the highly disturbed nature of this forest, nonnative species such as multiflora rose, Oriental bittersweet (*Celastrus orbiculus*), and Japanese honeysuckle are the dominant ground and vine cover.

Forest Area D

Forest Area D is located at the southwest tip of Greenbury Point. Most of this forest consists of a narrow strip of trees dominated by black cherry, winged sumac, and persimmon that are 20 to 40 feet in height. Japanese honeysuckle, blackberry, and poison ivy (*Toxicodendron radicans*) form a thick mat of ground cover in areas with forest openings. Some of the wetter forest openings are dominated by common reed.

Forest Area E1

Forest Area E1 is the largest contiguous forest at NSAA North Severn. It is located south and west of Kincaid Road and west of Beach Road. A 6-acre pond is in the center of the stand. Chestnut oak and tulip poplar are the dominant tree species in this forest and in some areas grow up to 100 feet in height and from 22 to 43 inches dbh. Other tree species of large size include scattered specimens of southern red oak, white oak, and black oak up to 100 feet tall and from 18 to 31 inches dbh. Many other species of trees are distributed throughout this forest such as willow oak, black walnut (*Juglans nigra*), loblolly pine, and American elm, which are widely scattered and smaller in size. The southeastern portion of this forest, in and around the family campgrounds, contains invasive, nonnative tree species such as sweet cherry (*Prunus avium*) and tree of heaven, and shrub and ground cover species such as multiflora rose, Japanese honeysuckle, and English ivy.

Forest Area E2

Forest Area E2 is located within the NSA Annapolis portion of the NSAA North Severn. It is bounded by Kincaid, Eucalyptus, Gage, and Bennion roads. Tulip poplar is the dominant species and averages 100 feet in height and 17 to 36 inches dbh. Other canopy tree species include northern red oak and white oak. Red maple and black cherry comprise an under story layer, 30 to 40 feet in height, that occur in openings and along a power line right-of-way.

Forest Area F

Forest Area F is located south of Alder Road and is east and south of the sewer treatment plant and baseball field. This forest stand is comprised of a discontinuous canopy of loblolly pine averaging 80 feet in height and 16 to 24 inches dbh. Large areas of black cherry, black locust, and other hardwood species from 30 to 40 feet in height are the most common species along the edges and openings in this forest. Poison ivy and Japanese honeysuckle are the dominant ground cover species and create a continuous mat of vegetation in the openings and along the edges of the stand.

b. Management Goals

The primary objectives of forest management at NSAA North Severn are to:

- Conserve and enhance existing forested areas that contribute to overall ecosystem function; and
- Increase forested acreage through reforestation where practicable, within the constraints of the installation mission.

c. Management Practices

Although commercial forestry is not an objective of forest management at NSAA North Severn; management of the forested area is necessary to maintain and enhance this valuable resource. The primary issues concerning the forested areas are land development and invasive plant control. In accordance with the 2007 Base Master Plan, current development plans limit development to previously developed or disturbed (U.S. Navy 2007a). Future base plans should continue to conserve the installation's forested areas. In particular, the forest mitigation site (see Figure 5-11) must be maintained in a permanently forested condition as a Chesapeake Bay Critical Area forest mitigation site.

Invasive species dominate much of the natural areas at NSAA North Severn. The forest, shrub, and grasslands at Greenbury Point are particularly infested with invasive species such as Japanese honeysuckle, multiflora rose, Chinese lespedeza (*Lespedeza cuneata*), Bradford pear (*Prunus calleryana*), sawtooth oak, tree of heaven, Russian and autumn olive (*Elaeagnus angustifolium* and *Elaeagnus umbellata*), and Oriental bittersweet. Control efforts have included

cutting and spraying herbicides and prescribed burns in various areas. As much of the forest mitigation site was infested with invasive species prior to planting, additional effort must be made to control invasives to ensure the survival of the planted trees. However no pre-or post-treatment mapping has been conducted so it is not possible to assess the effectiveness of treatments. Before conducting further control, a survey and mapping should be conducted in the treatment area.

(7) Vegetative Management

a. Program Description and Current Conditions

Vegetative management includes grounds maintenance in improved grounds, landscaped areas, grassland and scrub-shrub habitat, and other non-forested areas at NSAA North Severn. Grounds maintenance is largely the responsibility of the PWD Facilities Engineering and Acquisition Division, which oversees the facility maintenance contract, whereas the NAAA oversees the grounds maintenance at the golf course. The NAVFAC PWD Annapolis Natural Resources Manager supports vegetation management through providing guidance on landscape planting species lists as well as initiating habitat improvement projects such as riparian buffer enhancements, invasive species control, and grassland management. The MDNR Forest Service, USFWS and volunteers such as the Midshipmen Action Group and local Boy Scout and Girl Scout troops can also assist with habitat enhancement projects undertaken at USNA.

b. Management Goals

The goals of vegetative management and grounds maintenance are to:

- Maintain safe conditions for personnel and visitors to NSAA North Severn;
- Provide an attractive, well-maintained working environment for installation personnel through the proper management and enhancement of landscaped areas; and
- Enhance landscaped areas to better contribute to overall ecosystem function.

c. Management Practices

Grasslands and Scrub-shrub Communities

A large area of warm season grasslands was established on Greenbury Point by the natural resources program in 1996. Maintenance of the area has not been conducted consistently and the grasslands have largely succeeded into scrub-shrub habitat. Nonnative, cool season grasses and a variety of native and nonnative shrubs species are competing with the planted warm season grasses. Restoring portions of the site to native warm season grasses through an annual prescribed burning program and/or mowing, while maintaining other areas as scrub-shrub

habitat, would benefit a wide variety of wildlife including many migratory bird species that are dependant on these habitats.

Frequent fires (intervals of less than 5 years) can be used to maintain early successional communities and improve habitat conditions for a number of wildlife species. The production of herbaceous growth sharply increases during the first growing season following a prescribed burn and gradually decreases over the next 2 to 4 years. However, frequent fires tend to favor annual species by eliminating competing perennial vegetation and can increase the occurrence of invasive exotic species. Bermuda grass (*Cynodon dactylon*), sericea lespedeza, and spotted knapweed (*Centaurea maculosa*) are nonnative invasive species that invade burned sites and should be watched for.

In support of native habitat restoration, a 9-acre field was burned in 2002 and another 19-acre field was burned in 2004. Planned burns were not able to be conducted in 2003 and 2005 because of the firing range schedule. A Prescribed Burn Plan was developed by the MDNR Forest Service in 2004 to address habitat management on Greenbury Point. The plan identified four fields totaling 88.8 acres to be burned on a four-year rotational to allow for a range of habitat conditions. Field #4 was planted as a Chesapeake Bay Critical Area forest mitigation site and should not be considered part of the burn plan in future treatments. Updating the plan to reflect current management goals and implementing prescribed burns on a rotational basis in the remaining portions of the conservation area would further restore native warm season grasses and control invasive species throughout the treatment area.



Greenbury Point Native Warm Season Grasses

Golf Course Management

The USNA Golf Course is managed privately by the NAAA and is not under the oversight of the natural resources manager. Although golf courses are traditionally, heavy users of fertilizers, pesticides, and fungicides, the Golf Course Superintendent recognizes the value of employing sustainable methods of grounds maintenance that reduce dependence on lawn chemicals and excessive water and improve wildlife habitat. Practices such as maximizing the use of roughs and natural areas and recycling irrigation water have been implemented at

*The Environmental Institute for Golf provides BMPs via their website:
<http://www.eifg.org/focus/default.asp>*

the USNA Golf Course. Additional information and BMPs are available from the Environmental Institute for Golf, which is an organization committed to strengthening the compatibility of golf with the natural environment. The Institute can provide guidance in the focus areas of water management, integrated plant management, wildlife and habitat management, energy and waste management, and golf course siting, design, and construction.

Beneficial Landscaping

In addition to the golf course and the natural areas on Greenbury Point, maintained lawns and landscaped areas are associated with the Navy Exchange, Commissary, Child Development Center, Family Service Center, and other facilities at NSAA North Severn. Implementing beneficial landscaping practices, as outlined in Section 2.B(7), throughout these areas is another important aspect of vegetation management on the installation. Minimizing the use of pesticides, controlling invasive species, and using native plants in landscaping and restoration sites are the primary practices that should be implemented. The natural resources manager should be consulted as landscaping plans are developed for new or remodeled facilities to ensure appropriate native species are used.

(8) Invasive Species Management

a. Program Description and Current Conditions

Invasive plant species were identified at NSAA North Severn during the forest survey conducted prior to developing the 2001 INRMP (U.S. Navy 2001c) and during a survey for developing the *Alien Plant Management Plan for Greenbury Point* (U.S. Navy 2000a). The survey identified areas infested with invasive species on a 114-acre study site. Japanese honeysuckle, multiflora rose, and common reed were determined to be the most problematic species on the site. Other invasive species observed included various crabapples and ornamental cherry (*Malus* and *Pyrus*), Oriental bittersweet, Johnson grass (*Sorghum halepense*), thistle (*Cirsium* spp.), and silver or plume grass (*Miscanthus sinensis*). Common reed is also widespread throughout the disturbed wetland areas. No surveys have been conducted for nonnative or invasive animal species, though there is potential for Asiatic clam, northern snakehead fish, and other invasive wildlife species to occur (Invasive Species Specialist Group 2009).

The NAVFAC PWD Annapolis Natural Resources Manager and the PWD Facilities Maintenance Branch share responsibility for invasive species control at NSAA North Severn. The natural resources manager can initiate invasive species control projects (particularly in natural areas) through the INRMP whereas Facilities Maintenance can include invasive species treatments (particularly in landscaped areas) in the facility maintenance contract. The Federal Interagency Committee for the Management of Noxious and Exotic Weeds, The Nature Conservancy, and the Maryland Natural Heritage Program may provide guidance on invasive species management issues and projects. Volunteers such as the Midshipmen Action Group and

local Boy Scout and Girl Scout troops can provide support for invasive species control projects undertaken at NSAA North Severn.

b. Management Goals

The overall goal of invasive species management is to protect ecosystems and native plant and animal species from invasive species through compliance with EO 13112. Specific objectives include developing a facility-wide invasive species survey and GIS database, site specific assessments and recommendations, and implementing a control program.

c. Management Practices

Invasive species control efforts were implemented throughout much of Greenbury Point Conservation Area from 2000 to 2005 in accordance with the invasive species management plan (U.S. Navy 2000a). Treatments included late winter mowing and/or brush-hogging followed by early summer and late summer herbicide applications. Follow-up treatments and assessments are required to ensure management objectives are met. As the area of managed grasslands has been significantly reduced through reforestation efforts and development of the Chesapeake Bay Critical Area forest mitigation site, the treatment areas and prescriptions recommended in the 2000 *Alien Plant Management Plan for Greenbury Point* are no longer appropriate and must be reassessed and updated to fit current conditions.

In order to minimize risks associated with herbicide use, the amount and concentration of chemical use shall be based on the most recent science available regarding invasive plant control. In addition, all herbicide applicators will have a current DoD or Maryland certified applicator's license, all chemical mixing will be done at the golf course mixing/containment pad or off site, and all herbicides are to be used in accordance with safety guidelines specified by the Maryland Department of Agriculture, Office of Plant Industries and Pest Management, Pesticide Regulation Section, as well as the material data safety sheets and labels provided for each chemical. Pesticide application records must be submitted following all treatments. A pesticide approval form must be submitted to the IPM Coordinator and Environmental Office prior to any pesticide application and a pest management record form must be submitted following application to track pesticide usage.

(9) Outdoor Recreation and Environmental Awareness

a. Program Description and Current Conditions

Because of the extensive area of undeveloped land, outdoor recreation and environmental awareness are the primary focus of the NRP at NSAA North Severn. Outdoor recreation includes natural resources-based recreation activities and does not refer to sports/athletics or boating, which also occur at NSAA North Severn. The Greenbury Point Nature Center, 2.1

miles of walking trails, and a bird-watching platform are the primary natural resource-based activities supported by the Environmental Office. Picnicking is authorized at the Retelle Park and Seabee Beach. Camping facilities (a primitive campsite and picnic area and 14 recreational vehicle campsites) are available at the Retelle Park. Camping, which is considered an outdoor recreation, is allowed at the family campground at Retelle Park. However, the campground, marina, picnic areas, and cottages are managed by MWR, and are not under the oversight of the NRP. The natural resources manager coordinates with MWR on such issues as erosion control, vegetation management, and nuisance and invasive species control at MWR facilities.



Greenbury Point Nature Trail

b. Management Goals

The primary goals of outdoor recreation management at NSAA North Severn are to:

- Provide outdoor recreational opportunities for station personnel, their dependents, and the general public to the maximum extent possible within the constraints of the installation mission and capability of the natural resources; and
- Foster understanding and awareness of the environment through educational conservation programs.

c. Management Practices

Greenbury Point Nature Center

The Greenbury Point Nature Center is a 2,400 square-foot structure housing 16 exhibits on cultural and natural resources. Since opening in 2000, the nature center has offered programs for scouts, school children, and volunteer organizations. Over two miles of walking trails and a bird-watching platform located near the nature center are two of the key features of outdoor recreation and environmental awareness at NSAA North Severn. One walking trail, Bobwhite Circuit



Nature Center Activity

Trail originating at the nature center, consists of a half-mile crushed rock that provides access to persons with disabilities. The Timberdoodle Trail consists of wildflower meadow and Chesapeake Bay views and the Pipsisewa Trail provides a woodland walk with waterfowl, wading birds, and other creek life observations on Carr Creek.

Trail maintenance, nature center operations, program organization and presentation, updating the natural resources website, and volunteer oversight are ongoing activities conducted by the natural resources manager. Planning and participating in annual Earth Day, Arbor Day, and National Public Lands Day events are additional environmental awareness responsibilities of the NRP.

Fishing

All active duty and retired military members and their dependents and non-temporary civilian employees assigned to NSA Annapolis are eligible to fish and crab at Possum Point on NSAA North Severn. Many improvements have been made at the Possum Point Fishing Area. In 2000, the NRP repaired the gravel road, created a gravel parking lot, added an outdoor informational bulletin board and trash/recycling bin (built by Eagle Scouts), planted native grasses, and installed fishing pole holders. Bait stations and aluminum benches were also installed. Posting signs that educate anglers on live and nonnative bait restrictions would help prevent further introduction of nonnative species into the Chesapeake Bay and its tributaries.

(10) Agricultural Outleasing

Although open lands that were previously used for dairy farming do occur, agricultural outleasing would be impractical at NSAA North Severn because of the relative isolation of the site and decline of agricultural activity in the area over the past several decades. There is however, potential an agricultural out lease on Greenbury point for Goats and other browser animals for invasive species control.

(11) Wildland Fire Management

There is no requirement for a Wildland Fire Management Program at NSAA North Severn. The USNA Fire Department and local fire department are responsible for all structural and wildfire control at the installation.

(12) Conservation Law Enforcement

There is no requirement for a separate conservation law enforcement program at NSAA North Severn; all law enforcement is accomplished through the USNA Security Department.

(13) Cultural Resources Management

a. Program Description and Current Conditions

NSAA North Severn is recognized for its historical and archaeological significance dating back to the 1600s which includes some of Maryland's first colonial settlements. Two archeological sites have been documented at NSAA North Severn (Figure 5-12). Fort Nonsense (18AN550), which was constructed in 1812 as part of a system of defenses for Annapolis, is listed in the National Register of Historic Places. Excavations at another the seventeenth century site, Towne Neck (18AN944), dating to 1649, indicate the site is potentially eligible for listing in the National Register; however, no formal nomination has been submitted. Areas of high probability for 17th Century significance occur throughout NSAA North Severn and are generally located within previously undisturbed areas.

The NSA Annapolis ICRMP (U.S. Navy 2000c) provides an inventory of known prehistoric, historic, archeological, and architectural resources and provides recommendations for their management of cultural resources at NSAA North Severn. The PWD Cultural Resources Coordinator at NSA Annapolis oversees all cultural resources issues. Cultural resources maps will be consulted and any proposed activity with potential to impact these resources at NSA Annapolis must be coordinated through the SHPO.

b. Management Goals

The goals of cultural resources management are to protect all significant cultural resources to the greatest extent practicable and meet the compliance requirements of federal laws.

c. Management Practices

To avoid disturbing cultural resources at NSAA North Severn, planning and consultation with the cultural resources staff is necessary before any potentially ground-disturbing activities are carried out. The NSA Annapolis ICRMP has detailed maps of known site locations for use as a planning tool. These documents should be consulted during project planning. It is possible that currently buried and unknown archeological resources may be uncovered during ground-disturbing activities. If any archeological resources are encountered during ground disturbing activities, the ICRMP provides standard operating procedures to follow. The Cultural Resources Coordinator and NAVFAC Regional Historic Preservation Officer must be notified to ensure compliance with the NHPA. All construction work would be suspended until a qualified archaeologist could determine the significance of the encountered resource(s).

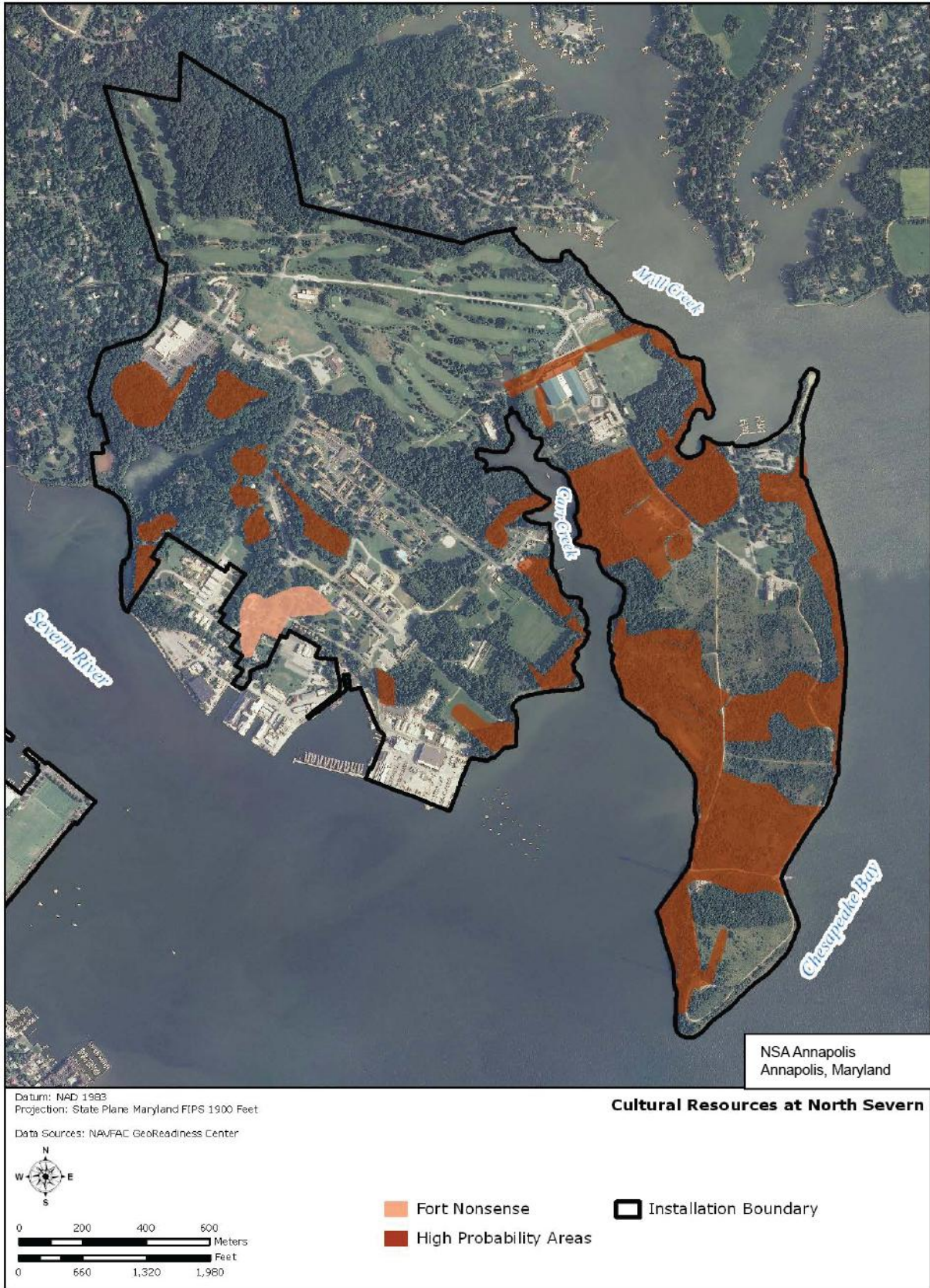


Figure 5-12. Cultural Resources at NSAA North Severn

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6. USNA DAIRY FARM

A. INSTALLATION INFORMATION

“The USNA Dairy Farm is currently leased to Anne Arundel County parks and recreation division. As the lessee the county has sole and exclusive rights to the Dairy Farm property for the term of the lease. The Navy as the landowner currently approves proposed work but does not conduct any project outside the scope of the lease. “

(1) General Location

The USNA Dairy Farm encompasses 857 acres in Gambrills, Maryland in north-central Anne Arundel County (Figure 6-1). It is located approximately 15 miles northwest of Annapolis, 30 miles northeast of Washington D.C., and 20 miles south of Baltimore. The Patuxent Research Refuge and Fort Mead are other federal facilities located less than five miles from the USNA Dairy Farm. The USNA Dairy Farm also lies adjacent to the Odenton Natural Area.



View of USNA Dairy Farm

(2) Installation History

In 1681, the USNA Dairy Farm was part of a 500-acre land grant known as “Howard’s Adventure”, which in 1701 was acquired by the Hammond family. The Hammond Manor House (constructed before 1730) and the Hammond Family Cemetery (Figure 6-2) are included in historic sites in the Maryland Inventory of Historic Properties. The manor house, which burned in 1980, is also listed in the National Register of Historic Places (U.S. Navy 2001c). The Hammond Plantation was divided among heirs and eventually subdivided further and sold outside of the family in the late 1800s. Several eighteenth to early nineteenth century domestic sites and numerous buried prehistoric and historic cultural resources have also found to be widespread on the property (U.S. Navy 2000c).

A 1910 typhoid fever epidemic among the Academy midshipmen spurred the Navy to establish a dairy farm to supply the USNA with fresh, safe dairy products. Initially a small dairy farm was established on Naval Academy grounds, and then in 1913, the bulk of the present USNA Dairy Farm acreage was purchased. Subsequent purchases in the early 1900s acquired the remaining acreage for a total of 857 acres. The majority of buildings were constructed in 1914. The original complex included a power plant, milk house, five cow barns, a bull barn, a maternity/hospital barn, a horse barn, five silos, a pump house, artesian well houses, 18 cottages for employees, and a dormitory and mess hall for unmarried employees (U.S. Navy 2000c). In

2008, the Maryland Historical Trust determined that the 66 of the 68 buildings and structures are contributing features of the historic landscape of the USNA Dairy Farm. Under federal and state laws, specific historic preservation practices must be undertaken to protect the historic character of the Village (Anne Arundel County 2009a).

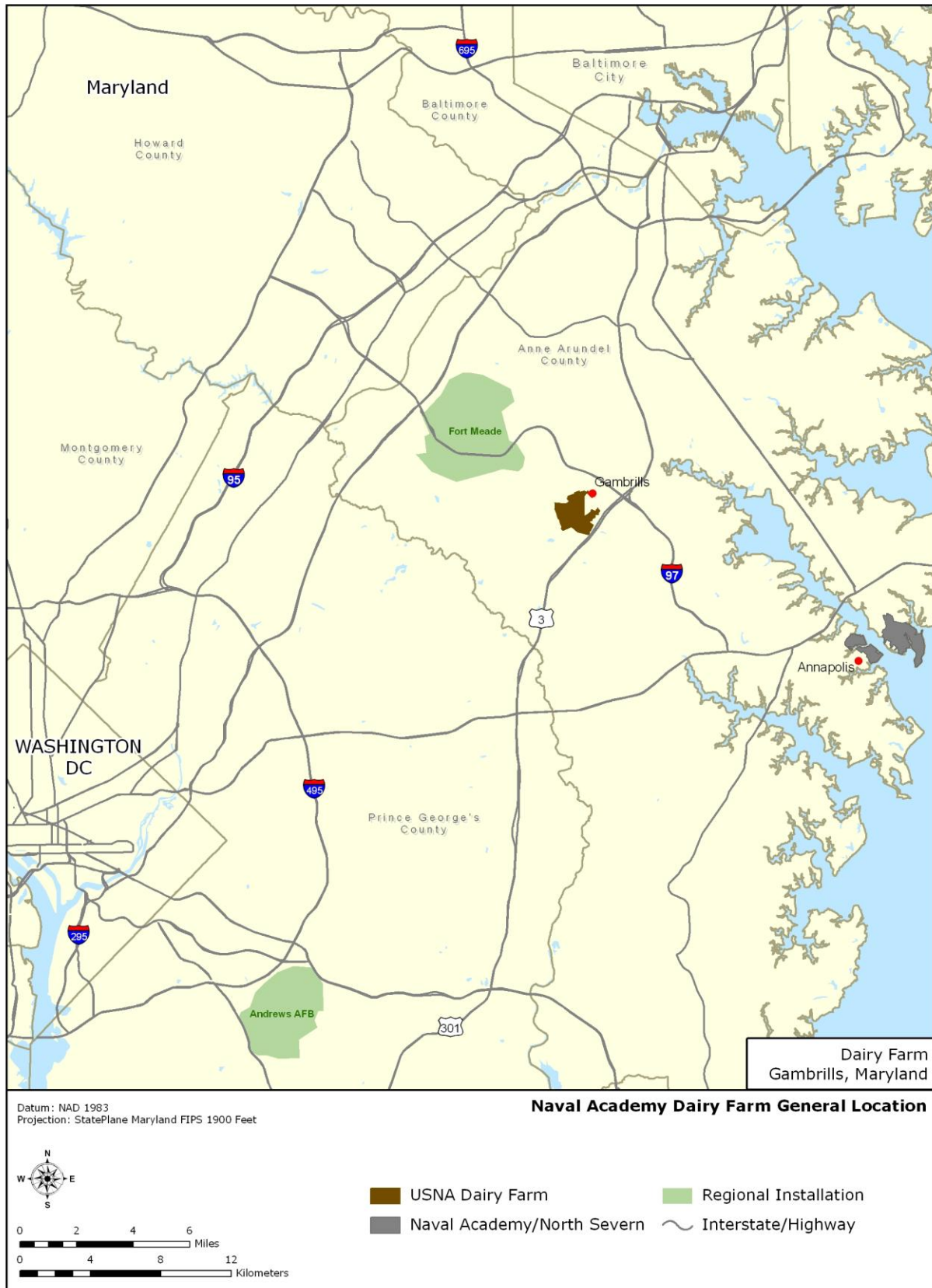


Figure 6-1. USNA Dairy Farm General Location

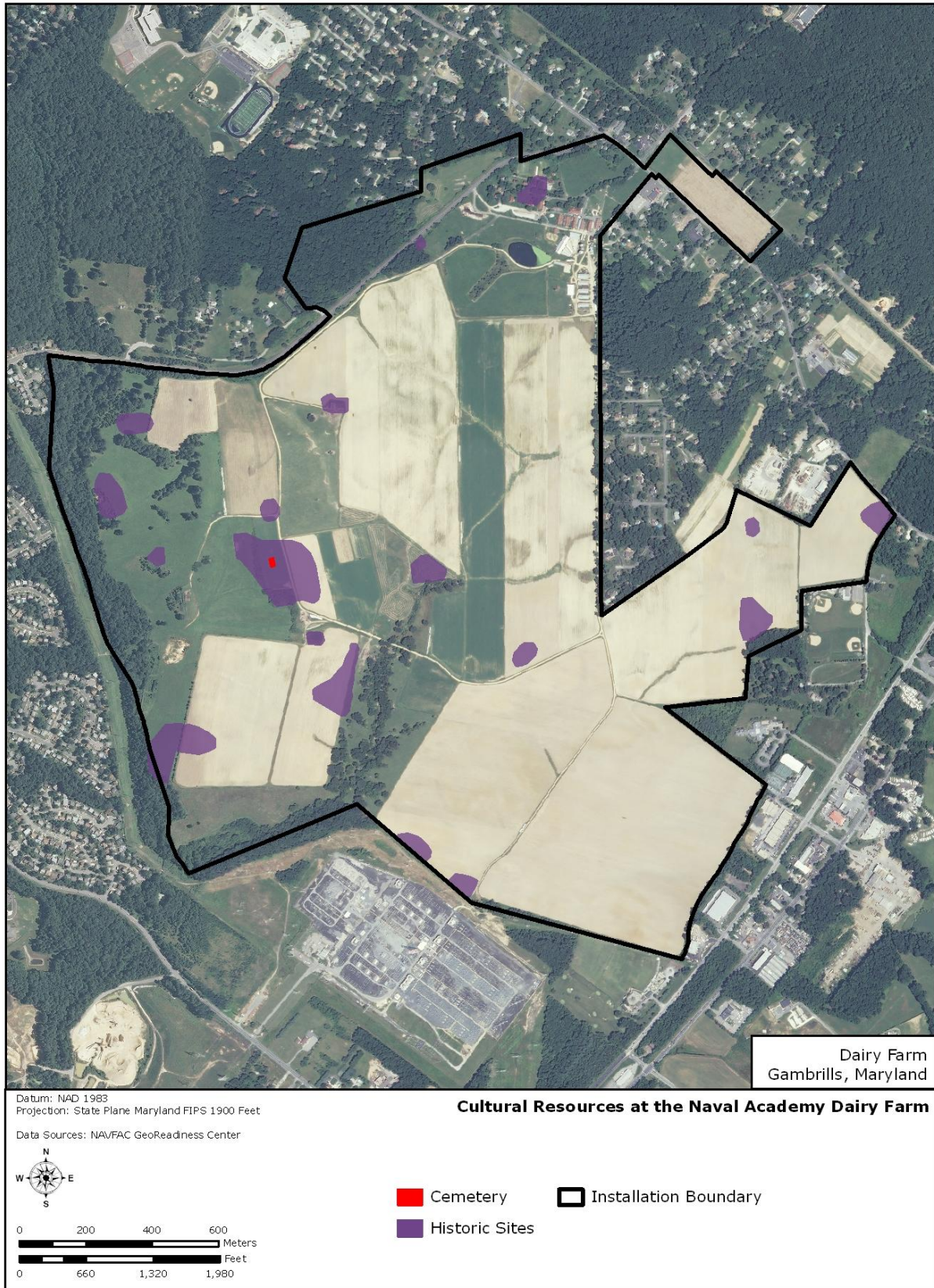


Figure 6-2. Cultural Resources at the USNA Dairy Farm

The National Defense Authorization Act for Fiscal Year 1998 (Public Law 105-85), which repealed the requirement to operate the USNA Dairy Farm also protects the USNA Dairy Farm from commercial or residential development stating that the land “may not be declared to be excess...or transferred or otherwise disposed of by the Navy or any Federal agency,” and “shall be maintained in its rural and agricultural nature.” At that time, the USNA ceased dairy production. In 2000, Horizon Organic Dairy won the lease and established a Farm and Education Center on a portion of the farm and Maryland Sunrise, Inc. of Chestertown, Maryland farms the remaining 800 acres of crops. Horizon Organic ceased operations at the farm in January 2005, whereas Maryland Sunshine, Inc. held the remaining portion of the lease until 2010.

In 2008, a 30-year lease agreement was signed by the Navy and Anne Arundel County. The Navy oversees and enforces compliance with the lease, but responsibility for land and natural resources management now falls to the County. Of the 857 acres at the USNA Dairy Farm, approximately 165 acres are available for pasture, 630 acres are available for crop production, 26 acres are improved, and 32 acres are identified as wetlands.

(3) General Physical Environment

a. Physiography, Topography, and Soils

The USNA Dairy Farm is located in the Western Shore Uplands Region of the Coastal Plain physiographic province of Maryland (Maryland Geological Survey 2008). The topography of the is gently to moderately rolling hills, with elevation ranging from 98 feet above mean sea level on the southern end of the installation to 210 feet on the northwest corner (Figure 6-3).

The 2002 USDA, NRCS soil survey for Anne Arundel County indicates there are seven major soil series at USNA Dairy Farm (USDA, NRCS 2008; Figure 6-4). With the exception of previously built areas, 73.5 percent of the area is classified as prime farmland or farmland of statewide importance (USDA, NRCS 2006). Approximately 8.5 percent of the soils at USNA Dairy Farm are hydric (Table 6-1).

b. Hydrology

Watersheds

The USNA Dairy Farm is primarily (approximately 88 percent) located in the Little Patuxent watershed within Patuxent River tributary basin. The Little Patuxent River joins the Patuxent River just southeast of the Patuxent Research Refuge between the towns of Bowie and Crofton. The drainage area of the Little Patuxent River watershed is 103 square miles (MDE 2008b).

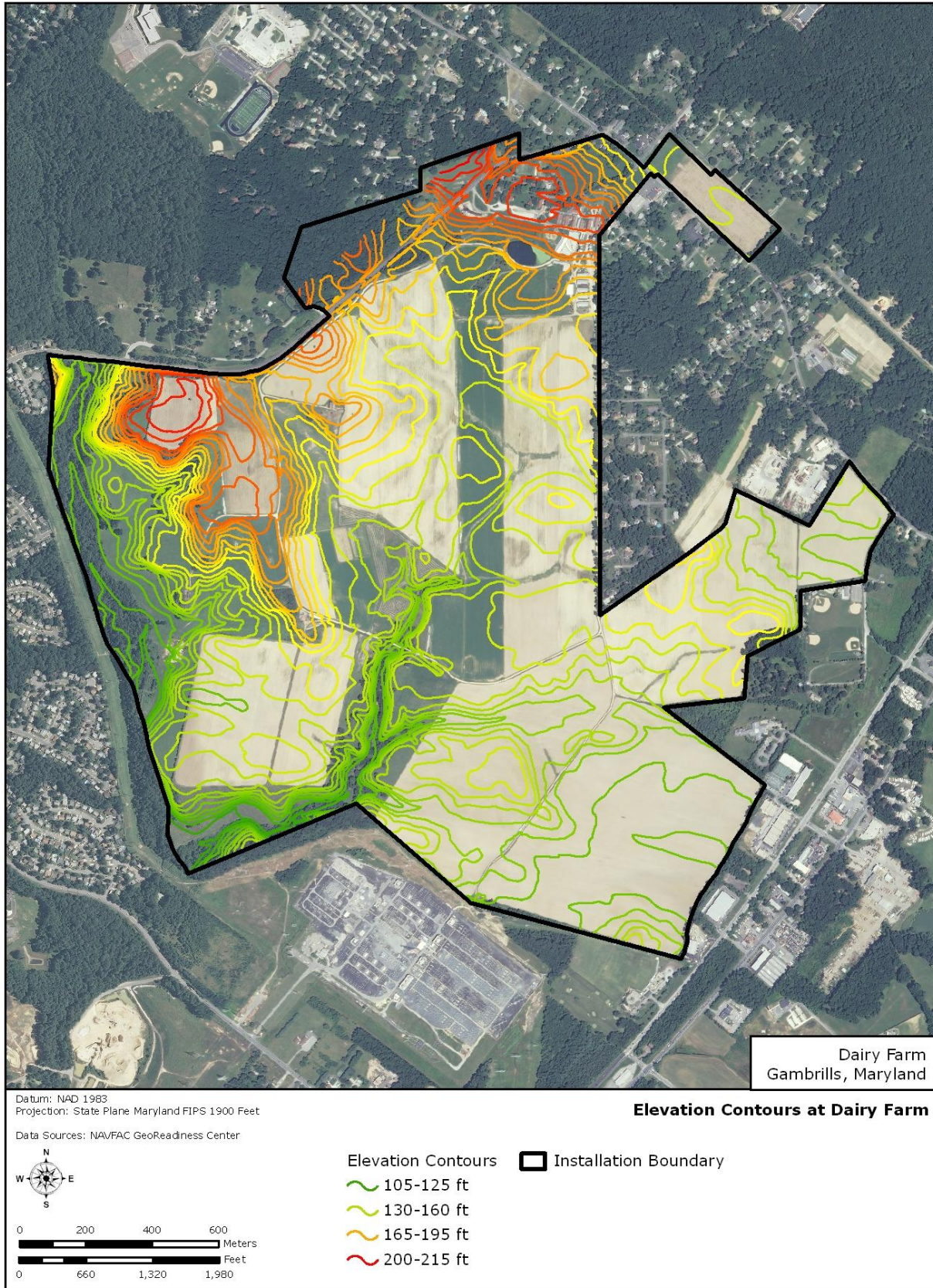


Figure 6-3. Elevation Contours at USNA Dairy Farm

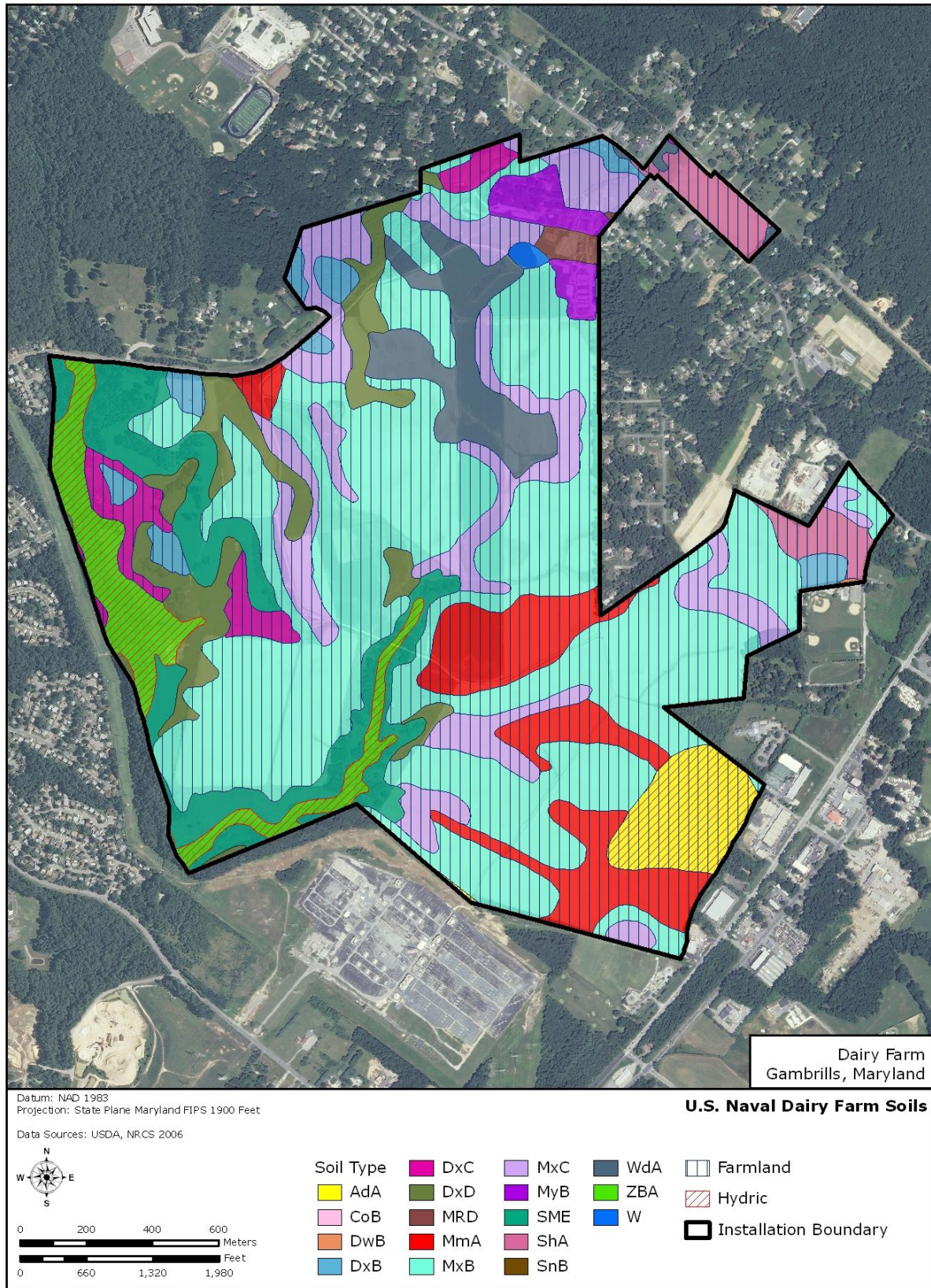


Figure 6-4. USNA Dairy Farm Soils

Table 6-1. USNA Dairy Farm Soils

Label	Soil Series	Drainage Class	Acres
	Hydric		
AdA	Adelphia-Holmdel complex, 0 to 2 percent slopes	Moderately well drained	29.6
ZBA	Zekiah and Issue soils, 0 to 2 percent slopes, frequently flooded	Poorly drained	43.0
	Non-Hydric		
CoB	Collington-Wist complex, 2 to 5 percent slopes	Well drained	0.0
DwB	Downer-Hammonton-Urban land complex, 0 to 5 percent slopes	Onsite determination	0.2
DxB	Downer-Phalanx complex, 2 to 5 percent slopes	Well drained	19.6
DxC	Downer-Phalanx complex, 5 to 10 percent slopes	Well drained	21.6
DxD	Downer-phalanx complex, 10 to 15 percent slopes	Well drained	51.4
MmA	Matapeake silt loam, 0 to 2 percent slopes	Well drained	71.4
MRD	Matapeake and Mattapex soils, 10 to 15 percent slopes	Moderately well drained	4.1
MxB	Mattapex-Butlertown complex, 2 to 5 percent slopes	Moderately well drained	360.2
MxC	Mattapex-Butlertown complex, 5 to 10 percent slopes	Moderately well drained	102.5
MyB	Mattapex-Butlertown-Urban land complex, 0 to 5 percent slopes	Moderately well drained	15.0
ShA	Sassafras-Hambrook complex, 0 to 2 percent slopes	Well drained	21.9
SME	Sassafras and Croom soils, 15 to 25 percent slopes	Well drained	70.8
SnB	Sassafras-Urban land complex, 0 to 5 percent slopes	Well drained	0.0
WdA	Woodstown sandy loam, 0 to 2 percent slopes	Moderately well drained	41.0
Total			852.3

A smaller portion of USNA Dairy Farm land (approximately 12 percent) drains eastward into Jabez Branch, of the Severn River watershed. Jabez Branch is a watershed of high concern, as it is the only natural trout stream in the Coastal Plain physiographic province. There are three subasins of the USNA Dairy Farm including Towser's Branch, Jabez Branch 1, and Jabez Branch 2 (Figure 6-5).

Surface Waters

The USNA Dairy Farm has two unnamed tributaries to Towser's Branch and Towser's Branch, which is a tributary of the Little Patuxent River. Towser's Branch runs along the western edge of the property where it is well buffered by forests and woodlands. One unnamed tributary passes through agricultural fields and lacks riparian buffer for most of its length, whereas the

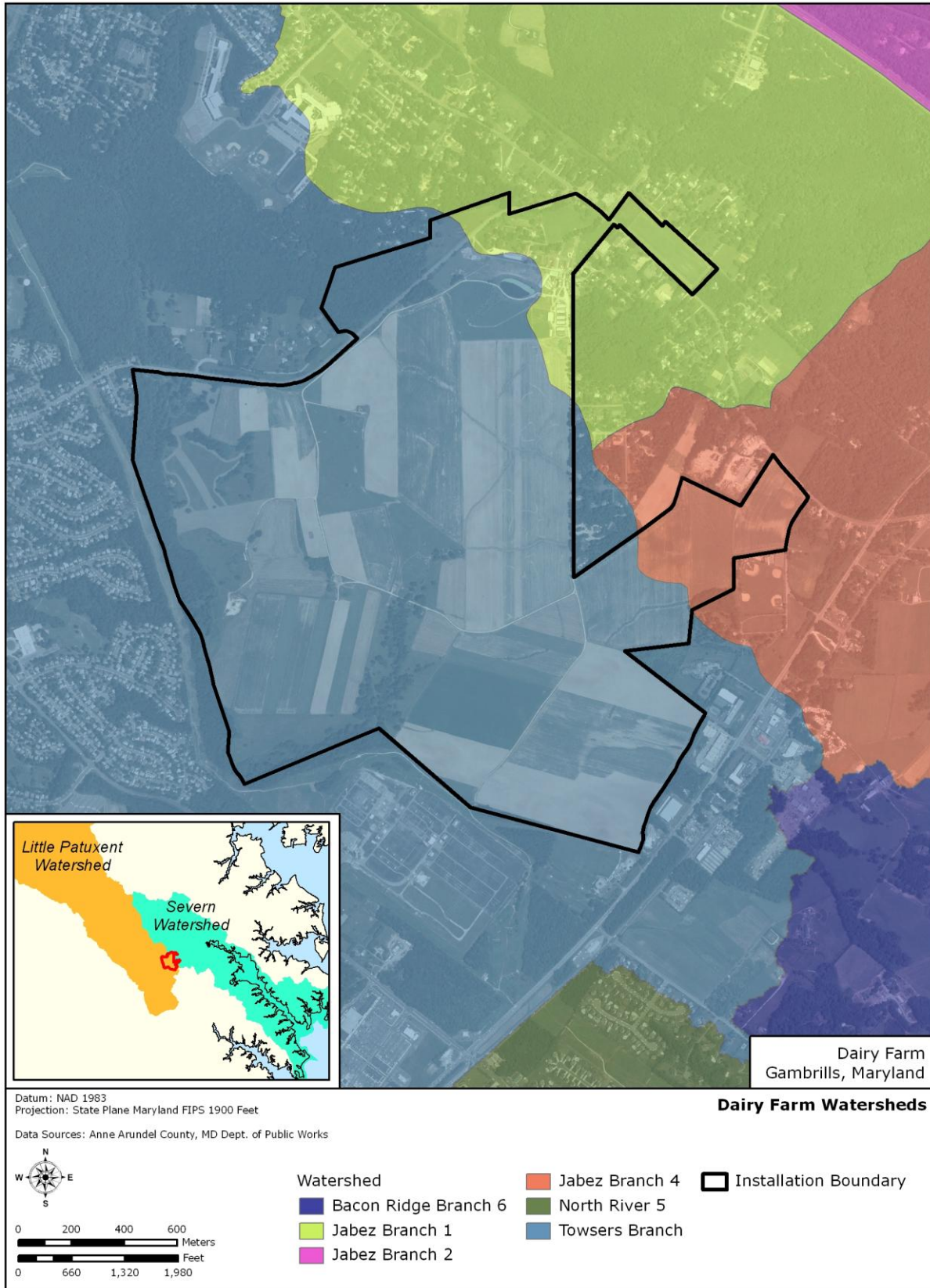


Figure 6-5. USNA Dairy Farm Watersheds

other runs along the southern boundary of the USNA Dairy Farm and is intermittently buffered. There is also a 1.6-acre farm pond in the northeast section of the property. Towser's Branch is listed as an impaired waterway based on poor biological communities (MDE 2006). Jabez Branch is a watershed of high concern, as it is the only natural trout water in the Coastal Plain that has a reproducing brook trout population. Minimizing sediment, stormwater runoff, and nutrients in the tributaries of these creeks is important to their restoration and preservation.

Wetlands

A wetland survey was completed of the property in 2004, and indicated approximately 32.5 acres of wetlands occur at the USNA Dairy Farm (U.S. Navy 2004). The wetlands include nontidal palustrine emergent, palustrine forested wetlands associated with the surface waters, and riverine wetlands (Table 6-2; Figure 6-6). Other areas, currently in agricultural production, are prior converted wetlands, and are exempt from CWA regulations. The wetland boundaries have not yet been accepted by the USACE. A formal jurisdictional determination would be required prior to conducting any activities with potential to disturb wetlands.

Table 6-2. Wetlands Types at USNA Dairy Farm

Code	Cowardin Classification	Acres
AG BMP	Agricultural Pond/Palustrine Open Water	1.60
PEM/FO1A	Palustrine Emergent/Forested Broad-leaved Deciduous, temporarily flooded	0.09
PEM1A	Palustrine Emergent Persistent, temporarily flooded	0.13
PFO1A	Palustrine Forested Broad-leaved Deciduous, temporarily flooded	22.88
PFO1A/B	Palustrine Forested Broad-leaved Deciduous, temporarily flooded/saturated	3.12
PFO1E	Palustrine Forested Broad-leaved Deciduous, seasonally flooded/saturated	0.26
R2	Riverine Lower Perennial	4.17
R4	Riverine Intermittent	0.23
Total		32.47

Floodplains

A narrow strip of 100 year floodplain exists on the western perimeter of the property following the Towser's Branch. No 500-year floodplain has been identified on the property.

(4) General Biotic Environment

a. Rare, Threatened, and Endangered Species

The MDNR Natural Heritage Program has indicated that historical accounts exist of the occurrence of the state-listed threatened glassy darter (*Etheostoma vitreum*) in nearby Little Patuxent River (2008b MDNR). The Natural Heritage database has also indicated that there is a

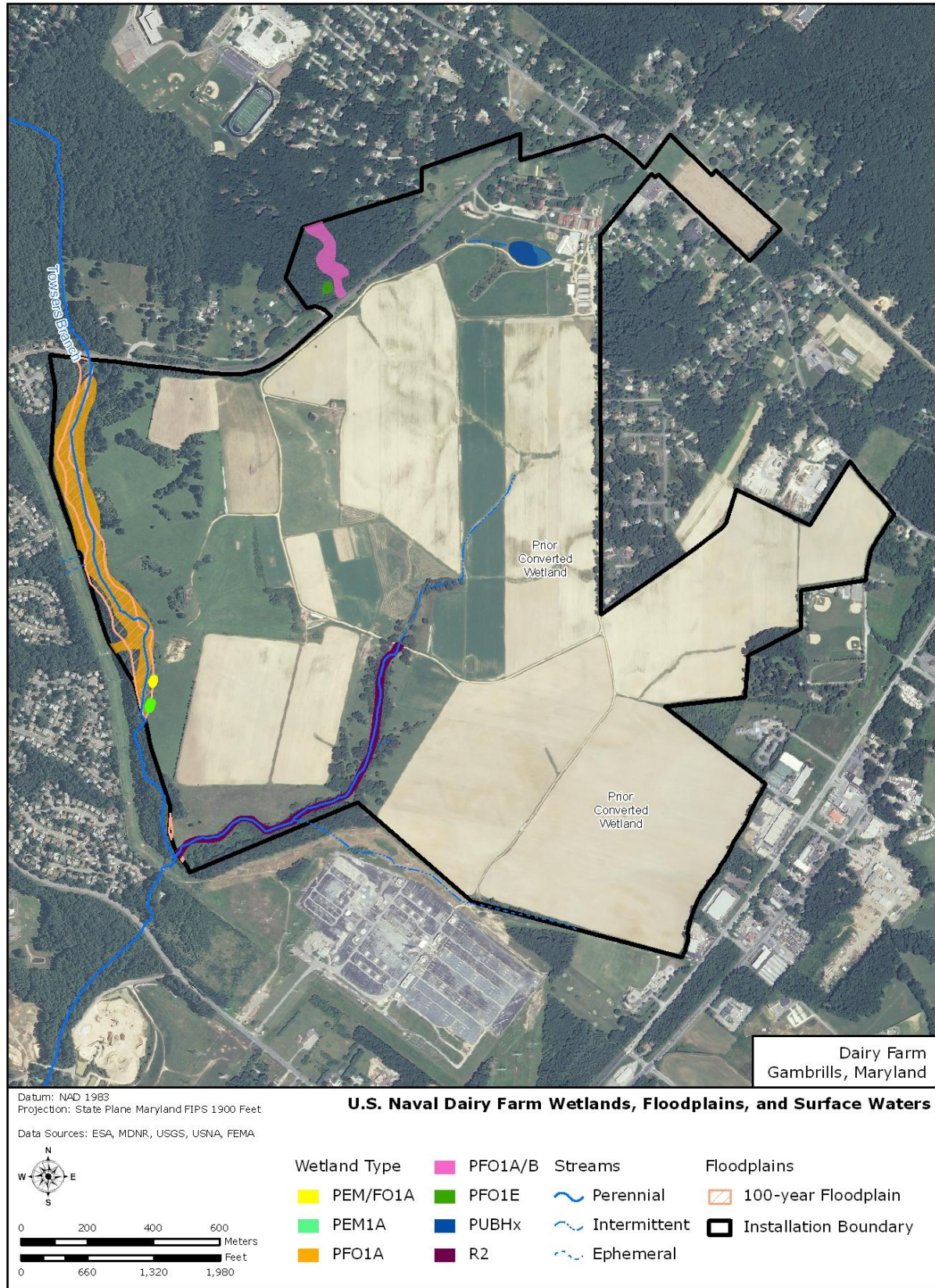


Figure 6-6. USNA Dairy Farm Wetlands, Floodplains, and Surface Waters

1960 record for the narrow-leaved pinweed (*Lechea tenuifolia*), a species with endangered extirpated state status, known to occur within the vicinity of the USNA Dairy Farm (U.S. Navy 2001c). This species could potentially occur on the site itself if the appropriate habitat exists. Appropriate habitat consists of dry sandy or rocky open woods and barrens.

In addition, reports of loggerhead shrikes (*Lanius ludovicianus*), a state endangered species and a bird of conservation concern, were made in 1998 and 1999 at the USNA Dairy Farm; however, it is not known if the species breeds at the USNA Dairy Farm or within the county. This neotropical migratory bird is susceptible pesticide contamination, reduction of suitable habitat, increased competition with other species such as the American kestrel, increased human disturbance, and climatic change. Preferred habitats for loggerhead shrike are open country, thinly wooded or scrubby land with clearings, meadows, pastures, shelterbelts, and thickets along roads and other rights-of-ways with perches. Adjacent areas of dense, ungrazed or lightly grazed grassland are important habitats for potential prey. Loggerhead shrikes are typically welcomed in farming communities as a natural pest control. Loggerhead shrikes prey on grasshoppers, crickets, beetles and other invertebrates, as well as small mammals and other songbirds. Given the organic agricultural efforts recently at the USNA Dairy Farm, the benefits to the loggerhead shrike should be by default improving annually.

b. Fish and Wildlife

Although no comprehensive fish and wildlife surveys have been conducted at the USNA Dairy Farm, fauna may be expected to be those that are typical of rural agricultural settings in Maryland. It is expected that whitetail deer are the primary large mammal; fox, raccoons, cottontail, woodchuck, and skunks are common medium sized mammals, and that a variety of moles, voles, mice, and shrews are common small mammals.

Bird species are expected to be those dependent on grasslands and open space. Northern harrier (*Circus cyaneus*), bobolink (*Dolichonyx oryzivorus*), grasshopper sparrow (*Ammodramus savannarum*), and loggerhead shrike have been observed. The ponds are likely to support mallards (*Anas platyrhynchos*) and Canada geese (*Branta canadensis*). Rock pigeons (*Columba livia*) and house sparrows (*Passer domesticus*) are nonnative species that frequently become pests in and around building areas. Non-migratory Canada geese are another species that can become a nuisance because of their large numbers.

c. Natural Vegetative Communities

Although most of the USNA Dairy Farm consists of cropland and pasture, approximately 68 acres are forested. No comprehensive vegetative surveys have been conducted, however, a site assessment prepared for Anne Arundel County (Human and Rohde 2008) and survey data from a recent wetland delineation (U.S. Navy 2004) have noted a number of tree species. Trees of forested uplands include tulip poplar, American beach, white oak, hickory, chestnut oak,

southern red oak, and American holly (*Ilex opaca*). In disturbed areas around old home sites and fence rows black cherry, black walnut (*Juglans nigra*), eastern red cedar (*Juniperus virginiana*), and mulberry were observed. Green ash (*Fraxinus pennsylvanica*), red maple, sweetgum, box elder (*Acer negundo*), and sycamore occurred in wetter areas and floodplains along with shrubs such as winterberry (*Ilex verticillata*), arrowwood (*Viburnum dentatum*), and highbush blueberry (*Vaccinium corymbosum*) and herbaceous species such as skunk cabbage (*Symplocarpus foetidus*). A number of nonnative invasive species were also recorded. Included are Japanese stiltgrass (*Microstegium vimineum*), multiflora rose, Oriental bittersweet (*Celastrus orbiculata*), and apple (*Malus* sp.)

(5) Current Operations and Activities

a. Organic Farming

The USNA Dairy Farm has been a certified organic farm since 2000. It is currently the largest parcel of organic land in the state, and the only certified organic operation in Anne Arundel County. The farm also hosts the Anne Arundel County 4-H Dairy Leasing Club, providing urban youth with a hands-on agricultural education experience. The environmental education program Arlington Echo, which works with Anne Arundel County Public School students, uses the farm for its plant propagation Chesapeake Connections program.

Information on the Maryland Organic Certification Program is available at: http://www.mda.state.md.us/pdf/organic_operations.pdf.

Organic farming is based on a system of production that maintains and replenishes soil fertility without the use of toxic and persistent pesticides and fertilizers. Organically produced foods also must be produced without the use of antibiotics, synthetic hormones, genetic engineering and other excluded practices, sewage sludge, or irradiation (Organic Trade Association 2008).

USDA's National Organic Program regulates the standards for any farm, wild crop harvesting, or handling operation that wants to sell an agricultural product as organically produced. National organic standards require that organic growers and handlers be certified by third-party state or private agencies or other organizations that are accredited by USDA. The Maryland Department of Agriculture is accredited by the USDA for compliance with the National Organic Program. The Maryland Organic Certification Program is designed to provide assurance to consumers who purchase organic products that the products were grown according to the national organic standards.

b. Organic Farming Benefits

Organic farming can provide both economic and environmental benefits to the County. Organic foods are one of the fastest growing segments in the overall food market and in 2008, the U.S.

organic industry grew 17 percent overall to reach \$22.9 billion in consumer sales (Organic Trade Association 2008). Organic farming systems have potential to lower input costs, decrease reliance on nonrenewable resources, capture high-value markets and premium prices, and boost farm income. In addition, statistics show that organic farms yield 95 to 100 (or more) percent of conventional farm yields and are as efficient, economical and financially competitive as conventional methods (Rodale Institute 2007).

Organic farming benefits the environment and human health by using natural methods, such as diversifying and rotating crops and using natural fertilizer and cover crops to improve soil fertility and biological activity while avoiding the use of toxic chemicals that can accumulate in soil, water, food, and people. Organic farming also helps eliminate reliance on fertilizers derived from fossil fuels, which reduces carbon emissions as well as depleting the nation's fuel supply. Additionally, organic farmers are required to create buffers around their farm to protect it from unapproved substances from neighboring farms. These buffers also help protect water quality, create wildlife habitat, including pollinators, and reduce wind erosion.



Organic Farming at the U.S. Naval Dairy Farm

Organic food and agriculture are also a means of supporting local and regional businesses that build the vitality and strength of the community. The growth of both farmers markets and the Community Supported Agriculture movement serve as a testament to the ability of organic farming to revitalize downtown centers and reestablish partnerships between regional agricultural and urban areas.

c. Organic Farming Incentives

Because of increased federal and private funding for organic farming, a number of funding opportunities and incentives are available for maintaining organic status and providing organic research and educational programs at the USNA Dairy Farm. The USDA Economic Research Service (ERS) identifies a number of provisions in the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill) that support organic farming. Specifically, the 2008 Farm Bill reauthorizes block grants for States to enhance specialty crop competitiveness; provides funds for farmers' markets and to expand fruit and vegetable market news reporting; and increases funding to help producers and handlers with organic certification costs, to enhance data

collection on organic agriculture, and to support Federal organic regulatory activities (USDA, ERS 2009).

The USDA NRCS does not have a policy of promoting organic agriculture over other forms of agriculture. However, the NRCS entered into a MOU with the Organic Trade Association (OTA) that establishes a framework for cooperation between NRCS and OTA on program activities that involve the conservation of natural resources specifically related to organic farming. The NRCS also manages a conservation effort that provides incentives for improving environmental performance on farms and ranches. Under the NRCS Environmental Quality Incentives Program (EQIP), farmers and ranchers are eligible for up to \$20,000 per year with a limit of \$80,000 over six years for conservation and ecological practices tied to organic conversion—including pollinator plantings, additional cover crops, biodiversity enhancement and expanded organic acreage.

Other funding incentives are available from the Organic Farming Research Foundation (OFRF) grants program. OFRF's objective in making grants is to generate practical, science-based knowledge to support modern organic farming systems. OFRF encourages farmers, ranchers, researchers, and extension personnel to consider applying for funding in two areas, research and education and outreach.

More information on EQIP is available at:
<http://www.in.nrcs.usda.gov/intranet/publications/OrganicAg.pdf>

More information on OFRF grants is available at:
<http://ofrf.org/grants/apply.html>

(6) Future Operations and Activities

a. County Conceptual Plan

A preliminary conceptual plan prepared by the Anne Arundel County Department of Recreation and Parks outlines the proposed operations and activities to be conducted at the USNA Dairy Farm under the County's 30-year lease. Key features of the plan are the preservation of agricultural lands and open space; managing the USNA Dairy Farm as a sustainable crop and livestock farming operation; providing a variety of recreational activities and events to the public; and supporting educational programs designed to encourage the advancement of agricultural and environmental issues.

Public access is planned for approximately 150 acres in the western portion of the farm. A visitor's center, community gardens, theme gardens, walking/biking trail, fruit orchard, picnic pavilion, parking, and other facilities are planned for this area. The remainder of the farm area is intended to be kept in agricultural use. The Department of Recreation and Parks is required by

County Procurement Laws and Regulations to engage in a formal and open bidding process for parties interested in subleasing the USNA Dairy Farm.

Changes in land use, development, and other proposed management activities at the USNA Dairy Farm must be conducted in accordance with Soil and Water Conservation Plan for the USNA Dairy Farm (U.S. Navy 2008) and should consider the protection measures for the glassy darter as described in the Environmental Review for USNA Dairy Farm (MDNR 2008b).

b. Soil and Water Conservation Plan

The lease of the USNA Dairy Farm is authorized by Section 2881 of the National Defense Authorization Act of 1998 and is subject to the military requirements for the land. Of the 857-acre parcel, approximately 165 acres are available for pasture and 630 acres are available for crop production. As required by OPNAV5090.1C, a Soil and Water Conservation Plan was developed for the USNA Dairy Farm lease agreement that details the best management practices to protect the natural resources and government interests under the lease (Appendix 5). The plan addresses soil management, riparian buffer requirements; grazing and crop and rotational requirements, irrigation systems maintenance, pest management, nutrient management, and other land management activities. NAVFAC Washington provides the technical and administrative oversight for the soil and water conservation plan.

Some of the specific requirements of the plan include maintaining existing riparian buffers on land adjacent to water courses, waterbodies, and wetlands; establishing field borders of perennial vegetation; delaying harvest on 50 contiguous acres of hayfield to improve grassland breeding bird success; obtaining written approval from the NAVFAC Washington real estate contracting officer for any substantial changes to the contour or condition of the land, and any additional ornamental plantings. The planting of vineyard, orchard, rice crops, or sod farming is not permitted.

To facilitate the protection and enhancement of natural resources including fish and wildlife populations and their associated habitat; wetlands, streams, and floodplains; and rare, threatened, and endangered species, the soil and water conservation plan requires the County to coordinate farming and grazing practices on the USNA Dairy Farm with NAVFAC Washington natural resources personnel. Establishing a cooperative a partnership between the County and Navy to implement conservation practices and natural resources protection projects would help ensure compliance requirements of with the soil and water conservation plan , as well as compliance with federal, state, and local water quality, threatened and endangered species protection, and historic preservation laws and regulations.

c. Environmental Review

An environmental review of the lease of the USNA Dairy Farm to Anne Arundel County and their proposed activities was conducted by MDNR in 2008 (MDNR 2008b). MDNR identified

the occurrence of the state-listed glassy darter in the Little Patuxent River and provided a series of protective measures for reducing impacts to streams and associated habitats supporting the species. Protective measures outlined by the MDNR include:

- Pursue environmentally sensitive stormwater management design that use nonstructural BMPs to the maximum extent possible;
- Minimize land clearing;
- Retain forest cover;
- Stabilize soil within 24 hours of conducting ground-disturbing activities;
- Provide a minimum 100-foot forested upland buffer on permanent and intermittent streams and nontidal wetlands; and
- Where instream work is unavoidable, provide adequate passage for fish, reptiles, and amphibians.

(7) Partnering Opportunities

A number of partnering opportunities that would help achieve County and Navy goals for natural resources protection and enhancement, and environmental awareness and education at the USNA Dairy Farm are available. The Navy may not provide any reimbursement for work (i.e., improvements, land management, conservation efforts, landscaping, etc.) conducted on the leased portion; however, alternative funding opportunities that can support joint projects are available through such initiatives as Chesapeake Bay Program, National Public Lands Day, North American Wetlands Conservation Act, and Pulling Together, as identified in Table 2-2. Specific projects that could be accomplished through partnership with the Navy are riparian buffer enhancements, stream restoration, reforestation, and invasive species control along the USNA Dairy Farms numerous streams and wetlands and various other sites.

a. Riparian Buffer Enhancements

Although much of the mainstem of Towser's Branch is buffered by by more than 100 feet of woody vegetation on either side, a public sewer line, which is mowed regularly Anne Arundel County lies to the east of the creek. Controlling invasive species and maintaining this 30-foot right-of-way as early successional habitat by reducing mowing frequency would help reduce erosion and sedimentation in the creek and improve wildlife habitat. Riparian forest buffers outside of the rights-of-way can be enhanced by planting native trees and shrubs and controlling invasive species. The northern portion of Towser's Branch receives runoff off-site from Odenton Park Recreation Area. Any efforts to reduce runoff or improve water quality in this area should be coordinated with the park.

b. Stream Restoration

The central unnamed tributary to Towser's Creek (eastern fork of the creek) and its ephemeral tributaries lie within actively managed agricultural lands. Several of these streams are deeply eroded and are in need of significant restoration. Structural restoration such as bank modifications and installing erosion control devices would need to be implemented before riparian buffer enhancements can be made. Any structural work should be conducted in cooperation with MDNR, MDE, and the USACE. Appropriate wetland permits must be obtained prior to initiating work.

c. Reforestation

Reforesting portions of the USNA Dairy Farm that are no longer used for agricultural or recreational purposes would improve wildlife value for and reduce long-term maintenance costs. Because of the areas long-term agricultural use, site preparation, weed control, and post planting care will likely be required to ensure planting success. Tree planting often serves as an opportunity for volunteer participation, but should not be relied on as the only means of reforestation. Large-scale reforestation may be better accomplished through professional tree planters. Planting materials should be restricted to native trees and shrubs that have been selected to match site conditions.

d. Invasive Species Control

A large portion of the wooded and naturalized areas at the USNA Dairy Farm are invaded with nonnative, invasive species. Mapping and the extent of the invasions and implementing control measures would improve the value of the natural areas for wildlife, recreation, and educational purposes. To be consistent with the organic farming mission of the USNA Dairy Farm, only mechanical methods such as cutting, mowing, and hand pulling should be used. Volunteers as well as regular maintenance would be required to significantly reduce the number of invasive species at the USNA Dairy Farm.

e. Baseline Species Surveys

The most recent species counts are from at least 5 if not 10 years ago which includes Rare, Threatened, and Endangered species counts. These counts can be done by coordinated groups of volunteers on small scales. A recent call for a state wide reptile count included a count sheet and some materials for identification. These can be copied and distributed at coordinated events.

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Appendix 1

INRMP Project Descriptions
INRMP Project Implementation Schedule

PRIORITY: Best Management Practice

WETLANDS MANAGEMENT

Project Title

Base-wide Wetlands Delineation at NSA Annapolis

Project Description

Conduct base-wide wetland delineation at USNA using GPS technology and develop a wetlands GIS layer. Describe wetlands according to the Cowardin classification system.

Objective

Assess the base-wide occurrence of wetlands and provide a wetlands map for planning purposes.

Background/Justification

The existing NWI wetlands assessment was conducted with little or no ground truthing and appears to overstate the occurrence of wetlands in the interior portion of the Academy. An updated planning-level or jurisdictional delineation would provide valuable wetland information to site planners.

Impact to Mission

The lack of up-to-date wetlands delineation and GIS data layer can impede planning activities and may result in wetlands violations.

Regulatory Drivers

CWA, CZMA, EO 11990 (Protection of Wetlands), 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1, EO 13508 (Chesapeake Bay Restoration)

Implementation Schedule: POM 12 Cycle

Priority: OMB/EPA Class II, ERL 3, Navy Level 2

Funding Sources: O&MN

Cost Estimate: \$75,000

PRIORITY: High Priority

WATERSHED AND SHORELINE MANAGEMENT

Project Title

Riparian Buffer Establishment and Enhancement at NSA Annapolis

Project Description

Complete riparian forest buffer restoration on previously identified sites. Identify additional areas, through a shoreline assessment, where riparian buffers may be established or enhanced by being removed from the mowing contract, planting with native tree and shrub species, or a combination of both. Post educational signs identifying the sites as riparian buffers. The signs should be made using recycled materials. Monitor sites annually and treat for invasive species infestations as necessary.

Objective

Support the Navy's commitment to the Chesapeake Bay Program to protect wetlands and water quality by establishing or enhance riparian buffers where practicable.

Background/Justification

In 2000, two sites were identified in the Navy's Chesapeake Bay Riparian Forest Buffer Site Assessment (U.S. Navy 2000b) as potential site for riparian buffer enhancement. A 300-foot long area adjacent to College Creek at the Lower Yard and a 50-foot long area on the Severn River at the Upper Yard were identified. Planting options, species lists, and site maps were provided for each site.

Implementing the riparian buffer planting plans would help the Navy meet its goals of supporting the Chesapeake Bay Agreements as well as contribute to watershed protection at USNA.

Impact to Mission

Project implementation is important to meeting water quality objectives established by federal and state laws and regulations and maintaining the Navy's commitment as a signatory to the Chesapeake Bay Agreements.

Regulatory Drivers

CWA, CZMA, EO 11990 (Protection of Wetlands), EO 13112 (Invasive Species), OPNAVINST 5090.1C, Chesapeake Bay Preservation Act and Federal Agreement, EO 13508 (Chesapeake Bay Restoration)

Implementation Schedule:	2012, 2013
Priority:	OMB/EPA Class II, ERL 4, Navy Level 1
Funding Sources:	NPLD, Recycling funds, O&MN
Cost Estimate:	\$50,000

PRIORITY: High Priority

SHORELINE RESTORATION

Project Title

Shoreline Restoration Planning and Implementation at NSA Annapolis

Project Description

Develop and implement shoreline restoration plans based on appropriate nonstructural and structural methods for sites along College Creek, around Greenbury Point, Mill Creek, and Carr Creek. Once plans are developed, move forward with permitting and construction as funding allows.

Objective

Restore shoreline conditions to the greatest extent practicable in order to protect Navy real estate while enhancing aquatic habitats, and water quality.

Background/Justification

Actions such as replacing bulkheads with living shorelines, riparian forest buffer enhancement, and marsh creation are recommended to improve shoreline habitat and benefit SAV, fish, and benthic invertebrates within the area. A site assessment conducted in 2008 by the PWD Environmental Division Natural Resources Manager and NAVFAC Washington Natural Resources Specialist identified one potential restoration sites along USNA shoreline. St. John's College recently completed a shoreline restoration project on approximately 800 feet of College Creek, which can serve as a model for NSA Annapolis restoration efforts.



Impact to Mission

Project implementation is important to meeting water quality objectives established by federal and state laws and regulations and maintaining the Navy's commitment as a signatory to the Chesapeake Bay Agreements.

Regulatory Drivers

CWA, CZMA, EO 11990 (Protection of Wetlands), EO 13112 (Invasive Species), OPNAVINST 5090.1C, Chesapeake Bay Preservation Act and Federal Agreement, EO 13508 (Chesapeake Bay Restoration)

Implementation Schedule:	2012 - 2014
Priority:	OMB/EPA Class II, ERL 3, Navy Level 2
Funding Sources:	O&MN, Chesapeake Bay Program, NOAA
Cost Estimate:	\$50,000 and up

PRIORITY: High Priority

SHORELINE RESTORATION

Project Title

Submerged Aquatic Vegetation Site Assessment and Restoration at NSA Annapolis

Project Description

Conduct assessment surveys to identify areas that could benefit from submerged aquatic vegetation restoration. A site assessment that analyses salinity, turbidity, and water depth should be included in the pre-visits construction phase. Consider partnering with the Friends of College Creek, NOAA, or the Anne Arundel County Soil Conservation District on this project

Objective

Support the Navy's commitment to the Chesapeake Bay Program to restore 185,000 acres of SAV in the Chesapeake Bay and its tributaries.

Background/Justification

Ongoing mapping of SAV by organizations, such as the Chesapeake Bay Foundation, and local watershed groups, such as Friends of College Creek, indicate SAV beds planted during the St. John's College living shoreline restoration have been successfully established. Conducting additional SAV restoration would help the Navy meet its goals of supporting the Chesapeake Bay Agreements as well as contribute to watershed protection at NSA Annapolis.

Impact to Mission

SAV is a sensitive water-quality indicator, as well as a regulated wetland plant. Declines in SAV populations around USNA may indicate an unchecked pollution source on the Academy. Project implementation is important to meeting water quality objectives established by federal and state laws and regulations and maintaining the Navy's commitment as a signatory to the Chesapeake Bay Agreements.

Regulatory Drivers

CWA, CZMA, EO 11990 (Protection of Wetlands), EO 13112 (Invasive Species), OPNAVINST 5090.1C, Chesapeake Bay Preservation Act and Federal Agreement, EO 13508 (Chesapeake Bay Restoration)

Implementation Schedule:	2012, 2014 plus annual monitoring
Priority:	OMB/EPA Class II, ERL 3, Navy Level 2
Funding Sources:	O&MN, Chesapeake Bay Program, NOAA
Cost Estimate:	\$30,000

PRIORITY: High Priority

SHORELINE RESTORATION

Project Title

Oyster Bed Restoration at NSA Annapolis

Project Description

Construct oyster reefs in appropriate habitat in the waters around the Academy. Waterway assessments that analyze salinity, turbidity, and water depth should be conducted prior to beginning such a project. Site monitoring should be continued for three to five years to assess the effectiveness of the project. Consider partnering with Friends of College Creek, the Spa Creek Conservancy, professors at the US Naval Academy, and NOAA on this project.

Objective

Improve water quality and increase native oyster populations in the Chesapeake Bay and its tributaries.

Background/Justification

Since 1977, midshipmen have participated in an oyster recovery effort by moving oyster shell bars from a nursery in Mill Creek to an oyster bar at the mouth of the Severn River. The Station also provides access to a pier at the MWR Marina. Additional commitment to increase oyster beds around USNA would provide benefits to the creek by improving water quality as a result of their filter-feeding activity, which would improve success rates for SAV.

Impact to Mission

Project implementation is important to meeting water quality objectives established by federal and state laws and regulations and maintaining the Navy's commitment as a signatory to the Chesapeake Bay Agreements.

Regulatory Drivers

CWA, CZMA, EO 11990 (Protection of Wetlands), EO 13112 (Invasive Species), OPNAVINST 5090.1C, Chesapeake Bay Preservation Act and Federal Agreement, EO 13508 (Chesapeake Bay Restoration)

Implementation Schedule:	2011, 2013 plus annual monitoring
Priority:	OMB/EPA Class II, ERL 3, Navy Level 2
Funding Sources:	O&MN, Chesapeake Bay Program, Legacy Funding
Cost Estimate:	\$45,000

PRIORITY: Low Priority

MIGRATORY BIRD MANAGEMENT

Project Title

Habitat Management for Cavity Nesters at NSA Annapolis

Project Description

A number nest boxes and roosting structures have been installed and monitored on the golf course and Greenbury Point since the 1990s. As of 2000, there were 79 bluebird boxes, 16 osprey platforms, 15 purple martin houses, 4 raptor and owl boxes, and 3 or more bat boxes. In addition, one to two wood duck boxes could be installed along the edge of Shady Lake and several bluebird and/or tree swallow boxes could be set up along the wood edge west of the water plant (building 591) or USNA Cemetery. Periodic surveys for the target species should be conducted throughout the breeding season prior to installing nest boxes to ensure the presence of the species. Mapping nest box locations using GPS technology and annual maintenance and monitoring would improve the effectiveness of this program.

Objective

Enhance nesting habitat for migratory birds.

Background/Justification

Appropriate habitat for nesting and brooding has declined for many bird species world-wide. Nesting habitat can be created or enhanced for a number of species, whose populations have been in decline, by the use of artificial nest boxes/platforms.

Impact to Mission

Failure to implement this project would demonstrate a lack of commitment to management and would fall short of stewardship responsibilities under the MBTA and other regulatory drivers.

Regulatory Drivers

Sikes Act, MBTA, 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1

Implementation Schedule: 2012 plus annual monitoring and maintenance

Priority: OMB/EPA Class III, ERL 1, Navy Level 5

Funding Sources: NPLD, O&MN

Cost Estimate: \$6,500

PRIORITY: Low Priority

FISH AND WILDLIFE MANAGEMENT

Project Title

Baseline Faunal Surveys at NSA Annapolis

Project Description

Conduct baseline faunal surveys at NSA Annapolis, NSAA North Severn and Greenbury Point to assess the occurrence of wildlife species utilizing the installation. Seasonal surveys should be conducted for breeding and migratory landbirds, waterfowl, aquatic organisms, herpetofauna, and bats and other mammals in the semi-natural and natural areas at NSAA. It is critical to develop written protocols, GPS-located survey points, and a digital database for each survey so that future monitoring can be accomplished.

Objective

Assess the occurrence of wildlife populations utilizing the installation to better manage for all wildlife species.

Background/Justification

The Sikes Act, 32CFR190 (DoD Natural Resources Management Program), and Navy policy require current inventories on Navy-managed lands. Most of the wildlife surveys conducted at USNA were conducted as a minor component of surveys being conducted at Greenbury Point on NSAA North Severn. The resulting data for USNA are not available as separate species lists. Many of the surveys were conducted in the late 1990s and are in need of updating in order to provide a better understanding of the current conditions at USNA.

Impact to Mission

Baseline faunal surveys have not been conducted at NSAA or its special areas. Therefore failure to implement this project would result in noncompliance with the Sikes Act and Navy policy on natural resources management including management of federally listed species of concern.

Regulatory Drivers

Sikes Act, 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1, USFWS 2008 Birds of Conservation Concern

Implementation Schedule:	2012
Priority:	OMB/EPA Class II, ERL 3, Navy Level 2
Funding Sources:	O&MN
Cost Estimate:	\$75,000

PRIORITY: Low Priority

FISH AND WILDLIFE MANAGEMENT

Project Title

Posting Fishing Restrictions Signs at Greenbury Point and NSAA North Severn

Project Description

Post signs that educate anglers on live and nonnative bait restrictions to prevent further introduction of nonnative species into the Chesapeake Bay and its tributaries. The signs should be made using recycled materials.

Objective

Educate anglers on problems caused by nonnative live bait and reduce the spread of nonnative invasive aquatic species.

Background/Justification

Fisheries resources at and in the immediate vicinity of the installation include the brackish/saltwater fisheries of the Severn Rive, College Creek, and Spa Creek. EO 13112 - Invasive Species and the Chesapeake Bay Preservation Act restricts the introduction of harmful exotic species into native ecosystems. Although the state of Maryland does not currently have restrictions on nonnative live bait, the Navy should implement proactive measures to protect native fish populations and prevent the spread of aggressive nonnative species by prohibiting use of all live bait other than night crawlers and bloodworms.

Impact to Mission

Project implementation is important fisheries management objectives established by federal and state laws and regulations and maintaining the Navy's commitment as a signatory to the Chesapeake Bay Agreements.

Regulatory Drivers

Sikes Act, 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1, EO 11987 (Exotic Organisms), EO 13112 (Invasive Species), Chesapeake Bay Preservation Act, EO 13508 (Chesapeake Bay Restoration)

Implementation Schedule:	2011
Priority:	OMB/EPA Class II, ERL 3, Navy Level 2
Funding Sources:	O&MN, recycling funds
Cost Estimate:	\$2,000 (in-house design and implementation)

PRIORITY: High Priority

INVASIVE SPECIES MANAGEMENT

Project Title

Invasive Species Mapping at NSA Annapolis

Project Description

Conduct invasive species mapping (excluding landscaped areas) using GPS technology and develop a management plan and priorities for treatment.

Objective

Identify and map target invasive species to prevent the further spread and degradation of natural habitats at USNA.

Background/Justification

EO 13112 - Invasive Species and the Chesapeake Bay Preservation Act restricts the introduction of harmful exotic species into native ecosystems, and to the extent practicable and permitted by law, to detect and control such species; accurately monitor invasive species populations; provide for restoration of native species and habitats that have been invaded; promote public education on invasive species, and conduct research on invasive species to prevent their introduction and provide for environmentally sound control. A thorough inventory of invasive species has not been conducted at USNA to date. To comply with EO 13112, a formal survey for invasive species should be conducted and the location and extent of invasive species mapped. Regularly monitoring for new populations of invasive species allows for early control of infestations, since management efforts are more effective when population sizes are small.

Impact to Mission

Absence of an active control program results in degradation of habitat that supports the mission and disregards Navy stewardship responsibilities.

Regulatory Drivers

Sikes Act, EO 11987 (Exotic Organisms), EO 13112 (Invasive Species), 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1, EO 13508 (Chesapeake Bay Restoration)

Implementation Schedule:	2012
Priority:	OMB/EPA Class I, ERL 4, Navy Level 1
Funding Sources:	O&MN
Cost Estimate:	\$50,000

PRIORITY: High Priority

INVASIVE SPECIES MANAGEMENT

Project Title

Invasive Species Control at NSA Annapolis

Project Description

Implement management recommendations developed in the invasive species survey and management plan. Conduct follow up treatments and monitoring to assess treatment effectiveness.

Objective

Restore natural habitats and prevent the further spread of invasive species at NSA Annapolis

Background/Justification

Preserving the small remaining area of wetland and shrub/scrub habitat that occurs on NSAA and special areas is a natural resources priority. Treatment of common reed has been conducted periodically at Shady Lake since 1999. Continuing to control invasive species through annual treatments would help maintain the integrity of the site improve its wildlife and aesthetic value.

EO 13112 - Invasive Species and the Chesapeake Bay Preservation Act restrict the introduction of harmful exotic species into native ecosystems, including wetlands, and to control invasive species to the extent practicable and permitted by law.

Impact to Mission

Absence of an active control program results in degradation of habitat that supports the mission and disregards Navy stewardship responsibilities.

Regulatory Drivers

Sikes Act, EO 11987 (Exotic Organisms), EO 13112 (Invasive Species), 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1

Implementation Schedule:	2012-2016
Priority:	OMB/EPA Class I, ERL 4, Navy Level 1
Funding Sources:	O&MN, National Fish and Wildlife Foundation
Cost Estimate:	\$200,000

PRIORITY: High Priority

INVASIVE SPECIES MANAGEMENT

Project Title

Control Common Reed throughout Wetland Sites within NSAA and Special Areas

Project Description

Assess past treatment efforts and continue to control common reed through annual spot treatments at Shady Lake and other wetlands areas, if necessary.

Objective

Restore and prevent the further spread of common reed and degradation of wetland habitats within NSAA and special areas.

Background/Justification

Preserving the small remaining area of wetland that occurs on NSAA and its special areas is a natural resources priority. Treatment of common reed has been conducted periodically at Shady Lake and other sites since 1999. Continuing to control common reed through annual spot treatments would help maintain the integrity of the site improve its wildlife and aesthetic value. These efforts should be coordinated with the private community to treat common reed that occurs on private property contiguous with that of the USNA/AAC, to prevent re-establishment of common reed.

EO 13112 - Invasive Species and the Chesapeake Bay Preservation Act restrict the introduction of harmful exotic species into native ecosystems, including wetlands, and to control invasive species to the extent practicable and permitted by law.

Impact to Mission

Absence of an active control program results in degradation of habitat that supports the mission and disregards Navy stewardship responsibilities.

Regulatory Drivers

Sikes Act, EO 11987 (Exotic Organisms), EO 13112 (Invasive Species), 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1

Implementation Schedule:	Annual
Priority:	OMB/EPA Class I, ERL 4, Navy Level 1
Funding Sources:	O&MN, Chesapeake Bay Program
Cost Estimate:	\$30,000 annually

PRIORITY: Best Management Practice

RARE, THREATENED, AND ENDANGERED SPECIES MANAGEMENT

Project Title

RT&E Species Survey Update at NSAA North Severn and Greenbury Point

Project Description

Conduct an RT&E survey update monitoring of populations or individuals of protected species determined present during the initial surveys project at NSAA North Severn and Greenbury Point.

Objective

Monitor the occurrence, population size, and relative health of RT&E species at NSAA North Severn and Greenbury Point.

Background/Justification

A survey for unique natural communities and rare, threatened and endangered species was conducted in 1996 at Greenbury Point, but no other portion of NSAA North Severn (U.S. Navy 1997). Survey efforts focused on birds, plants, and butterflies. No federally listed threatened, endangered, or candidate species were identified at in the survey. A number of state-listed bird species, however, have been documented. Included are three state-endangered species, mourning warbler (*Oporornis philadelphia*), royal tern (*Thalasseus maximus*), and short-eared owl (*Asio flammeus*); a state-threatened species, least tern (*Sternula antillarum*); and two species listed as in need of conservation, American peregrine falcon (*Falco peregrinus anatum*) and Nashville warbler (*Vermivora ruficapilla*) (MDNR 2010a). The bald eagle is listed as S3.1B by the state Natural Heritage Program has also been documented at Greenbury Point.

Of the plant species observed at Greenbury Point, only Lancaster's sedge is currently tracked by the MDNR Wildlife and Heritage Services, Natural Heritage Program. It is classified as SU; possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the state (MDNR 2010b). Plant surveys also identified grass-leaved arrowhead (*Sagittaria graminea*), also listed as SU, and broad-fruited bur-reed (*Sparganium eurycarpum*), classified as S3; rare to uncommon in the state. However, the locations and populations of these species were not documented.

Impact to Mission

Federal agencies are required to ensure that their actions will not adversely impact endangered species. Updates to past surveys to substantiate the presence or absence of listed species are necessary to ensure compliance and population health. Failure to implement this project would result in noncompliance with the Sikes Act and Navy policy on natural resources management, and potential noncompliance with the ESA and state laws.

Regulatory Drivers

Sikes Act, CZMA, ESA, 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1, Bald and Golden Eagle Protection Act

Implementation Schedule:	2011
Priority:	OMB/EPA Class II, ERL 3 Navy Level 1
Funding Sources:	O&MN
Cost Estimate:	\$48,000

PRIORITY: High Priority

SHORELINE RESTORATION

Project Title

Repair of the Berm Shoreline at Green Bury Point and Emergency Tree Removal

Project Description

Repair existing berm shoreline on Green Bury Point and remove existing trees on berm.

Objective

Restore shoreline conditions to the greatest extent practicable in order to protect the existing berm while enhancing aquatic habitats, and water quality.

Background/Justification

The Berm at Green Bury point was created to hold dredge spoils in the 1940s during the construction of the David Taylor Research basins and the dredging of Annapolis Harbor and Church Channels. These dredge spoils were subsequently been found to be hazardous, and actions were taken to remove most of the hazardous material from the site. In the intervening years, storm surge and other natural processes have weakened the remaining berm walls, and they are now in danger of failing. This project seeks to repair the existing berm walls while creating habitat for various local species. Actions such as replacing bulkheads with living shorelines, riparian forest buffer enhancement, and marsh creation are recommended to improve shoreline habitat and benefit SAV, fish, and benthic invertebrates within the area.



Impact to Mission

Project implementation is important to meeting water quality objectives established by the CWA and state regulations and maintaining the Navy's commitment as a signatory to the Chesapeake Bay Agreements.

Regulatory Drivers

CWA, CZMA, EO 11990 (Protection of Wetlands), OPNAVINST 5090.1C, Chesapeake Bay Preservation Act and Federal Agreement, EO 13508 (Chesapeake Bay Restoration)

Implementation Schedule: 2012

Priority: OMB/EPA Class II, ERL 3, Navy Level 2

Funding Sources: O&MN, Chesapeake Bay Program

Cost Estimate: \$267,000 emergency repairs

\$775,000 living shoreline restoration

PRIORITY: High Priority

MIGRATORY BIRD MANAGEMENT

Project Title

Northern Bobwhite Quail Habitat Management

Project Description

Enhance bobwhite quail habitat through a combination of mowing and invasive species treatments at Greenbury Point. Treatments should be conducted on a rotational basis, with no more than one-third of the area being treated in a given year. Seeding in rows of partridge pea (*Cassia fasciculata*) or other native legume species can also improve habitat value for quail. Annual quail surveys would be required to assess the effectiveness of management practices at NSAA North Severn. Annual surveys should be coordinated with the MDNR upland game bird biologist, who can advise the natural resources manager on an appropriate survey route and survey protocol.

Objective

Enhance nesting and feeding habitat for declining bobwhite quail populations.

Background/Justification

Once common throughout Maryland, northern bobwhite populations have declined by more than 90 percent in the past 40 years (MDNR 2008e). As one of Anne Arundel County's few remaining areas that support a population of northern bobwhite, Greenbury Point provides important habitat for this species. The bobwhite is primarily an edge species and a species of early successional plant communities. Urbanization, changes in farming practices, lack of prescribed burning, and the use of agricultural chemicals are, in part, responsible for the decrease in quail populations. Past maintenance practices that kept mowed grass areas and bare ground around the base of radio towers at NSAA North Severn have benefitted northern bobwhite.

Impact to Mission

Failure to implement this project would demonstrate a lack of commitment to management and would fall short of stewardship responsibilities under the MBTA and other regulatory drivers.

Regulatory Drivers

Sikes Act, MBTA, 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1

Implementation Schedule: 2012-2014 plus annual monitoring and maintenance

Priority: OMB/EPA Class III, ERL 1, Navy Level 5

Funding Sources: O&MN, Ag. Outlease

Cost Estimate: \$20,000; funding only includes habitat enhancement. Invasive species costs are accounted for under different projects

PRIORITY: High Priority

FISH AND WILDLIFE MANAGEMENT

Project Title

Nuisance Wildlife Management at NSAA North Severn and Greenbury Point

Project Description

Implement deer population management through an Interagency Agreement with APHIS-WS. Because of the large number of deer requiring removal, an environmental assessment analyzing various alternatives for deer control may be required in accordance with the NEPA, prior to implementation.

Objective

Maintain deer, resident Canada goose, and raccoon populations at NSAA North Severn and Greenbury Point within biological and cultural carrying capacities.

Background/Justification

In 2008, a spotlight survey conducted at NSAA North Severn with support of APHIS-WS identified 200 deer on the 827-acre property. Considering the availability and quality of habitat, a population of 20 to 30 deer is recommended for the site (Healy 2008). Although hunting on DoD facilities is authorized and promoted by the Sikes Act, DoDI 4715.3, OPNAVINST 5090.1C, the DoD Natural Resources Management Program, and NAVFAC MO 100.3, Fish and Wildlife Management Manual, there is no hunting program at NSAA North Severn. Adequate baseline surveys for raccoon and Canada Geese have not yet been conducted.

Impact to Mission

Project implementation is important to prevent further habitat degradation caused by excessive deer browse.

Regulatory Drivers

Sikes Act, 32 CFR 190 (Natural Resources Management Program), DoDI 4715.3 (Environmental Conservation Program), OPNAVINST 5090.1

Implementation Schedule: Annual

Priority: OMB/EPA Class II, ERL 3, Navy Level 2

Funding Sources: O&MN

Cost Estimate: \$40,000

PRIORITY: High Priority

FISH AND WILDLIFE MANAGEMENT

Project Title

Tick Control

Objective

Implement tick control and the incidence of Lyme disease through topical application of pesticides to whitetail deer

Background

Whitetail deer are the preferred host for adult deer tick (*Ixodes scapularis*), which is the known vector of Lyme disease. The USDA has patented a device for the topical application of pesticides to deer for the control of ticks. The device, called a 4-poster deer treatment bait station, has paint rollers mounted on each corner that apply pesticide to the head and neck areas while deer feed from two troughs containing corn. Studies show that the use of the 4-poster bait station with approved tickicide has resulted in control of 92 to 100 percent of ticks after 3 years of use with approved tickicide (Solberg et al. 2003). The EPA has approved a specially formulated 10 percent permethrin based pesticide for use in treating ticks on deer. The 4-Poster Deer Treatment Bait Station was developed and patented by researchers at the USDA.



Project Description

Purchase and install up to eight 4 poster deer treatment bait stations. Place one to two bait stations at the Naval Academy and the remaining at various locations around NSAA North Severn and Greenbury Point. Evening or spotlight surveys may be needed to identify deer congregation areas that would be suitable locations. To initially attract deer to the stations, disperse extra corn and apple slices along trails leading to the stations. Fill each bait station with 225 pounds of whole, shelled corn. The 4-poster bait stations should be maintained on a year-round basis other than periods when temperatures are below freezing.

The rollers should be treated with 15 ml of 10 percent permethrin solution. Retreat the rollers approximately two times per week and after inclement weather. The trough plates should be closed before and during inclement weather to prevent moisture from entering and causing molding and caking.

To assess the effectiveness of tick control efforts, tick sampling should be conducted prior to implementing this program. Two techniques to sample for ticks are recommended: (1) dragging cloth flags over vegetation or (2) collecting from the investigator's clothing. Flagging for ticks involves using a cotton flannel or other fabric attached to a wooden pole. The cloth is either

hung at one end in a flag configuration and dragged, or is attached to the middle and dragged by rope tied to each end of the wooden pole. The use of flags is the preferred method when collecting larval and nymphal *Ixodes* ticks as it samples host-seeking ticks in the leaf litter over a quantifiable distance or exposure. Collecting ticks from the investigator while walking involves wearing cotton pants tucked into socks, and collecting attached ticks periodically while walking through the sampling area. This latter method is particularly effective for sampling adult ticks (Patnaude and Mather 2007).

Impact to Mission

Project implementation is important to reduce human health impacts from deer ticks.

Regulatory Drivers

Sikes Act

Proposed Implementation Schedule:	Ongoing
Priority:	OMB/EPA Class II, ERL 3, Navy Level 2
Funding Sources:	O&MN
Cost Estimate:	\$8,500 first year (Materials only) \$4,000 annually (Materials only)

PRIORITY: Low Priority

FISH AND WILDLIFE MANAGEMENT

Project Title

Feral Cat Population Assessment and Control at NSAA North Severn

Project Description

Consistent with Navy Policy and in conjunction with local USDA efforts for raccoon trapping/vaccination, feral animals will be removed from Navy lands and transported to local shelters for disposition.

Objective

Eliminate feral cat populations at NSAA North Severn in order to protect small mammal and bird populations and to eliminate potential vectors of rabies from feral cats to humans living and working in the area.

Background/Justification

Evidence from the USDA-WS coordinator for the raccoon trapping and vaccination program indicates the potential need for a feral cat capture program. Because of the devastating impacts feral cats can have on native bird and small mammal populations, a pilot cat survey and, if necessary, trapping program should be initiated to assess the extent of the problem of feral cats at NSAA North Severn. Baited stations and infrared motion-activated cameras placed in areas likely to attract feral cats (abandoned buildings, shacks, etc.) can be used to detect the presence of cats. Trapping feral cats should be accomplished through the use of humane feral cat traps baited with fish, meats, oil of catnip, sardines, canned tuna, or chicken. Captured cats will be brought to a local animal shelter for assessment of adoptability, and euthanized if considered unadoptable. Navy policy prohibits trap, neuter, release programs.

Impact to Mission

Project implementation is important to prevent impacts to native bird and wildlife populations.

Regulatory Drivers

NEPA, OPNAVINST 5090.1

Implementation Schedule:	2012
Priority:	OMB/EPA Class II, ERL 3, Navy Level 2
Funding Sources:	O&MN
Cost Estimate:	\$15,000

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Table A1. NSAA, NSAA North Severn, and Greenbury Point NRMP Project Implementation Schedule

Project #	Project Description	Implementation Schedule (FY)	Legal Driver/ Initiative	OMB Class ERL Navy Level	Cost Estimate (\$)	Funding Source	Date Completed
	Base-wide Wetlands Delineation	2012, 2013	B, D, E, H, J	II, 3, 2	75,000	O&MN	
	Riparian Buffer Establishment and Enhancement	2012, 2013	B, D, E, H, J	II, 4, 1	50,000	NPLD, Recycling	
	Shoreline Restoration Planning and Implementation	2012 - 2014	B, D, E, H, J	II, 3, 2	50,000 +	O&MN, CBP	
	Submerged Aquatic Vegetation Site Assessment and Restoration	2012, 2014	B, D, E, H, J	II, 3, 2	30,000	O&MN, CBP NOAA	
	Oyster Bed Restoration	2012, 2013	B, D, E, H, J	II, 3, 2	45,000	O&MN, CBP Legacy	
	Habitat Management for Cavity Nesters	2012	A, C, G, H, I	III, 1, 5	6,500	NPLD, O&MN	
	Baseline Faunal Surveys	2012	A, G, H, I	II, 3, 2	75,000	O&MN	
	Posting Fishing Restrictions Signs	2011	A, G, H, I	II, 3, 2	2,000	O&MN Recycling	
	Invasive Species Mapping	2012	A, F, G, H, I	II, 4, 1	50,000	O&MN	
	Invasive Species Control	2012-2016	A, F, G, H, I	II, 4, 1	200,000	O&MN NFWF	
	Common Reed Control	Annual	A, F, G, H, I	II, 4, 1	30,000	O&MN CBP	
	RT&E Species Survey Update	2011	A, G, H, I, K	II, 3, 1	48,000	O&MN	

Table A1. NSAA, NSAA North Severn, and Greenbury Point NRMP Project Implementation Schedule (cont'd)

Project #	Project Description	Implementation Schedule (FY)	Legal Driver/ Initiative	OMB Class ERL Navy Level	Cost Estimate (\$)	Funding Source	Date Completed
	Emergency measures (i.e. tree removal along the berm)	2011	B, D, E, H, J	II, 3, 2	267,000	O&MN CBP	
	Repair of the Berm Shoreline at Green Bury Point	2012	B, D, E, H, J	II, 3, 2	775,000	O&MN CBP	
	Northern Bobwhite Quail Habitat Management	2012-2014	A, C, G, H, I	III, 1, 5	20,000	O&MN, Ag outlease	
	Nuisance Wildlife Management (Deer)	Annual	A, G, H, I	II, 3, 2	40,000	O&MN	
	Tick Control	Ongoing	A	II, 3, 2	8,500	O&MN	
	Feral Cat Population Assessment and Control	2012	C, M	II, 3, 2	15,000	O&MN	

A – Sikes Act

B – Clean Water Act

C – Migratory Bird Treaty Act

D – Coastal Zone Management Act

E – EO 11990 (Protection of Wetlands)

F – EO 13112 (Invasive Species)

G – 32 CFR Part 190 (DoD Natural Resources Management Program)

H – OPNAVINST 5090.1 (Environmental and Natural Resources Program Manual)

I – DoD Instruction 4715.3 (Environmental Conservation Program)

J – Chesapeake Bay Agreements

K – Endangered Species Act

L – National Environmental Policy Act

M – Navy Policy on Feral Pets

O&MN – Operations and Maintenance, Navy

NPLD – National Public Lands Day

Recycling – Recycling Funds

CBP – Chesapeake Bay Program

NFWF - National Fish and Wildlife Foundation

Appendix 2

State and Federally Listed Threatened and Endangered Wildlife Species of Maryland
State and Federally Listed Threatened and Endangered Plant Species of Maryland Wildlife
Birds of Conservation Concern
Species Known to Occur at NSA Annapolis
Plant Species Known to Occur at NSA Annapolis

Rare, Threatened, and Endangered Animals of Maryland

April 2010



**Maryland Wildlife and Heritage Service
Natural Heritage Program**



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Cover photo: Eastern Tiger Salamander (*Ambystoma tigrinum*) © Jim White

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RARE, THREATENED, AND ENDANGERED ANIMALS OF MARYLAND

April 5, 2010

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INTRODUCTION

The following report identifies those native Maryland animals that are among the rarest and most in need of conservation efforts as elements of our State's natural diversity. It includes species occurring in Maryland that are listed or that are candidates for listing on the Federal list of Endangered and Threatened Wildlife and Animals, species currently on the State's Threatened and Endangered Species List, and additional species that are considered rare by the Maryland Wildlife and Heritage Service. The purpose of this report is to inform the public of which species are rare, to provide an indication of their degree of rarity, to solicit additional information on the status and distribution of these species, and to promote an interest in their protection.

Compiled by Natural Heritage Program staff, this list of rare species is a result of 30 years of data gathering from numerous sources, such as museums and private collections, scientific literature, unpublished documents, reports from biologists and amateur naturalists, and field work conducted by scientists from the Department of Natural Resources (DNR). The original version of this list was included in DNR's 1984 publication Threatened and Endangered Plants and Animals of Maryland, which also contained detailed information on the distribution and status of Maryland's rare species known at that time.

Since 1984, our knowledge of Maryland's fauna has grown steadily. Through extensive field work, Wildlife and Heritage Service biologists and other researchers have located species which were previously unrecorded for the State and have discovered that some species are scarcer than previously known. Similarly, some species are now known to be either more widespread or less vulnerable to ecological disturbances than previously believed. Thus, the list and status of each species is periodically revised to keep pace with new information.

The official State Threatened and Endangered Species List is part of the State Threatened and Endangered Species regulations (COMAR 08.03.08). Wildlife and Heritage Service biologists are concerned with many more species than those included on the State's Threatened and Endangered Species List. Some of these species are potential candidates for listing and usually require further investigation into their rarity and endangerment status. Others are thought to be secure at present, but are worthy of attention because of limited distributions, declining populations, or ecological vulnerabilities.

ABOUT THIS LIST

The list of rare, threatened, and endangered animals is arranged phylogenetically with invertebrate groups listed before vertebrate groups. Within each group, species are listed alphabetically by scientific name. Some invertebrate groups are not fully represented or are entirely absent from this list. To date, available information has been compiled for only certain species or groups of invertebrates. Many invertebrate species are not well known and have not been fully researched or inventoried in Maryland, and the taxonomy of some has not been standardized.

Birds and other migratory species are tracked and considered rare by the Wildlife and Heritage Service on the basis of their breeding status alone. For example, Dark-eyed Juncos are abundant backyard birds during the winter; however, they breed in only a few remote areas in western Maryland during the summer. To be included on the official State Threatened and Endangered Species List, migrants that are rare Maryland breeders must also be rare during the non-breeding season. Thus, the Dark-eyed Junco cannot be included on the official State List under current listing criteria. Other migratory species, such as whales and sea turtles, have been included because of their Federal status even though they typically do not breed in Maryland.

Four columns are printed to the right of each name. The global and state rarity ranks of each species are included in the first and second columns, respectively. The third column indicates the species' legal status on the State Threatened and Endangered Species List. The last column shows the Federal legal status of each species as determined by the U.S. Fish and Wildlife Service. Definitions for the codes used in all four columns are provided below. At the end of the list is a series of four Appendices. **Appendix I** contains a summary of the changes to state ranks and statuses since the last time this list was published. Because taxonomists periodically update scientific names, a partial list of synonym names is included as a cross reference in **Appendix II**. The names used in this publication might not reflect the most recently published taxonomic changes or standards. Species currently under consideration for inclusion on the list appear in **Appendix III**. **Appendix IV** contains a list of species with unusual, non-standard ranks and has been provided to clarify their current conservation status in Maryland. Natural Heritage Program biologists welcome any information on the status and location of the species in Appendices III and IV from all interested parties.

EXPLANATION OF SPECIES RANK AND STATUS CODES

GLOBAL AND STATE RANKS

The global and state ranking system is used by all 50 state Natural Heritage Programs and numerous Conservation Data Centers in other countries in this hemisphere. Because they are assigned based upon standard criteria, the ranks can be used to assess the range-wide status of a species, as well as the status within portions of the species' range. The primary criterion used to define these ranks is the number of known distinct occurrences with consideration given to the total number of individuals at each locality. Additional factors considered include the current level of protection, the types and degree of threats, ecological vulnerability, and population trends. Global and state ranks are used in combination to set inventory, protection, and management priorities for species both at the state as well as regional level.

GLOBAL RANK

- G1 Highly globally rare. Critically imperiled globally because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
- G2 Globally rare. Imperiled globally because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
- G3 Either very rare and local throughout its range or distributed locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; typically with 21 to 100 estimated occurrences.
- G4 Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.
- G5 Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery.
- GH No known extant occurrences (i.e., formerly part of the established biota, with the expectation that it may be rediscovered).
- GU Possibly in peril range-wide, but its status is uncertain; more information is needed.
- GX Believed to be extinct throughout its range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.
- G? The species has not yet been ranked.

- _Q Species containing a "Q" in the rank indicates that the taxon is of questionable or uncertain taxonomic standing (i.e., some taxonomists regard it as a full species, while others treat it at an infraspecific level).
- _T Ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species.

STATE RANK

- S1 Highly State rare. Critically imperiled in Maryland because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres in the State) or because of some factor(s) making it especially vulnerable to extirpation. Species with this rank are actively tracked by the Wildlife and Heritage Service.
- S2 State rare. Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated. Species with this rank are actively tracked by the Wildlife and Heritage Service.
- S3 Watch List. Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Species with this rank are not actively tracked by the Wildlife and Heritage Service.
- S3.1 A "Watch List" species that is actively tracked by the Wildlife and Heritage Service because of the global significance of Maryland occurrences. For instance, a G3 S3 species is globally rare to uncommon, and although it may not be currently threatened with extirpation in Maryland, its occurrences in Maryland may be critical to the long term security of the species. Therefore, its status in the State is being monitored.
- S4 Apparently secure in Maryland with typically more than 100 occurrences in the State or may have fewer occurrences if they contain large numbers of individuals. It is apparently secure under present conditions, although it may be restricted to only a portion of the State.
- S5 Demonstrably secure in Maryland under present conditions.
- SA Accidental or a vagrant in Maryland.
- SE Established, but not native to Maryland; it may be native elsewhere in North America.
- SH Historically known from Maryland, but not verified for an extended period (usually 20 or more years), with the expectation that it may be rediscovered.
- SNA Species is not a suitable conservation target
- SP Potentially occurring in Maryland or likely to have occurred in Maryland (but without persuasive documentation).
- SR Reported from Maryland, but without persuasive documentation that would provide a basis for either accepting or rejecting the report (e.g., no voucher specimen exists).
- SRF Reported falsely (in error) from Maryland, and the error may persist in the literature.
- SU Possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the State. Uncertainty spans a range of 4 or 5 ranks as defined above.

- SX Believed to be extirpated in Maryland with virtually no chance of rediscovery.
- S? The species has not yet been ranked.
- _B A qualifier at the end of a rank. This species is a migrant and the subrank refers only to the breeding status of the species in Maryland. This species may have a different subrank for non-breeding populations.
- _N A qualifier at the end of a rank. This species is a migrant and the subrank refers only to the non-breeding status of the species in Maryland. This species may have a different subrank for breeding populations.

STATE STATUS

State status is the legal protection status of a species as determined by the Maryland Department of Natural Resources in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

- E Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.
- T Threatened; a species of flora or fauna that appears likely, within the foreseeable future, to become endangered in the State.
- I In Need of Conservation; an animal species whose population is limited or declining in the State such that it may become threatened in the foreseeable future if current trends or conditions persist.
- X Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.
- * A qualifier denoting the species is listed in a limited geographic area only.

FEDERAL STATUS

Federal Status is the legal protection status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CFR 17.

- LE Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.
- LT Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
- PE Taxa proposed to be listed as endangered.
- PT Taxa proposed to be listed as threatened.
- C Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

ADDITIONAL RESOURCES AND INFORMATION

The U.S. Fish and Wildlife Service's Office of Endangered Species publishes a list of federally-designated threatened and endangered species, as well as those species considered to be candidates for official listing. Copies of the U.S. Department of Interior's booklets, Endangered and Threatened Wildlife and Plants (50 CFR 17.11 & 17.12), can be obtained from the Publication Unit, U.S. Fish and Wildlife Service, Washington, DC 20240 or viewed at <http://www.fws.gov/angered/wildlife.html>. In addition, NatureServe Explorer (<http://www.natureserve.org/explorer/>) provides information on the global, national, and state conservation ranks and statuses of over 70,000 plants and animals.

The Maryland Department of Natural Resources Fisheries Service maintains an official list of game and commercial fish species that are designated as endangered, threatened, or in need of conservation in Maryland. The list of Endangered and Threatened Fish Species (COMAR 08.02.12) can be obtained by contacting the Fisheries Service, Department of Natural Resources, Tawes State Office Building, Annapolis, MD 21401 or by visiting their website at <http://dnr.maryland.gov/fisheries/>.

To obtain additional copies of this report, to receive a copy of "Rare, Threatened, and Endangered Plants of Maryland," or to receive other information on Maryland's rare species and natural areas, please contact the Maryland Natural Heritage Program at the address shown above or visit their website at <http://www.dnr.maryland.gov/wildlife/nhpintro.asp>.

SUBMITTING INFORMATION ON RARE, THREATENED, AND ENDANGERED SPECIES

The Wildlife and Heritage Service is the lead State agency for the identification, ranking, and protection of Maryland's rare species and significant natural areas. Staff biologists obtain information on the biology and status of rare native flora and fauna from various sources, including scientific experts, knowledgeable amateur naturalists, and research projects funded through the Chesapeake Bay and Endangered Species tax check-off. You can take an active part in protecting Maryland's rare species by contacting the Wildlife and Heritage Service with the following types of information:

1. Location (exact mapped location, if possible) and population size/vigor information for any species on the Program's rare, threatened, and endangered species list, including historical information.
2. Data indicating that a species should be assigned a different state rank or status.
3. Nominations of additional rare species to be included on the list or of species that should be deleted from the list, with supporting data.
4. Documentation of threats to any rare species populations, including the species' habitat.
5. Information on the biology or ecology of rare species and references to the species in the literature.
6. Any additional information that would support the protection, conservation, or management of rare species, habitats, or natural communities in Maryland.

If you would like to provide location information for any rare species, please fill out the reporting form found at the web address provided above and mail it to the Wildlife and Heritage Service along with a location map. You can also send an e-mail message to Ross Geredien, Natural Heritage Information Manager, at rgeredien@dnr.state.md.us

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Scientific Name	Common Name	Global Rank	State Rank	State Status	Federal Status
<u>PLANARIANS</u>					
<i>Macrocotyla hoffmasteri</i>	Hoffmaster's Cave Planarian	G3G4	S1	E	
<i>Phagocata virilis</i>	A Planarian	GNR	S1		
<i>Planaria dactyligera</i>	A Planarian	GNR	S2		
<i>Procotyla typhlops</i>	A Planarian	G1G2	S1	E	
<i>Sphalloplana</i> sp. 1	A Planarian	GNR	S1S2		
<u>MOLLUSKS</u>					
<i>Alasmidonta heterodon</i>	Dwarf Wedge Mussel	G1G2	S1	E	LE
<i>Alasmidonta undulata</i>	Triangle Floater	G4	S1	E	
<i>Alasmidonta varicosa</i>	Brook Floater	G3	S1	E	
<i>Anodonta implicata</i>	Alewife Floater	G5	S3		
<i>Discus catskillensis</i>	Angular Disc	G5	S1		
<i>Elliptio fisheriana</i>	Northern Lance	G4	S3		
<i>Elliptio lanceolata</i>	Yellow Lance	G2G3	SU		
<i>Elliptio producta</i>	Atlantic Spike	G3Q	S2	I	
<i>Fontigens bottimeri</i>	Appalachian Spring Snail	G2	S2		
<i>Fontigens orolibas</i>	Blue Ridge Spring Snail	G3	S1	E	
<i>Glyphyalinia raderi</i>	Rader's Snail (Maryland Glyph)*	G2	SH	X	
<i>Hendersonia occulta</i>	Cherrydrop Snail (Cherrystone Drop)*	G4	S2	I	
<i>Lampsilis cariosa</i>	Yellow Lampmussel	G3G4	SU		
<i>Lampsilis radiata</i>	Eastern Lampmussel	G5	SU		
<i>Lasmigona subviridis</i>	Green Floater	G3	S1	E	
<i>Leptodea ochracea</i>	Tidewater Mucket	G3G4	S1S2		
<i>Ligumia nasuta</i>	Eastern Pondmussel	G4	S1S2		
<i>Stenotrema simile</i>	Bear Creek Slitmouth	G2	SU		
<i>Strophitus undulatus</i>	Squawfoot (Creeper)*	G5	S2	I	
<i>Triodopsis picea</i>	Spruce Knob Threetooth	G3	S1		
<i>Utterbackia imbecillis</i>	Paper Pondshell	G5	S3		
<i>Vertigo ventricosa</i>	Five-tooth Vertigo	G5	SU		
<i>Webbhelix multilineata</i>	Striped Whitelip	G5	S1		
<u>CRUSTACEANS</u>					
<i>Ankylocythere tridentata</i>	An Entocytherid Ostracod	GNR	SH		
<i>Attheyella spinipes</i>	A Harpacticoid Copepod	GNR	SU		
<i>Caecidotea franzi</i>	Franz's Cave Isopod	G2G4	S1	E	
<i>Caecidotea mausi</i>	Maus' Isopod	G3	S1	E	
<i>Caecidotea pricei</i>	Price's Cave Isopod	G5	S3		
<i>Caecidotea</i> sp. 1	An Isopod	G1	S1		
<i>Caecidotea</i> sp. 2	An Isopod	GNR	S1		
<i>Caecidotea</i> sp. 4	An Isopod	GNR	S1		
<i>Caecidotea</i> sp. 5	John Friend Cave Isopod	GNR	S1		
<i>Caecidotea</i> sp. 6	An Isopod	GNR	S2		
<i>Cambarus acuminatus</i>	Acuminate Crayfish	G4Q	S3		
<i>Crangonyx dearolfi</i>	Dearolf's Cave Amphipod	G2	S1	E	
<i>Dactylocythere scotos</i>	An Entocytherid Ostracod	GNR	S1		

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Scientific Name	Common Name	Global Rank	State Rank	State Status	Federal Status
<u>CRUSTACEANS (cont.)</u>					
<i>Diacyclops palustris</i>	A Cyclopoid Copepod	GNR	SU		
<i>Orconectes obscurus</i>	A Crayfish	G5	S3		
<i>Stygobromus allegheniensis</i>	Allegheny Cave Amphipod	G5	S2S3	I	
<i>Stygobromus biggersi</i>	Biggers' Cave Amphipod	G2G4	S1	E	
<i>Stygobromus emarginatus</i>	Greenbrier Cave Amphipod	G3	S1	E	
<i>Stygobromus franzi</i>	Franz's Cave Amphipod	G3G4	S2S3	I	
<i>Stygobromus gracilipes</i>	Shenandoah Cave Amphipod	G3G4	S1	E	
<i>Stygobromus indentatus</i>	Tidewater Amphipod	G3	S1		
<i>Stygobromus kenki</i>	Rock Creek Groundwater Amphipod	G2G3	S1	E	
<i>Stygobromus pizzinii</i>	Pizzini's Cave Amphipod	G3G4	S1		
<i>Stygobromus sextarius</i>	A groundwater amphipod	GNR	S1	E	
<i>Stygobromus sp. 5</i>	Barrelville Amphipod	GNR	S1		
<i>Stygobromus sp. 6</i>	Devil's Hole Cave Amphipod	GNR	S1		
<i>Stygobromus sp. 14</i>	Roundtop Amphipod	GNR	S1		
<i>Stygobromus tenuis potomacus</i>	Potomac Stygobromid	G4T4	S3		
<i>Stygobromus tenuis tenuis</i>	Slender Stygobromid	G4T4	SU		
<u>SPIDERS</u>					
<i>Oreonetides s.p. 1</i>	Snivelys Cave Spider	GNR	SU		
<i>Porrhomma cavernicola</i>	Appalachian Cave Spider	G5	S2		
<i>Sphodros rufipes</i>	Red-legged Purse-web Spider	G4	S1S2		
<u>INSECTS</u>					
Collembola					
<i>Arrhopalites sp. 1</i>	Crabtree Cave Springtail	GNR	SU		
Ephemeroptera					
<i>Anthopotamus verticis</i>	Walker's Tusked Sprawler	G5	SU		
Odonata					
<i>Aeshna canadensis</i>	Canada Darner	G5	S2		
<i>Aeshna constricta</i>	Lance-tipped Darner	G5	SH		
<i>Aeshna tuberculifera</i>	Black-tipped Darner	G4	S2		
<i>Aeshna verticalis</i>	Green-striped Darner	G5	S2		
<i>Amphiagrion saucium</i>	Eastern Red Damsel	G5	S3S4		
<i>Anax longipes</i>	Comet Darner	G5	S3		
<i>Archilestes grandis</i>	Great Spreadwing	G5	S3		
<i>Argia bipunctulata</i>	Seepage Dancer	G4	S3		
<i>Argia sedula</i>	Blue-ringed Dancer	G5	S3		
<i>Boyeria grafiana</i>	Ocellated Darner	G5	S1		

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Odonata (cont.)					
<i>Brachymesia gravida</i>	Four-spotted Pennant	G5	S3S4		
<i>Calopteryx amata</i>	Superb Jewelwing	G4	S1S2	T	
<i>Calopteryx angustipennis</i>	Appalachian Jewelwing	G4	S1S2		
<i>Calopteryx dimidiata</i>	Sparkling Jewelwing	G5	S2		
<i>Celithemis fasciata</i>	Banded Pennant	G5	S3		
<i>Celithemis martha</i>	Martha's Pennant	G4	S1		
<i>Celithemis ornata</i>	Faded Pennant	G5	SH		
<i>Celithemis verna</i>	Double-ringed Pennant	G5	S2		
<i>Chromagrion conditum</i>	Aurora Damsel	G5	S3S4		
<i>Cordulegaster bilineata</i>	Brown Spiketail	G5	S3		
<i>Cordulegaster diastatops</i>	Delta-spotted Spiketail	G5	S3S4		
<i>Cordulegaster erronea</i>	Tiger Spiketail	G4	S3		
<i>Cordulegaster obliqua</i>	Arrowhead Spiketail	G4	S2		
<i>Cordulegaster obliqua fasciata</i>	Banded Spiketail	G4T3Q	S1		
<i>Cordulia shurtleffii</i>	American Emerald	G5	S3		
<i>Dorocordulia lepida</i>	Petite Emerald	G5	SH		
<i>Enallagma annexum</i>	Northern Bluet	G5	S1		
<i>Enallagma antennatum</i>	Rainbow Bluet	G5	S1		
<i>Enallagma carunculatum</i>	Tule Bluet	G5	S1		
<i>Enallagma daeckii</i>	Attenuated Bluet	G4	S3		
<i>Enallagma divagans</i>	Turquoise Bluet	G5	S3S4		
<i>Enallagma doubledayi</i>	Atlantic Bluet	G5	S1		
<i>Enallagma dubium</i>	Burgundy Bluet	G5	S1		
<i>Enallagma durum</i>	Big Bluet	G5	S3		
<i>Enallagma ebrium</i>	Marsh Bluet	G5	SH		
<i>Enallagma pallidum</i>	Pale Bluet	G4	S1		
<i>Enallagma traviatum</i>	Slender Bluet	G5	S3		
<i>Enallagma vesperum</i>	Vesper Bluet	G5	S3		
<i>Enallagma weewa</i>	Blackwater Bluet	G5	S2		
<i>Epiheca canis</i>	Beaverpond Baskettail	G5	S3		
<i>Epiheca costalis</i>	Slender Baskettail	G5	S1		
<i>Epiheca semiaquea</i>	Mantled Baskettail	G5	SH		
<i>Epiheca spinosa</i>	Robust Baskettail	G4	S1S2		
<i>Erpetogomphus designatus</i>	Eastern Ringtail	G5	S2		
<i>Erythrodiplax minuscula</i>	Little Blue Dragonlet	G5	S1		
<i>Gomphaeschna antilope</i>	Taper-tailed Darner	G4	S2		
<i>Gomphaeschna furcillata</i>	Harlequin Darner	G5	S3S4		
<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail	G3G4	S1		
<i>Gomphus adelphus</i>	Mustached Clubtail	G4	S1		
<i>Gomphus descriptus</i>	Harpoon Clubtail	G4	S1S2		
<i>Gomphus fraternus</i>	Midland Clubtail	G5	S2		
<i>Gomphus lineatifrons</i>	Splendid Clubtail	G4	S1		
<i>Gomphus parvidens</i>	Piedmont Clubtail	G4	SH	X	
<i>Gomphus quadricolor</i>	Rapids Clubtail	G3G4	S2	I	
<i>Gomphus rogersi</i>	Sable Clubtail	G4	S2	I	
<i>Gomphus ventricosus</i>	Skillet Clubtail	G3	SH	X	
<i>Gomphus viridifrons</i>	Green-faced Clubtail	G3G4	S1		
<i>Helocordulia selysii</i>	Selys' Sunfly	G4	S2	T	

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Odonata (cont.)					
<i>Helocordulia uhleri</i>	Uhler's Sundragon	G5	S3		
<i>Hetaerina titia</i>	Smoky Rubyspot	G5	SH		
<i>Ischnura kellicotti</i>	Lilypad Forktail	G5	S3S4		
<i>Ischnura prognata</i>	Furtive Forktail	G4	S1		
<i>Ladona exusta</i>	White Corporal	G4	S1	E	
<i>Ladona julia</i>	Chalk-fronted Skimmer	G5	S3		
<i>Lanthus parvulus</i>	Northern Pygmy Clubtail	G4	S2		
<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	G4	S2		
<i>Lestes congener</i>	Spotted Spreadwing	G5	S3		
<i>Lestes dryas</i>	Emerald Spreadwing	G5	SH		
<i>Lestes eurinus</i>	Amber-winged Spreadwing	G4	S3		
<i>Lestes forcipatus</i>	Sweetflag Spreadwing	G5	S3		
<i>Lestes unguiculatus</i>	Lyre-tipped Spreadwing	G5	SH		
<i>Leucorrhinia frigida</i>	Frosted Whiteface	G5	S1		
<i>Leucorrhinia glacialis</i>	Crimson-ringed Whiteface	G5	S1		
<i>Leucorrhinia hudsonica</i>	Hudsonian Whiteface	G5	S1		
<i>Leucorrhinia intacta</i>	Dot-tailed Whiteface	G5	S3		
<i>Libellula auripennis</i>	Golden-winged Skimmer	G5	S3		
<i>Libellula axilena</i>	Bar-winged Skimmer	G5	S3		
<i>Libellula flavida</i>	Yellow -sided Skimmer	G5	S2S3		
<i>Macromia alleghaniensis</i>	Allegheny River Cruiser	G4	S2		
<i>Macromia illinoiensis georgina</i>	Georgia River Cruiser	G5T5	S3S4		
<i>Macromia taeniolata</i>	Royal River Cruiser	G5	S3		
<i>Nannothemis bella</i>	Elfin Skimmer	G4	S1	E	
<i>Nasiaeschna pentacantha</i>	Cyrano Darner	G5	S3S4		
<i>Nehalennia gracilis</i>	Sphagnum Sprite	G5	S2		
<i>Nehalennia integricollis</i>	Southern Sprite	G5	S1S2		
<i>Nehalennia irene</i>	Sedge Sprite	G5	S3		
<i>Neurocordulia obsoleta</i>	Umber Shadowdragon	G5	S3		
<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	G5	S3		
<i>Ophiogomphus incurvatus incurvatus</i>	Appalachian Snaketail	G3T2T3	S1	E	
<i>Ophiogomphus mainensis fastigiatus</i>	Maine Snaketail	G4TU	S1		
<i>Ophiogomphus rupinsulensis</i>	Rusty Snaketail	G5	S2		
<i>Ophiogomphus sp. 1</i>	Chesapeake Snaketail	G1	S1		
<i>Progomphus obscurus</i>	Common Sanddragon	G5	S3		
<i>Rhionaeschna mutata</i>	Spatterdock Darner	G4	S1	E	
<i>Somatochlora elongata</i>	Ski-tailed Emerald	G5	S2		
<i>Somatochlora filosa</i>	Fine-lined Emerald	G5	S2		
<i>Somatochlora linearis</i>	Mocha Emerald	G5	S3S4		
<i>Somatochlora provocans</i>	Treetop Emerald	G4	S1	E	
<i>Somatochlora walshii</i>	Brush-tipped Emerald	G5	S1		
<i>Stylurus amnicola</i>	Riverine Clubtail	G4	SH	X	
<i>Stylurus laurae</i>	Laura's Clubtail	G4	S2S3		
<i>Stylurus plagiatus</i>	Russet-tipped Clubtail	G5	S3		
<i>Stylurus scudderi</i>	Zebra Clubtail	G4	S1		
<i>Stylurus spiniceps</i>	Arrow Clubtail	G5	S3		
<i>Sympetrum ambiguum</i>	Blue-faced Meadowhawk	G5	S3S4		
<i>Sympetrum obtusum</i>	White-faced Meadowhawk	G5	S3		

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Odonata (cont.)					
<i>Sympetrum semicinctum</i>	Band-winged Meadowhawk	G5	S3		
<i>Tachopteryx thoreyi</i>	Gray Petaltail	G4	S3		
<i>Telebasis byersi</i>	Duckweed Firetail	G5	S1		
Homoptera					
<i>Chlorotettix</i> sp. 1	A Cicadellid Leafhopper	GNR	SU		
<i>Limotettix minuendus</i>	Eastern Sedge Barrens Planthopper (Eastern Sedge Barrens Leafhopper)*	G1	S1	E	
Coleoptera					
<i>Cicindela abdominalis</i>	A Tiger Beetle	G3G4	S1	E	
<i>Cicindela ancocisconensis</i>	A Tiger Beetle	G3	S1	E	
<i>Cicindela dorsalis dorsalis</i>	Northeastern Beach Tiger Beetle	G4T2	S1	E	LT
<i>Cicindela dorsalis media</i>	White Tiger Beetle	G4T3T4	S1	E	
<i>Cicindela formosa</i>	Big Sand Tiger Beetle	G5	SU		
<i>Cicindela lepida</i>	Little White Tiger Beetle	G3G4	S1	E	
<i>Cicindela patruela</i>	Green-patterned Tiger Beetle	G3	S1	E	
<i>Cicindela puritana</i>	Puritan Tiger Beetle	G1G2	S1S2	E	LT
<i>Cicindela purpurea</i>	Cow Path Tiger Beetle	G5	S3		
<i>Cicindela scutellaris</i>	Festive Tiger Beetle	G5	S3		
<i>Cicindela splendida</i>	Splendid Tiger Beetle	G5	S1		
<i>Cicindela unipunctata</i>	One-spotted Tiger Beetle	G4G5	S3		
<i>Dryobius sexnotatus</i>	Six-banded Longhorn Beetle	GNR	S1	E	
<i>Helops cisteloides</i>	A Tenebrionid Beetle	GNR	S1	E	
<i>Hopierius planatus</i>	A Dytiscid Beetle	GNR	S2		
<i>Hydrochara occultus</i>	A Hydrophilid Beetle	GNR	SU		
<i>Hydrochus spangleri</i>	Seth Forest Water Scavenger Beetle	G1	S1	E	
<i>Hydrocolus deflatus</i>	A predaceous diving beetle	GNR	S?		
<i>Laccophilus schwarzi</i>	Schwarz' Diving Beetle	GNR	SX		
<i>Lucanus elephus</i>	Giant Stag Beetle	G3G5	SU		
<i>Nephus gordonii</i>	A Coccinellid Beetle	GNR	SU		
<i>Nicrophorus americanus</i>	American Burying Beetle	G2G3	SX	X	LE
<i>Pseudanophthalmus</i> sp. 15	Maryland Cave Beetle	G1	S1		
<i>Schoenicus puberulus</i>	A Tenebrionid Beetle	GNR	S1	E	
<i>Sperchopsis tessellatus</i>	A Hydrophilid Beetle	GNR	S2		
Trichoptera					
<i>Hydropsyche brunneipennis</i>	A Scalaris Trichopteran	G3G4	S3		

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Lepidoptera – Butterflies					
<i>Amblyscirtes hegon</i>	Pepper-and-salt Skipper	G4	S2	I	
<i>Atlides halesus</i>	Great Purple Hairstreak	G4G5	S1S2	T	
<i>Autochton cellus</i>	Golden-banded Skipper	G4	SH	X	
<i>Boloria selene</i>	Silver-bordered Fritillary	G5	S3		
<i>Calephelis borealis</i>	Northern Metalmark	G3G4	S2	T	
<i>Callophrys hesseli</i>	Hessel's Hairstreak	G3G4	SH	X	
<i>Callophrys irus</i>	Frosted Elfin	G3	S1	E	
<i>Callophrys polios</i>	Hoary Elfin	G5	S1	E	
<i>Celastrina neglectamajor</i>	Appalachian Blue	G4	S3S4		
<i>Celastrina nigra</i>	Dusky Azure	G4	SH	X	
<i>Chlosyne harrisii</i>	Harris' Checkerspot	G4	S2	T	
<i>Colias interior</i>	Pink-edged Sulphur	G5	S1		
<i>Erora laeta</i>	Early Hairstreak	GU	S1	E	
<i>Erynnis martialis</i>	Mottled Duskywing	G3	S1	E	
<i>Euchloe olympia</i>	Olympia Marble	G4G5	S2	I	
<i>Euphydryas phaeton</i>	Baltimore Checkerspot	G4	S2		
<i>Euphyes bimacula</i>	Two-spotted Skipper	G4	S1	E	
<i>Euphyes dion</i>	Dion Skipper	G4	S3		
<i>Glaucopsyche lygdamus</i>	Silvery Blue	G5	S2	I	
<i>Hermeuptychia sosybius</i>	Carolina Satyr	G5	S1S3		
<i>Hesperia sassacus</i>	Indian Skipper	G4G5	S3		
<i>Lycaena epixanthe</i>	Bog Copper	G4G5	S1	E	
<i>Nymphalis vau-album</i>	Compton Tortoiseshell	G5	S1B	E	
<i>Papilio cresphontes</i>	Giant Swallowtail	G5	S2	I	
<i>Papilio palamedes</i>	Palamedes Sw allowtail	G4	S1	E	
<i>Phyciodes batesii</i>	Tawny Crescent	G4	SH	X	
<i>Pieris virginiensis</i>	West Virginia White	G3G4	S1S2		
<i>Poanes massasoit chermocki</i>	Chermock's Mulberry Wing	G4T1	S1	E	
<i>Polites mystic</i>	Long Dash	G5	S3		
<i>Problema bulenta</i>	Rare Skipper	G2G3	S1	T	
<i>Pyrgus wyandot</i>	Grizzled Skipper	G1G2Q	S1	E	
<i>Satyrrium caryaevorus</i>	Hickory Hairstreak	G4	S1	E	
<i>Satyrrium edwardsii</i>	Edwards' Hairstreak	G4	S1	E	
<i>Satyrrium favonius ontario</i>	Northern Oak hairstreak	G4T4	S1S2	E	
<i>Satyrrium kingi</i>	King's Hairstreak	G3G4	S1	E	
<i>Speyeria atlantis</i>	Atlantis Fritillary	G5	S1	T	
<i>Speyeria idalia</i>	Regal Fritillary	G3	SH	X	

Lepidoptera – Moths

<i>Agnorisma bollii</i>	A Noctuid Moth	G4?	SU		
<i>Apamea apamiformis</i>	A Noctuid Moth	G4	S2S3		
<i>Apamea mixta</i>	A Noctuid Moth	GU	S1		
<i>Apamea plutonia</i>	A Noctuid Moth	G4	SU		
<i>Capis curvata</i>	A Noctuid Moth	G4	S1S2		
<i>Catocala marmorata</i>	Marbled Underwing	G3G4	SH		
<i>Catocala pretiosa pretiosa</i>	Precious Underwing	G4T2	SH		

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Lepidoptera – Moths (cont.)					
Ectoedemia castaneae	American Chestnut Nepticulid Moth	GH	SH		
Ectoedemia phleophaga	Phleophagan Chestnut Nepticulid Moth	GH	SH		
Elaphria georgei	A Noctuid Moth	G4	SU		
Hadena ectypa	A Noctuid Moth	G3G4	SU		
Isoparce cupressi	Cypress Sphinx Moth	G4	S1S2		
Lytrosis sinuosa	Sinuuous Lytrosis	G4	S1S3		
Meropleon titan	A Noctuid Moth	G2G4	S2S4		
Papaipema duovata	Seaside Goldenrod Stem Borer	G4	SU		
Papaipema polymniae	Polymnia Stalk Borer	G4	SH		
Sphinx franckii	Franck's Sphinx	G4	S1S2		
Diptera					
Wyeomyia smithii	Pitcher-plant Mosquito	G5	S2		
FISHES					
Acantharchus pomotis	Mud Sunfish	G5	S2	I	
Acipenser brevirostrum	Shortnose Sturgeon	G3	S1	E	LE
Acipenser oxyrinchus	Atlantic Sturgeon	G3	S1		C
Ameiurus catus	White Catfish	G5	SU		
Amia calva	Bowfin	G5	S1?		
Catostomus catostomus	Longnose Sucker	G5	SH	X	
Centrarchus macropterus	Flier	G5	S1S2	T	
Clinostomus elongatus	Redside Dace	G3G4	SX?		
Cottus bairdii	Mottled Sculpin	G5	S3S4		
Cottus sp. 7	Checkered Sculpin	G4Q	S1S2		
Enneacanthus chaetodon	Blackbanded Sunfish	G4	S1	E	
Enneacanthus gloriosus	Bluespotted Sunfish	G5	S3S4		
Enneacanthus obesus	Banded Sunfish	G5	S2		
Etheostoma fusiforme	Swamp Darter	G5	S2	I	
Etheostoma nigrum	Johnny Darter	G5	S3		
Etheostoma sellare	Maryland Darter	GH	SH	E	LE
Etheostoma vitreum	Glassy Darter	G4G5	S1S2	T	
Fundulus luciae	Spotfin Killifish	G4	S2?		
Lampetra appendix	American Brook Lamprey	G4	S1S2	T	
Lepisosteus osseus	Longnose Gar	G5	S2?		
Lepomis gulosus	Warmouth	G5	S3?		
Luxilus chrysocephalus	Striped Shiner	G5	S1S2	I	
Margariscus margarita	Pearl Dace	G5	S1S2	T	
Notropis amoenus	Comely Shiner	G5	S2	T	
Notropis bifrenatus	Bridle Shiner	G3	SH	X	
Notropis chalybaeus	Ironcolor Shiner	G4	S1	E	
Noturus flavus	Stonecat	G5	S1	E	
Parahinichthys bowersi	Cheat Minnow	G1G2Q	SX	X	
Percina caprodes	Logperch	G5	S1S2	T	

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Scientific Name	Common Name	Global Rank	State Rank	State Status	Federal Status
<u>FISHES (cont.)</u>					
<i>Percina notogramma</i>	Stripeback Darter	G4	S1	E	
<i>Percina peltata</i>	Shield Darter	G5	S3		
<i>Percopsis omiscomaycus</i>	Trout-perch	G5	SX	X	
<i>Salvelinus fontinalis</i>	Brook Trout	G5	S3S4		
<u>AMPHIBIANS</u>					
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	G4	S3		
<i>Ambystoma tigrinum</i>	Eastern Tiger Salamander	G5	S2	E	
<i>Aneides aeneus</i>	Green Salamander	G3G4	S2	E	
<i>Cryptobranchus alleganiensis</i>	Eastern Hellbender	G3G4	S1	E	
<i>Gastrophryne carolinensis</i>	Eastern Narrow-mouthed Toad	G5	S1S2	E	
<i>Hyla gratiosa</i>	Barking Treefrog	G5	S1	E	
<i>Necturus maculosus</i>	Common Mudpuppy	G5	S1	X	
<i>Plethodon wehrlei</i>	Wehrle's Salamander	G4	S2	I	
<i>Pseudacris brachyphona</i>	Mountain Chorus Frog	G5	S1	E	
<i>Rana virgatipes</i>	Carpenter Frog	G5	S3		
<u>REPTILES</u>					
<i>Apalone spinifera</i>	Eastern Spiny Softshell	G5	S1	I	
<i>Caretta caretta</i>	Loggerhead Sea Turtle	G3	S1	T	LT
<i>Cemophora coccinea</i>	Northern Scarletsnake	G5	S3		
<i>Chelonia mydas</i>	Green Sea Turtle	G3	S1N	T	LT
<i>Crotalus horridus</i>	Timber Rattlesnake	G4	S3		
<i>Dermochelys coriacea</i>	Leatherback Sea Turtle	G2	S1	E	LE
<i>Eretmochelys imbricata</i>	Atlantic Hawksbill Sea Turtle	G3	SRN	E	LE
<i>Eumeces anthracinus</i>	Northern Coal Skink	G5	S1	E	
<i>Farancia erythrogramma</i>	Rainbow Snake	G4	S1	E	
<i>Glyptemys muhlenbergii</i>	Bog Turtle	G3	S2	T	LT
<i>Graptemys geographica</i>	Northern Map Turtle	G5	S1	E*	
<i>Lepidochelys kempii</i>	Kemp's Ridley Sea Turtle	G1	S1N	E	LE
<i>Nerodia erythrogaster erythrogaster</i>	Red-bellied Watersnake	G5T5	S2S3		
<i>Pituophis melanoleucus</i>	Northern Pinesnake	G4	SH		
<i>Virginia valeriae pulchra</i>	Mountain Earthsnake	G5T3T4	S1S2	E	
<u>BIRDS</u>					
<i>Accipiter gentilis</i>	Northern Goshawk	G5	S1B	E	
<i>Accipiter striatus</i>	Sharp-shinned Hawk	G5	S1S2B		
<i>Actitis macularius</i>	Spotted Sandpiper	G5	S3S4B		
<i>Aegolius acadicus</i>	Northern Saw-whet Owl	G5	S1B		
<i>Aimophila aestivalis</i>	Bachman's Sparrow	G3	SHB	X	
<i>Ammodramus caudacutus</i>	Saltmarsh Sparrow	G4	S3B		
<i>Ammodramus henslowii</i>	Henslow's Sparrow	G4	S1S2B	T	
<i>Anas discors</i>	Blue-winged Teal	G5	S2B		
<i>Anas strepera</i>	Gadwall	G5	S2B		

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BIRDS (cont.)					
<i>Asio flammeus</i>	Short-eared Owl	G5	S1B	E	
<i>Asio otus</i>	Long-eared Owl	G5	SHB		
<i>Bartramia longicauda</i>	Upland Sandpiper	G5	S1B	E	
<i>Botaurus lentiginosus</i>	American Bittern	G4	S1S2B	I	
<i>Campyphillus principalis</i>	Ivory-billed Woodpecker	G1	SX	X	LE
<i>Caprimulgus vociferus</i>	Whip-poor-will	G5	S3S4B		
<i>Carpodacus purpureus</i>	Purple Finch	G5	S3B		
<i>Catharus guttatus</i>	Hermit Thrush	G5	S3S4B		
<i>Catharus ustulatus</i>	Swainson's Thrush	G5	SXB		
<i>Charadrius melodus</i>	Piping Plover	G3	S1B	E	LT
<i>Charadrius wilsonia</i>	Wilson's Plover	G5	S1B	E	
<i>Chondestes grammacus</i>	Lark Sparrow	G5	SXB	X	
<i>Chordeiles minor</i>	Common Nighthawk	G5	S3S4B		
<i>Circus cyaneus</i>	Northern Harrier	G5	S2B		
<i>Cistothorus platensis</i>	Sedge Wren	G5	S1B	E	
<i>Contopus cooperi</i>	Olive-sided Flycatcher	G4	SHB	E	
<i>Corvus corax</i>	Common Raven	G5	S2		
<i>Dendroica caerulescens</i>	Black-throated Blue Warbler	G5	S3S4B		
<i>Dendroica cerulea</i>	Cerulean Warbler	G4	S3S4B		
<i>Dendroica fusca</i>	Blackburnian Warbler	G5	S1S2B	T	
<i>Dendroica magnolia</i>	Magnolia Warbler	G5	S3S4B		
<i>Egretta caerulea</i>	Little Blue Heron	G5	S3B		
<i>Egretta tricolor</i>	Tricolored Heron	G5	S3B		
<i>Empidonax alhorum</i>	Alder Flycatcher	G5	S2B	I	
<i>Empidonax minimus</i>	Least Flycatcher	G5	S3S4B		
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	G4T4	S2	I	
<i>Gallinula chloropus</i>	Common Moorhen	G5	S2B	I	
<i>Gelochelidon nilotica</i>	Gull-billed Tern	G5	S1B	E	
<i>Haematopus palliatus</i>	American Oystercatcher	G5	S3B		
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G5	S3.1B		
<i>Ixobrychus exilis</i>	Least Bittern	G5	S2S3B	I	
<i>Junco hyemalis</i>	Dark-eyed Junco	G5	S2B		
<i>Lanius ludovicianus</i>	Loggerhead Shrike	G4	S1B	E	
<i>Laterallus jamaicensis</i>	Black Rail	G4	S1	E	
<i>Leucophaeus atricilla</i>	Laughing Gull	G5	S1B		
<i>Limnothlypis swainsonii</i>	Swainson's Warbler	G4	S1B	E	
<i>Lophodytes cucullatus</i>	Hooded Merganser	G5	S1B		
<i>Melospiza georgiana nigrescens</i>	Coastal Plain Swamp Sparrow	G5T3	S2B	I	
<i>Numenius borealis</i>	Eskimo Curlew	GH	SXN	X	LE
<i>Nyctanassa violacea</i>	Yellow-crowned Night-heron	G5	S2B		
<i>Oporornis philadelphia</i>	Mourning Warbler	G5	S1B	E	
<i>Passerculus sandwichensis</i>	Savannah Sparrow	G5	S3S4B		
<i>Pelecanus occidentalis</i>	Brown Pelican	G4	S1B		
<i>Picoides borealis</i>	Red-cockaded Woodpecker	G3	SHB	X	LE
<i>Podilymbus podiceps</i>	Pied-billed Grebe	G5	S2B		
<i>Poocetes gramineus</i>	Vesper Sparrow	G5	S3S4B		
<i>Porzana carolina</i>	Sora	G5	S1B		
<i>Rallus elegans</i>	King Rail	G4	S3S4B		

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<u>BIRDS (cont.)</u>					
<i>Regulus satrapa</i>	Golden-crowned Kinglet	G5	S2B		
<i>Riparia riparia</i>	Bank Swallow	G5	S3S4B		
<i>Rynchops niger</i>	Black Skimmer	G5	S1B	E	
<i>Seiurus noveboracensis</i>	Northern Waterthrush	G5	S2S3B		
<i>Sitta canadensis</i>	Red-breasted Nuthatch	G5	S1B		
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker	G5	SHB		
<i>Spiza americana</i>	Dickcissel	G5	S2B		
<i>Sterna dougallii</i>	Roseate Tern	G4	SHB	X	LE
<i>Sternula antillarum</i>	Least Tern	G4	S2B	T	
<i>Thalasseus maximus</i>	Royal Tern	G5	S1B	E	
<i>Thalasseus sandvicensis</i>	Sandwich Tern	G5	S1B		
<i>Thryomanes bewickii</i>	Bewick's Wren	G5T2Q	S1B	E	
<i>Troglodytes troglodytes</i>	Winter Wren	G5	S2B		
<i>Tympanuchus cupido</i>	Greater Prairie-chicken	G4	SX	X	
<i>Tyto alba</i>	Barn Owl	G5	S3		
<i>Vermivora chrysoptera</i>	Golden-winged Warbler	G4	S3B		
<i>Vermivora ruficapilla</i>	Nashville Warbler	G5	S1S2B	I	
<i>Wilsonia canadensis</i>	Canada Warbler	G5	S3B		
<u>MAMMALS</u>					
<i>Balaenoptera borealis</i>	Sei Whale	G3	SZN	E	LE
<i>Balaenoptera musculus</i>	Blue Whale	G3G4	SZN	E	LE
<i>Balaenoptera physalus</i>	Finback Whale (Fin Whale)*	G3G4	SZN	E	LE
<i>Bos bison</i>	American Bison	G4	SX		
<i>Canis lupus</i>	Gray Wolf	G4	SX	X	LE
<i>Cervus canadensis</i>	American Elk	G5	SX	X	
<i>Condylura cristata parva</i>	Southeastern Star-nosed Mole	G5T4	SU		
<i>Erethizon dorsatum</i>	Porcupine	G5	S1S2	I	
<i>Eubalaeana glacialis</i>	Black Right Whale	G1	SZN	E	LE
<i>Felis (Puma) concolor cougar*</i>	Eastern Mountain Lion (Eastern Cougar)*	G5THQ	SH	X	LE
<i>Lepus americanus</i>	Snowshoe Hare	G5	SH	X	
<i>Lynx rufus</i>	Bobcat	G5	S3	I	
<i>Martes americana</i>	(American) Marten*	G5	SX	X	
<i>Megaptera novaeangliae</i>	Humpback Whale	G3	SZN	E	LE
<i>Microtus chrotorrhinus carolinensis</i>	Southern Rock Vole	G4T3	S1	E	
<i>Mustela nivalis</i>	Least Weasel	G5	S2S3	I	
<i>Myotis leibii</i>	Eastern Small-footed Bat	G3	S1	E	
<i>Myotis sodalis</i>	Indiana Bat	G2	S1	E	LE
<i>Neotoma magister</i>	Allegheny Woodrat	G3G4	S1	E	
<i>Physeter macrocephalus</i>	Sperm Whale	G3G4	SZN	E	LE
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse	G5	SH	X	
<i>Sciurus niger cinereus</i>	Delmarva Fox Squirrel	G5T3	S1	E	LE
<i>Sorex dispar</i>	Long-tailed Shrew	G4	S2	I	
<i>Sorex fumeus</i>	Smoky Shrew	G5	S2S3	I	
<i>Sorex hoyi winnemana</i>	Southern Pygmy Shrew	G5T4	S2		
<i>Sorex longirostris</i>	Southeastern Shrew	G5	S3S4		

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<u>MAMMALS (cont.)</u>					
Sorex palustris punctulatus	Southern Water Shrew	G5T3	S1	E	
Spilogale putorius	Eastern Spotted Skunk	G5	S1		
Sylvilagus obscurus	Appalachian Cottontail	G4	S1	I	
Synaptomys cooperi	Southern Bog Lemming	G5	S3		
Ursus americanus	Black Bear	G5	S3S4		

* Names in parentheses indicate commonly accepted taxonomic nomenclature. Names not in parentheses indicate names used in the Code Of Maryland Regulations (COMAR) 08.03.08.

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CHANGES TO STATE RANKS AND LEGAL STATUSES SINCE LAST PUBLISHED LIST (November 2007)

Scientific Name	Common Name	Current Rank	Former Rank	State Status	Former Status
<u>CRUSTACEANS</u>					
<i>Caecidotea mausi</i>	Maus' Isopod	S1	S1	E	-
<i>Stygobromus kenki</i>	Rock Creek Groundwater Amphipod	S1	NEW	E	NEW
<i>Stygobromus sextarius</i>	A groundwater amphipod	S1	NEW	E	NEW
<u>INSECTS</u>					
Odonata					
<i>Amphiagrion saucium</i>	Eastern Red Damsel	S3S4	S3		
<i>Calopteryx aequabilis</i>	River Jewelwing	SR	S1		
<i>Calopteryx amata</i>	Superb Jewelwing	S1S2	S2	T	-
<i>Calopteryx angustipennis</i>	Appalachian Jewelwing	S1S2	SP		
<i>Calopteryx dimidiata</i>	Sparkling Jewelwing	S2	SH		
<i>Celithemis martha</i>	Martha's Pennant	S1	S2		
<i>Celithemis ornata</i>	Faded Pennant	SH	S1		
<i>Cordulegaster bilineata</i>	Brown Spiketail	S3	S2		
<i>Cordulegaster diastatops</i>	Delta-spotted Spiketail	S3S4	S3		
<i>Cordulegaster erronea</i>	Tiger Spiketail	S3	S2		
<i>Cordulegaster obliqua fasciata</i>	Banded Spiketail	S1	NEW		
<i>Enallagma annexum</i>	Northern Bluet	S1	SU		
<i>Enallagma aspersum</i>	Azure Bluet	S4	S3S4		
<i>Enallagma carunculatum</i>	Tule Bluet	S1	SH		
<i>Enallagma doubledayi</i>	Atlantic Bluet	S1	SH		
<i>Enallagma hageni</i>	Hagen's Bluet	S4	S3S4		
<i>Enallagma sulcatum</i>	Golden Bluet	SNA	SU		
<i>Enallagma weewa</i>	Blackwater Bluet	S2	S1		
<i>Gomphaeschna furcillata</i>	Harlequin Darner	S3S4	S3		
<i>Gomphus abbreviatus</i>	Spine-crowned Clubtail	S1	SH		
<i>Gomphus adelphus</i>	Mustached Clubtail	S1	NEW		
<i>Gomphus descriptus</i>	Harpoon Clubtail	S1S2	S1		
<i>Gomphus lineatifrons</i>	Splendid Clubtail	S1	SH		
<i>Gomphus parvidens</i>	Piedmont Clubtail	SH	SH	X	-
<i>Gomphus quadricolor</i>	Rapids Clubtail	S2	S1	I	-
<i>Gomphus rogersi</i>	Sable Clubtail	S2	S1	I	E
<i>Gomphus spicatus</i>	Dusky Clubtail	SR	SP		
<i>Gomphus vastus</i>	Cobra Clubtail	S4	S3		
<i>Gomphus ventricosus</i>	Skillet Clubtail	SH	SH	X	-
<i>Hetaerina americana</i>	American Rubyspot	S4	S3S4		
<i>Helocordulia selysii</i>	Sely's Sunfly	S2	S2	T	-
<i>Ischnura prognata</i>	Furtive Forktail	S1	SP		
<i>Ladona exusta</i>	White Corporal	S1	S1	E	-

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Odonata (cont.)

<i>Ladona julia</i>	Chalk-fronted Skimmer	S3	S2		
<i>Lanthus parvulus</i>	Northern Pygmy Clubtail	S2	S1		
<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	S2	S1		
<i>Leucorrhinia frigida</i>	Frosted Whiteface	S1	SP		
<i>Libellula flavida</i>	Yellow-sided Skimmer	S2S3	S2		
<i>Nannothemis bella</i>	Elfin Skimmer	S1	S1	E	-
<i>Nasiaeschna pentacantha</i>	Cyrano Darner	S3S4	S3		
<i>Neurocordulia virginienensis</i>	Cinnamon Shadowdragon	SRF	S1		
<i>Neurocordulia yamaskanensis</i>	Stygian Shadowdragon	S3	S2		
<i>Ophiogomphus incurvatus incurvatus</i>	Appalachian Snaketail	S1	SNR	E	-
<i>Ophiogomphus mainensis fastigiatus</i>	Maine Snaketail	S1	NEW		
<i>Ophiogomphus sp. 1</i>	Chesapeake Snaketail	S1	NEW		
<i>Somatochlora elongata</i>	Ski-tailed Emerald	S2	S1		
<i>Somatochlora provocans</i>	Treetop Emerald	S1	S1	E	-
<i>Somatochlora tenebrosa</i>	Clamp-tipped Emerald	S4	S3S4		
<i>Somatochlora walshii</i>	Brush-tipped Emerald	S1	NEW		
<i>Stylogomphus albistylus</i>	Least Clubtail	S4	S3S4		
<i>Stylurus amnicola</i>	Riverine Clubtail	SH	SH	X	-
<i>Stylurus laurae</i>	Laura's Clubtail	S2S3	S2		
<i>Stylurus notatus</i>	Elusive Clubtail	SR	SU		
<i>Tachopteryx thoreyi</i>	Gray Petaltail	S3	S2		
<i>Telebasis byersi</i>	Duckweed Firetail	S1	NEW		

Homoptera

<i>Limotettix minuendus</i>	Eastern Sedge Barrens Planthopper	S1	S1	E	-
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Lepidoptera

<i>Callophrys polios</i>	Hoary Elfin	S1	S1	E	-
<i>Celastrina nigra</i>	Dusky Azure	SH	SH	X	E
<i>Cyclophora nanaria</i>	A Geometrid Moth	SU	S1?		
<i>Erynnis persius persius</i>	Persius Duskywing	SA	SRF		
<i>Euphydryas phaeton</i>	Baltimore Checkerspot	S2	S3		
<i>Hemileuca maia maia</i>	The Buckmoth	S4	SU		
<i>Hesperia attalus slossonae</i>	Dotted Skipper	SA	SH		
<i>Isoparce cupressi</i>	Cypress Sphinx Moth	S1S2	SU		
<i>Meropoleon titan</i>	A Noctuid Moth	S2S4	SU		
<i>Pieris virginienensis</i>	West Virginia White	S1S2	S3		
<i>Schinia parmeliana</i>	A Noctuid Moth	SU	SH		
<i>Synanthedon castaneae</i>	Chestnut Clearwing Moth	SU	SX		
<i>Thorybes confusus</i>	Confused Cloudywing	SA	SU		

FISHES

<i>Notropis bifrenatus</i>	Bridle Shiner	SH	SH	X	E
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BIRDS

<i>Haliaeetus leucocephalus</i>	Bald Eagle	S3.1B	S2S3B	-	T
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APPENDIX II

CROSS REFERENCE OF ANIMAL SYNONYM NAMES

Synonym Name	Current Name
<i>Aeshna mutata</i>	<i>Rhionaeschna mutata</i>
<i>Allocaupnia zekiah</i>	<i>Allocaupnia wrayi</i>
<i>Anodonta cataracta</i>	<i>Pyganodon cataracta</i>
<i>Anodonta imbecillis</i>	<i>Utterbackia imbecillis</i>
<i>Atypus bicolor</i>	<i>Sphodros rufipes</i>
<i>Caecidotea</i> sp. 3	<i>Caecidotea mausi</i>
<i>Cambarus carolinus</i>	<i>Cambarus dubius</i>
<i>Cariniocoris nyssae</i>	<i>Lygocoris nyssae</i>
<i>Celithemis monomelaena</i>	<i>Celithemis fasciata</i>
<i>Cervus elaphus</i>	<i>Cervus canadensis</i>
<i>Clemmys insculpta</i>	<i>Glyptemys insculpta</i>
<i>Clemmys muhlenbergii</i>	<i>Glyptemys muhlenbergii</i>
<i>Elliptio angustata</i>	<i>Elliptio lanceolata</i>
<i>Erythrodiplax connata minuscula</i>	<i>Erythrodiplax minuscula</i>
<i>Fallicambarus uhleri</i>	<i>Fallicambarus fodiens</i>
<i>Felis concolor</i>	<i>Puma concolor</i>
<i>Fixsenia favonius ontario</i>	<i>Satyrium favonius ontario</i>
<i>Fixsenia ontario</i>	<i>Satyrium favonius ontario</i>
<i>Gomphus notatus</i>	<i>Stylurus notatus</i>
<i>Hermeuptychia hermes</i>	<i>Hermeuptychia sosybius</i>
<i>Hydrochus</i> sp. 1	<i>Hydrochus spangleri</i>
<i>Hylogomphus adelphus</i>	<i>Gomphus adelphus</i>
<i>Incisalia irus</i>	<i>Callophrys irus</i>
<i>Larus atricilla</i>	<i>Leucophaeus atricilla</i>
<i>Leptohyphes robacki</i>	<i>Tricorythodes robacki</i>
<i>Libellula exusta</i>	<i>Ladona exusta</i>
<i>Libellula julia</i>	<i>Ladona julia</i>
<i>Lutra canadensis</i>	<i>Lontra canadensis</i>
<i>Macromia georgiana</i>	<i>Macromia illinoiensis georgina</i>
<i>Mesodon sayanus</i>	<i>Appalachina sayana</i>
<i>Mitoura hesseli</i>	<i>Callophrys hesseli</i>
<i>Notropis buccata</i>	<i>Notropis buccatus</i>
<i>Phoca groenlandica</i>	<i>Pagophilus groenlandicus</i>
<i>Phyciodes selenis</i> , <i>P. tharos</i>	<i>Phyciodes cocyta</i>
<i>Physeter catodon</i>	<i>Physeter macrocephalus</i>
<i>Plecotus rafinesquii</i>	<i>Corynorhinus rafinesquii</i>
<i>Porhomma cavernicola</i>	<i>Porrhomma cavernicola</i>
<i>Potamanthus walkeri</i>	<i>Anthopotamus verticis</i>
<i>Pseudemys scripta</i>	<i>Trachemys scripta</i>
<i>Puma concolor cougar</i>	<i>Felis concolor cougar</i>
<i>Satyrium caryaevorum</i>	<i>Satyrium caryaevorus</i>

2010 Rare, Threatened and Endangered Animals of Maryland

APPENDIX II

Synonym Name

Scymnus gordonii
Sphalloplana hoffmasteri
Sterna antillarum
Sterna maxima
Sterna nilotica
Sylvilagus transitionalis
Triodopsis multilineata
Xestia bollii

Current Name

Nephus gordonii
Macrocotyla hoffmasteri
Sternula antillarum
Thalasseus maximus
Gelocheilodon nilotica
Sylvilagus obscurus
Webbhelix multilineata
Agnorisma bollii

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APPENDIX III

ANIMAL SPECIES UNDER REVIEW FOR INCLUSION ON LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK
<u>MOLLUSKS</u>			
Allogona profunda	Broad-banded forestsnail	G5	SU
Appalachina sayana	Spike-lip crater	G4G5	SU
Gastrocopta corticaria	Bark snaggletooth	G4G5	SU
Glyphyalinia picea	Rust glyph	G3	SU
Paravitrea multidentata	Dentate supercoil	G4G5	SU
Stenotrema stenotrema	Inland slitmouth	G5	SU
Vertigo gouldi	Variable vertigo	G4G5	SU
Vitrina angelicae	Eastern glass-snail	G?	SU
<u>CRUSTACEANS</u>			
Eulimnadia diversa	A clam shrimp	G5	SU
<u>INSECTS</u>			
Ephemeroptera			
Paraleptophlebia assimilis	A mayfly	G3	S?
Tricorythodes robacki	A mayfly	G3	S?
Plecoptera			
Alloperla biserrata	A stonefly	G3	S?
Allocapnia wrayi	A plecopteran	G5	S?
Heteroptera			
Chinaola quercicola	A microphysid bug	G?	S?
Hesperophylum heidemanni	A plant bug	G?	S?
Lygocoris nyssae	A mirid bug	G?	S?
Coleoptera			
Cyphon sp. 1	A water beetle	G?	S?
Lepidoptera – Butterflies			
Atrytone logan	Delaware skipper	G5	S4
Atrytonopsis hianna	Dusted skipper	G4G5	S4
Chlosyne nycteis	Silvery checkerspot	G5	S4
Hesperia leonardus	Leonard's skipper	G4	S4
Hesperia metea	Cobweb skipper	G4G5	S3
Polygonia progne	Gray comma	G5	S1S3

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APPENDIX III

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK
Lepidoptera – Moths			
Anacamptodes pergracilis	A geometrid moth	G?	S?
Anisota stigma	Spiny oakworm	G5	S4
Anomogyna elimata	Southern variable dart moth	G5	S5
Argyrostroma quadrifilaris	Four-lined chocolate moth	G4	S?
Artace cribraria	A lasiocampid moth	G5	S5
Caripeta aretaria	A moth	G4	S4
Cisthene packardii	Packard's lichen moth	G5	S5
Cyclophora nanaria	A Geometrid Moth	G5	SU
Dasychira atrivenosa	A Lyamntrid Moth	G4	SU
Erastria coloraria	Broad-lined catopyrrha	G4	SH
Euxoa immixta	A noctuid moth	G4	S?
Hemeroplanis scopulepes	Variable tropic moth	G5	S?
Holomelina immaculata	Plain-winged holomelina	G?	S?
Holomelina laeta	Joyful holomelina moth	G5	S1?
Hypagyrtis esther	Esther moth	G5	S5
Idaea eremiata	A geometrid moth	G4	S1?
Lagoa crispata	Black-waved flannel moth	G5	SU
Lithophane lemmeri	Lemmer's noctuid moth	G3G4	S?
Macrochilo hypocritalis	A noctuid moth	G4	S4?
Metaxaglaea semitaria	Footpath sawfly moth	G5	S4
Pachypolia atricornis	Three-horned moth	G3G4	SH
Papaipema araliae	Aralia shoot borer moth	G3G4	S?
Papaipema marginidens	A borer moth	G4	S4
Parapema buffaloensis	A noctuid moth	G?	S?
Ptichodis bistrigata	Southern ptichodis	G3	S?
Ptichodis herbarum	Common ptichodis	G4	S?
Renia nemoralis	A noctuid moth	G4	S1S3
Rhodoecia aurantiago	Aureolaria seed borer	G4	S?
Semiothisa aequiferaria	A geometrid moth	G?	S?
Xylotype capax	Barrens xylotype	G4	SU
Zale curema	A noctuid moth	G3G4	S1?
Zale squamularis	A noctuid moth	G4	SU
Zale submediana	A noctuid moth	G4	S1S3
Zanclognatha martha	Pine Barrens zanclognatha	G4	S1S3
Diptera			
Wyeomyia haynei	A mosquito	G4	S?
AMPHIBIANS			
Pseudotriton montanus	Mud salamander	G5	S2?
REPTILES			
Clemmys insculpta	Wood turtle	G4	S4
Elaphe guttata	Corn snake	G5	S4
Eumeces laticeps	Broadhead skink	G5	S4
Regina septemvittata	Queen snake	G5	S5
Thamnophis sauritus	Eastern ribbon snake	G5	S5

2010 Rare, Threatened and Endangered Animals of Maryland

APPENDIX IV

ANIMAL SPECIES REPORTED, FALSELY REPORTED, POTENTIALLY OCCURRING, OR ACCIDENTAL IN MARYLAND

The following species do not regularly occur in Maryland as resident or breeding populations based on currently available information. Although not exhaustive, the list is included to provide clarification for those species whose rank in Maryland may be unclear due to conflicting reports or vague published accounts. For those species with a rank of SR, only unverified reports exist. Species with a rank of SRF have been falsely reported, and the error may persist in the literature. For those species ranked SA, only accidental, vagrant or highly irregular records exist, and there is no evidence of regularly occurring resident or breeding populations in the state. The list is also provided to bring attention to those species that potentially occur in Maryland (SP) and, if documented, their presence could have significant conservation value.

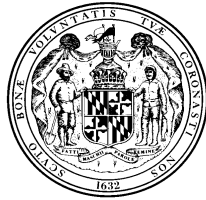
SCIENTIFIC NAME	COMMON NAME	STATE RANK
<u>MOLLUSKS</u>		
<i>Alasmidonta marginata</i>	Elktoe	SRF
<u>CRUSTACEANS</u>		
<i>Caecidotea holsingeri</i>	Holsinger's Cave Isopod	SRF
<u>INSECTS</u>		
Odonata		
<i>Calopteryx aequabilis</i>	River Jewelwing	SR
<i>Dromogomphus spoliatus</i>	Flag-tailed Spinyleg	SA
<i>Gomphus graslinellus</i>	Pronghorn Clubtail	SA
<i>Gomphus spicatus</i>	Dusky Clubtail	SR
<i>Miathyria marcella</i>	Greater Hyacinth Glider	SA
<i>Neurocordulia virginienensis</i>	Cinnamon Shadowdragon	SRF
<i>Orthemis ferruginea</i>	Roseate Skimmer	SA
<i>Stylurus notatus</i>	Elusive Clubtail	SR
<i>Sympetrum internum</i>	Cherry-faced Meadowhawk	SR
<i>Tamea calverti</i>	Striped Saddlebags	SA
<i>Tamea onusta</i>	Red-mantled Saddlebags	SA
Coleoptera		
<i>Cicindela marginipennis</i>	Cobblestone Tiger Beetle	SP
<i>Photuris bethaniensis</i>	A Lampyrid Firefly	SP
Lepidoptera - Butterflies		
<i>Calephelis virginienensis</i>	Little Metalmark	SR
<i>Cyllopsis gemma</i>	Gemmed Satyr	SR
<i>Erynnis persius persius</i>	Persius Duskywing	SA

2010 Rare, Threatened and Endangered Animals of Maryland

APPENDIX IV

SCIENTIFIC NAME	COMMON NAME	STATE RANK
Lepidoptera – Butterflies (cont.)		
<i>Euphyes pilatka</i>	Palatka Skipper	SA
<i>Hesperia attalus slossonae</i>	Dotted Skipper	SA
<i>Neonympha mitchellii</i>	Mitchell's Satyr	SR
<i>Phoebis agarithe</i>	Large Orange Sulphur	SA
<i>Phyciodes cocyta</i>	Northern Crescent	SP
<i>Satyrium acadica</i>	Acadian Hairstreak	SA
<i>Thorybes confusus</i>	Confused Cloudywing	SA
<u>FISHES</u>		
<i>Cottus cognatus</i>	Slimy Sculpin	SRF
<u>AMPHIBIANS</u>		
<i>Siren lacertina</i>	Greater Siren	SRF
<u>MAMMALS</u>		
<i>Corynorhinus rafinesquii</i>	Rafinesque's Big-eared Bat	SP
<i>Glaucomys sabrinus fuscus</i>	Virginia Northern Flying Squirrel	SP
<i>Halichoerus grypus</i>	Gray Seal	SA
<i>Mustela erminea</i>	Ermine	SR
<i>Myotis austroriparius</i>	Southeastern Myotis	SP
<i>Pagophilus groenlandicus</i>	Harp Seal	SA
<i>Phoca vitulina</i>	Harbor Seal	SA
<i>Pseudorca crassidens</i>	False Killer Whale	SR
<i>Trichechus manatus</i>	Manatee	SA

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Rare, Threatened, and Endangered Plants of Maryland

April 2010



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RARE, THREATENED, AND ENDANGERED PLANTS OF MARYLAND

April 5, 2010

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INTRODUCTION

The following report identifies those native Maryland plants that are among the rarest and most in need of conservation efforts as elements of our State's natural diversity. It includes species occurring in Maryland that are listed or that are candidates for listing on the Federal list of Endangered and Threatened Wildlife and Plants, species currently on the State's Threatened and Endangered Species List, and additional species that are considered rare by the Maryland Wildlife and Heritage Service. The purpose of this report is to inform the public of which species are rare, to provide an indication of their degree of rarity, to solicit additional information on the status and distribution of these species, and to promote an interest in their protection.

Compiled by Wildlife and Heritage Service staff, this list of rare species is a result of 30 years of data gathering from numerous sources, such as herbaria and private collections, scientific literature, unpublished documents, reports from botanists and amateur naturalists, and field work conducted by scientists from the Department of Natural Resources (DNR). The original version of this list was included in the Department of Natural Resources' 1984 publication Threatened and Endangered Plants and Animals of Maryland, which also contained detailed information on the distribution and status of Maryland's rare species known at that time.

Since 1984, our knowledge of Maryland's flora has grown steadily. Through extensive field work, Wildlife and Heritage Service biologists and other researchers have located species which were previously unrecorded for the State and have discovered that some species are scarcer than previously known. Similarly, some species are now known to be either more widespread or less vulnerable to ecological disturbances than previously believed. Thus, the list and status of each species is periodically revised to keep pace with new information.

The official State Threatened and Endangered Species List is part of the State Threatened and Endangered Species regulations (COMAR 08.03.08). Wildlife and Heritage Service biologists are concerned with many more species than those included on the State's Threatened and Endangered Species List. Some of these species are potential candidates for listing and usually require further investigation into their rarity and endangerment status. Others are thought to be secure at present, but are worthy of attention because of limited distributions, declining populations, or ecological vulnerabilities.

ABOUT THIS LIST

The list of rare, threatened, and endangered plants is arranged alphabetically by scientific name. Four columns are printed to the right of each name. The global and state rarity ranks of each species are included in the first and second columns, respectively. The third column indicates the species' status on the State Threatened and Endangered Species List. The last column shows the Federal status of each species as determined by the U.S. Fish and Wildlife Service. Definitions for the codes used in all four columns are provided below. At the end of the list is a series of four Appendices. **Appendix I** contains a summary of the changes to state ranks and statuses since the last time this list was published. Because taxonomists periodically update scientific names, a partial list of synonym names is included as a cross reference in **Appendix II**. The names used in this publication might not reflect the most recently published taxonomic changes or standards. Species currently under consideration for inclusion on the list appear in **Appendix III**. **Appendix IV** contains a list of species with unusual, non-standard ranks and has been provided to clarify their current conservation status in Maryland. Natural Heritage Program biologists welcome any information on the status and location of the species in Appendices III and IV from all interested parties.

EXPLANATION OF SPECIES RANK AND STATUS CODES

GLOBAL AND STATE RANKS

The global and state ranking system is used by all 50 state Natural Heritage Programs and numerous Conservation Data Centers in other countries in this hemisphere. Because they are assigned based upon standard criteria, the ranks can be used to assess the range-wide status of a species, as well as the status within portions of the species' range. The primary criterion used to define these ranks is the number of known distinct occurrences with consideration given to the total number of individuals at each locality. Additional factors considered include the current level of protection, the types and degree of threats, ecological vulnerability, and population trends. Global and state ranks are used in combination to set inventory, protection, and management priorities for species both at the state as well as regional level.

GLOBAL RANK

- G1 Highly globally rare. Critically imperiled globally because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
- G2 Globally rare. Imperiled globally because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
- G3 Either very rare and local throughout its range or distributed locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; typically with 21 to 100 estimated occurrences.
- G4 Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.
- G5 Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery.
- GH No known extant occurrences (i.e., formerly part of the established biota, with the expectation that it may be rediscovered).
- GU Possibly in peril range-wide, but its status is uncertain; more information is needed.
- GX Believed to be extinct throughout its range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.
- G? The species has not yet been ranked.
- _Q Species containing a "Q" in the rank indicates that the taxon is of questionable or uncertain taxonomic standing (i.e., some taxonomists regard it as a full species, while others treat it at an infraspecific level).
- _T Ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species.

STATE RANK

- S1 Highly State rare. Critically imperiled in Maryland because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres in the State) or because of some factor(s) making it especially vulnerable to extirpation. Species with this rank are actively tracked by the Wildlife and Heritage Service.
- S2 State rare. Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated. Species with this rank are actively tracked by the Wildlife and Heritage Service.
- S3 Watch List. Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Species with this rank are not actively tracked by the Wildlife and Heritage Service.
- S3.1 A "Watch List" species that is actively tracked by the Wildlife and Heritage Service because of the global significance of Maryland occurrences. For instance, a G3 S3 species is globally rare to uncommon, and although it may not be currently threatened with extirpation in Maryland, its occurrences in Maryland may be critical to the long term security of the species. Therefore, its status in the State is being monitored.
- S4 Apparently secure in Maryland with typically more than 100 occurrences in the State or may have fewer occurrences if they contain large numbers of individuals. It is apparently secure under present conditions, although it may be restricted to only a portion of the State.
- S5 Demonstrably secure in Maryland under present conditions.
- SA Accidental in Maryland.
- SE Established, but not native to Maryland; it may be native elsewhere in North America.
- SH Historically known from Maryland, but not verified for an extended period (usually 20 or more years), with the expectation that it may be rediscovered.
- SNA Species is not a suitable conservation target
- SP Potentially occurring in Maryland or likely to have occurred in Maryland (but without persuasive documentation).
- SR Reported from Maryland, but without persuasive documentation that would provide a basis for either accepting or rejecting the report (e.g., no voucher specimen exists).
- SRF Reported falsely (in error) from Maryland, and the error may persist in the literature.
- SU Possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the State. Uncertainty spans a range of 4 or 5 ranks as defined above.
- SX Believed to be extirpated in Maryland with virtually no chance of rediscovery.
- S? The species has not yet been ranked.

STATE STATUS

State status is the legal protection status of a species as determined by the Maryland Department of Natural Resources in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

- E Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.
- T Threatened; a species of flora or fauna that appears likely, within the foreseeable future, to become endangered in the State.
- X Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.
- * A qualifier denoting the species is listed in a limited geographic area only.

FEDERAL STATUS

Federal Status is the legal protection status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CFR 17.

- LE Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.
- LT Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
- PE Taxa proposed to be listed as endangered.
- PT Taxa proposed to be listed as threatened.
- C Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

ADDITIONAL RESOURCES AND INFORMATION

The U.S. Fish and Wildlife Service's Office of Endangered Species publishes a list of federally-designated threatened and endangered species, as well as those species considered to be candidates for official listing. Copies of the U.S. Department of Interior's booklets, Endangered and Threatened Wildlife and Plants and Plant Taxa for Listing as Endangered or Threatened Species: Notice of Review (reprinted from the Federal Register) can be obtained from the Publication Unit, U.S. Fish and Wildlife Service, Washington, DC 20240 or viewed at <http://www.fws.gov/endangered/wildlife.html>.

To obtain additional copies of this report, to receive a copy of "Rare, Threatened, and Endangered Animals of Maryland," or to receive other information on Maryland's rare species and natural areas, please contact the Maryland Wildlife and Heritage Service at the address shown above or visit their website at <http://www.dnr.maryland.gov/wildlife/nhpintro.asp>.

There are several online resources for plant taxonomy, which include comprehensive databases of taxonomic synonymy, scientific names, common names, and plant distribution. The USDA Plants Database (<http://plants.usda.gov/>) includes a general search of plant taxonomy, habitat, and distribution. The Biota of North American Program (<http://www.bonap.org/synth.html>) includes a link to The Synthesis of North American Flora, a database developed by Dr. John Kartesz that shows county-level distribution maps. NatureServe Explorer (<http://www.natureserve.org/explorer/>) provides information on the global, national, and state conservation ranks and statuses of over 70,000 plants and animals.

SUBMITTING INFORMATION ON RARE, THREATENED, AND ENDANGERED SPECIES

The Wildlife and Heritage Service is the lead State agency for the identification, ranking, and protection of Maryland's rare species and significant natural areas. Staff biologists obtain information on the biology and status of rare native flora and fauna from various sources, including scientific experts, knowledgeable amateur naturalists, and research projects funded through the Chesapeake Bay and Endangered Species tax check-off. You can take an active part in protecting Maryland's rare species by contacting the Wildlife and Heritage Service with the following types of information:

1. Location (exact mapped location, if possible) and population size/vigor information for any species on the Program's rare, threatened, and endangered species list, including historical information.
2. Data indicating that a species should be assigned a different state rank or status.
3. Nominations of additional rare species to be included on the list or of species that should be deleted from the list, with supporting data.
4. Documentation of threats to any rare species populations, including the species' habitat.
5. Information on the biology or ecology of rare species and references to the species in the literature.
6. Any additional information that would support the protection, conservation, or management of rare species, habitats, or natural communities in Maryland.

If you would like to provide location information for any rare species, please fill out the reporting form found at the web address provided above and mail it to the Wildlife and Heritage Service along with a location map. You can also send an e-mail message to Ross Geredien, Natural Heritage Information Manager, at rgeredien@dnr.state.md.us

2010 Rare, Threatened and Endangered Plants of Maryland

SCIENTIFIC NAME	COMMON NAME	Global Rank	State Rank	State Status	Federal Status
<i>Abies balsamea</i>	Balsam Fir	G5	S1		
<i>Aconitum uncinatum</i>	Blue Monkshood	G4	S1	E	
<i>Actaea podocarpa</i>	American Bugbane	G4	S2		
<i>Adlumia fungosa</i>	Climbing Fumitory	G4	S2	T	
<i>Aeschynomene virginica</i>	Sensitive Joint-vetch	G2	S1	E	LT
<i>Agalinis acuta</i>	Sandplain Gerardia	G1	S1	E	LE
<i>Agalinis auriculata</i>	Auricled Gerardia	G3	S1	E	
<i>Agalinis fasciculata</i>	Fascicled Gerardia	G5	SH		
<i>Agalinis obtusifolia</i>	Blunt-leaved Gerardia	G4G5Q	S1	E	
<i>Agalinis setacea</i>	Thread-leaved Gerardia	G5?	S1	E	
<i>Agalinis skinneriana</i>	Midwestern Gerardia	G3G4	S1	E	
<i>Agastache scrophulariifolia</i>	Purple Giant Hyssop	G4	S1S2	T	
<i>Agrimonia microcarpa</i>	Small-fruited Agrimony	G5	SU		
<i>Agrimonia striata</i>	Woodland Agrimony	G5	S1	E	
<i>Aletris aurea</i>	Golden Colicroot	G5	SH	X	
<i>Alnus maritima</i>	Seaside Alder	G3	S3.1		
<i>Amaranthus pumilus</i>	Seabeach Amaranth	G2	S1	E	LT
<i>Amelanchier humilis</i>	Running Serviceberry	G5	S1	T	
<i>Amelanchier nantucketensis</i>	Nantucket Shadbush	G3Q	S1	T	
<i>Amelanchier sanguinea</i>	Round-leaf Serviceberry	G5	S1	E	
<i>Amelanchier stolonifera</i>	Running Juneberry	G5	S2		
<i>Amianthium muscitoxicum</i>	Fly-poison	G4G5	S2?		
<i>Ammannia coccinea</i>	Scarlet Ammannia	G5	SU		
<i>Ammannia latifolia</i>	Koehne's Ammannia	G5	S2		
<i>Ampelopsis arborea</i>	Pepper-vine	G5	SU		
<i>Ampelopsis cordata</i>	Heartleaf Peppervine	G5	SU		
<i>Amphicarpum purshii</i>	Pursh's Amphicarpum	G4	S3		
<i>Anagallis minima</i>	Chaffweed	G5	SU	X	
<i>Anaphalis margaritacea</i>	Pearly Everlasting	G5	S3		
<i>Anemone canadensis</i>	Canada Anemone	G5	SH	X	
<i>Anemone lancifolia</i>	Mountain Thimble-weed	G5	SU		
<i>Angelica atropurpurea</i>	Great Angelica	G5	SH	X	
<i>Angelica triquinata</i>	Filmy Angelica	G4	S1	E	
<i>Antennaria solitaria</i>	Single-headed Pussytoes	G5	S2	T	
<i>Arabis glabra</i>	Tower Mustard	G5	SU		
<i>Arabis hirsuta</i>	Hairy Rockcress	G5	SU		
<i>Arabis missouriensis</i>	Missouri Rockcress	G5?Q	S1	E	
<i>Arabis patens</i>	Spreading Rockcress	G3	S3		
<i>Arabis shortii</i>	Short's Rockcress	G5	S3		
<i>Aralia hispida</i>	Bristly Sarsaparilla	G5	S1	E	
<i>Arctostaphylos uva-ursi</i>	Bearberry	G5	S1	E	
<i>Arethusa bulbosa</i>	Arethusa	G4	SH	X	
<i>Aristida lanosa</i>	Woolly Three-awn	G5	S1	E	
<i>Aristida tuberculosa</i>	Sea-beach Three-awn	G5	S1		
<i>Aristida virgata</i>	Wire Grass	G5	S1	E	
<i>Aristolochia macrophylla</i>	Pipevine	G5	S1	T	
<i>Armoracia lacustris</i>	Lake Cress	G4?	S1	E	
<i>Arnica acaulis</i>	Leopard's-bane	G4	S1	E	
<i>Arundinaria gigantea</i>	Giant Cane	G5	S2		

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<i>Asclepias lanceolata</i>	Smooth Orange Milkweed	G5	SU		
<i>Asclepias purpurascens</i>	Purple Milkweed	G5?	SU		
<i>Asclepias rubra</i>	Red Milkweed	G4G5	S1	E	
<i>Asclepias verticillata</i>	Whorled Milkweed	G5	S3		
<i>Asplenium bradleyi</i>	Bradley's Spleenwort	G4	SH	X	
<i>Asplenium pinnatifidum</i>	Lobed Spleenwort	G4	S1	E	
<i>Asplenium resiliens</i>	Black-stem Spleenwort	G5	S1	E	
<i>Asplenium ruta-muraria</i>	Wall-rue	G5	S3		
<i>Astilbe biternata</i>	False Goat's-beard	G4G5	S?		
<i>Astragalus canadensis</i>	Canada Milkvetch	G5	S1	E	
<i>Astragalus distortus</i>	Bent Milkvetch	G5	S2	T	
<i>Atriplex arenaria</i>	Sea-beach Orach	G5	S3		
<i>Aureolaria flava</i>	Smooth False Foxglove	G5	S3		
<i>Aureolaria laevigata</i>	Downy Yellow Foxglove	G5	SU		
<i>Axonopus furcatus</i>	Big Carpet Grass	G5	S2?		
<i>Bacopa innominata</i>	Mat-forming Water-hyssop	G3G5	SH	X	
<i>Bacopa monnieri</i>	Coastal Water-hyssop	G5?	SU		
<i>Baptisia australis</i>	Wild False Indigo	G5	S2	T	
<i>Bartonia paniculata</i>	Twining Bartonia	G5	S3		
<i>Berberis canadensis</i>	American Barberry	G3	SH	X	
<i>Betula populifolia</i>	Gray Birch	G5	SU		
<i>Bidens bidentoides</i> var. <i>mariana</i>	Maryland Bur-marigold	G3T3	S3.1		
<i>Bidens coronata</i>	Tickseed Sunflower	G5	S2S3		
<i>Bidens mitis</i>	Small-fruited Beggar-ticks	G4?	S1	E	
<i>Blephilia ciliata</i>	Downy Woodmint	G5	S3		
<i>Blephilia hirsuta</i>	Hairy Woodmint	G5?	S2		
<i>Boltonia asteroides</i>	Aster-like Boltonia	G5	S1	E	
<i>Borrichia frutescens</i>	Sea Ox-eye	G5TNR	SH	X	
<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>	Triangle Grape-fern	G5	SH	X	
<i>Botrychium matricariifolium</i>	Matricary Grape-fern	G5	SU		
<i>Botrychium multifidum</i>	Leathery Grape-fern	G5	SH	X	
<i>Botrychium oneidense</i>	Blunt-lobe Grape-fern	G4Q	S1	E	
<i>Botrychium simplex</i>	Small Grape-fern	G5	SH	X	
<i>Bouteloua curtipendula</i>	Side-oats Grama	G5	S2		
<i>Bromus ciliatus</i>	Fringed Brome	G5	S1?		
<i>Bromus kalmii</i>	Wild Chess	G5	S1	E	
<i>Bromus latiglumis</i>	Broad-glumed Brome	G5	S1	E	
<i>Bromus nottowanus</i>	Nottoway's Brome	G3G5	S1S2		
<i>Buchnera americana</i>	Blue-hearts	G5?	SH	X	
<i>Cacalia muehlenbergii</i>	Great Indian-plantain	G4	SH	X	
<i>Calamagrostis porteri</i>	Porter's Reedgrass	G4	S1	E	
<i>Calla palustris</i>	Wild Calla	G5	S1	E	
<i>Callicarpa americana</i>	French Mulberry	G5	SH	X	
<i>Calopogon tuberosus</i>	Grass-pink	G5	S1	E	
<i>Calystegia spithamea</i>	Low Bindweed	G4G5	S2		
<i>Campanula divaricata</i>	Southern Harebell	G4	SU	X	
<i>Campanula rotundifolia</i>	Harebell	G5	S2		
<i>Cardamine douglassii</i>	Purple Cress	G5	S3		
<i>Cardamine longii</i>	Long's Bittercress	G3	S1	E	
<i>Cardamine pratensis</i>	Cuckooflower	G5	S1		

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<i>Cardamine rotundifolia</i>	Mountain Watercress	G4	S3		
<i>Carex aestivalis</i>	Summer Sedge	G4	S1	E	
<i>Carex albursina</i>	A Sedge	G5	S3		
<i>Carex appalachica</i>	Appalachian Sedge	G4	S1?		
<i>Carex aquatilis</i>	Water Sedge	G5	S1		
<i>Carex argyrantha</i>	Hay Sedge	G5	S3		
<i>Carex barrattii</i>	Barratt's Sedge	G4	S3		
<i>Carex brevior</i>	Fescue Sedge	G5?	S2?		
<i>Carex brunnescens</i>	Brownish Sedge	G5	S3		
<i>Carex bullata</i>	Button Sedge	G5	S3		
<i>Carex buxbaumii</i>	Buxbaum's Sedge	G5	S2	T	
<i>Carex careyana</i>	Carey's Sedge	G4G5	S1	E	
<i>Carex cephaloidea</i>	Thin-leaved Sedge	G5	SH		
<i>Carex conoidea</i>	Field Sedge	G5	S1	E	
<i>Carex cristatella</i>	Crested Sedge	G5	S1?		
<i>Carex davisii</i>	Davis' Sedge	G4	S1	E	
<i>Carex decomposita</i>	Cypress-knee Sedge	G3	S1	E	
<i>Carex diandra</i>	Lesser Panicked Sedge	G5	S1	E	
<i>Carex digitalis</i> var. <i>macropoda</i>	A Carex	G5TNR	S1?		
<i>Carex eburnea</i>	Ebony Sedge	G5	S1	E	
<i>Carex echinata</i>	Little Prickly Sedge	G5	S3		
<i>Carex emoryi</i>	Emory's Sedge	G5	S3		
<i>Carex exilis</i>	Coast Sedge	G5	S1	E	
<i>Carex gigantea</i>	Giant Sedge	G4	S3		
<i>Carex glaucescens</i>	A Sedge	G4	S1	E	
<i>Carex haydenii</i>	Cloud Sedge	G5	S1	E	
<i>Carex hirtifolia</i>	Pubescent Sedge	G5	S3		
<i>Carex hitchcockiana</i>	Hitchcock's Sedge	G5	S1	E	
<i>Carex hyalinolepis</i>	Shoreline Sedge	G4G5	S2S3		
<i>Carex hystericina</i>	Porcupine Sedge	G5	S1	E	
<i>Carex interior</i>	Inland Sedge	G5	S1		
<i>Carex jorii</i>	Cypress-swamp Sedge	G4G5	S3		
<i>Carex lacustris</i>	Lake-bank Sedge	G5	S2		
<i>Carex lasiocarpa</i>	Hairy-fruited Sedge	G5	S1	E	
<i>Carex laxiculmis</i> var. <i>copulata</i>	Spreading Sedge	G5T3T5	S1?		
<i>Carex louisianica</i>	Louisiana Sedge	G5	S3		
<i>Carex lucorum</i>	A Sedge	G4	S1		
<i>Carex lupuliformis</i>	Hop-like Sedge	G4	S2		
<i>Carex meadii</i>	Mead's Sedge	G4G5	S1	E	
<i>Carex mitchelliana</i>	Mitchell's Sedge	G4	S2		
<i>Carex molesta</i>	Troublesome Sedge	G4	S1?		
<i>Carex pedunculata</i>	Long-stalked Sedge	G5	S1	E	
<i>Carex pellita</i>	Woolly Sedge	G5	S2?		
<i>Carex planispicata</i>	A Sedge	G4Q	S1S2		
<i>Carex plantaginea</i>	Plantain-leaved Sedge	G5	S1?		
<i>Carex polymorpha</i>	Variable Sedge	G3	SH	X	
<i>Carex projecta</i>	Necklace Sedge	G5	S2		
<i>Carex richardsonii</i>	Richardson's Sedge	G4	S1	E	
<i>Carex sartwellii</i>	Sartwell Sedge	G4G5	SH		
<i>Carex shortiana</i>	Short's Sedge	G5	S2	E	

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<i>Carex silicea</i>	Sea-beach Sedge	G5	S1	E	
<i>Carex sparganioides</i>	Burr-reed Sedge	G5	S1S2		
<i>Carex straminea</i>	Straw Sedge	G5	S1S2		
<i>Carex striatula</i>	Lined Sedge	G4G5	S3		
<i>Carex tenera</i>	Slender Sedge	G5	SH	X	
<i>Carex tetanica</i>	Rigid Sedge	G4G5	SH	X	
<i>Carex trichocarpa</i>	Hairy-fruited Sedge	G4	S2		
<i>Carex tuckermanii</i>	Tuckerman Sedge	G4	S1	E	
<i>Carex venusta</i>	Dark Green Sedge	G4	S2	T	
<i>Carex vesicaria</i>	Inflated Sedge	G5	S1	T	
<i>Carex vestita</i>	Velvety Sedge	G5	S2	T	
<i>Carya laciniosa</i>	Big Shellbark Hickory	G5	S1	E	
<i>Cassia marilandica</i>	Maryland Senna	G5	S3		
<i>Castanea dentata</i>	American Chestnut	G4	S2S3		
<i>Castilleja coccinea</i>	Indian Paintbrush	G5	S1	E	
<i>Celtis laevigata</i>	Sugarberry	G5	SU		
<i>Centella erecta</i>	Coinleaf	G5	S3		
<i>Centrosema virginianum</i>	Spurred Butterfly-pea	G5	S2		
<i>Ceratophyllum echinatum</i>	Prickly Hornwort	G4?	S1	E	
<i>Chamaecrista fasciculata</i> var. <i>macroserma</i>	Marsh Wild Senna	G5T3	S1	E	
<i>Chamaecyparis thyoides</i>	Atlantic White Cedar	G4	S3		
<i>Chamaedaphne calyculata</i>	Leatherleaf	G5	S1	T	
<i>Chamaelirium luteum</i>	Devil's-bit	G5	S3		
<i>Chamaesyce vermiculata</i>	Hairy Spurge	G5	SH		
<i>Chelone obliqua</i>	Red Turtlehead	G4	S1	T	
<i>Chenopodium gigantospermum</i>	Maple-leaved Goosefoot	G5	S1	E	
<i>Chenopodium leptophyllum</i>	Narrow -leaved Goosefoot	G5	SX		
<i>Chenopodium standleyanum</i>	Standley's Goosefoot	G5	S1	E	
<i>Chimaphila umbellata</i>	Prince's Pine	G5	S3		
<i>Chrysogonum virginianum</i>	Golden-knees	G5	S3		
<i>Cicuta bulbifera</i>	Bulb-bearing Water Hemlock	G5	S1	E	
<i>Cinna latifolia</i>	Slender Wood Reedgrass	G5	S3		
<i>Cirsium horridulum</i>	Yellow Thistle	G5	S3		
<i>Cirsium muticum</i>	Swamp Thistle	G5	S3		
<i>Claytonia caroliniana</i>	Carolina Spring-beauty	G5	S3		
<i>Cleistes divaricata</i>	Spreading Pogonia	G4	S1	E	
<i>Clematis occidentalis</i>	Purple Clematis	G5	S1	E	
<i>Clematis ochroleuca</i>	Curly-heads	G4	SH	X	
<i>Clematis viorna</i>	Leatherflower	G5	S3		
<i>Clintonia alleghaniensis</i>	Harned's Swamp Clintonia	G1Q	S1		
<i>Clintonia borealis</i>	Yellow Clintonia	G5	S2	T	
<i>Coeloglossum viride</i>	Long-bracted Orchis	G5	S1	E	
<i>Coelorachis rugosa</i>	Wrinkled Jointgrass	G5	S1	E	
<i>Commelina erecta</i>	Slender Dayflower	G5	S3		
<i>Coptis trifolia</i>	Goldthread	G5	S1	E	
<i>Corallorhiza trifida</i>	Early Coralroot	G5	S1	E	
<i>Corallorhiza wisteriana</i>	Wister's Coralroot	G5	S1	E	
<i>Coreopsis rosea</i>	Rose Coreopsis	G3	S1	E	
<i>Coreopsis tripteris</i>	Tall Tickseed	G5	S1	E	
<i>Coreopsis verticillata</i>	Whorled Coreopsis	G5	S3		

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<i>Cornus canadensis</i>	Bunchberry	G5	S1	E	
<i>Cornus rugosa</i>	Round-leaved Dogwood	G5	S1	E	
<i>Corydalis sempervirens</i>	Pale Corydalis	G4G5	S3		
<i>Corylus cornuta</i>	Beaked Hazelwood	G5	S3		
<i>Crassula aquatica</i>	Pygmyweed	G5	SH	X	
<i>Crotalaria rotundifolia</i>	Rabbit-bells	G5	S1	E	
<i>Croton capitatus</i>	Hogwort	G5	SU		
<i>Cuscuta coryli</i>	Hazel Dodder	G5?	SH	X	
<i>Cuscuta indecora</i>	Pretty Dodder	G5	S1?		
<i>Cuscuta polygonorum</i>	Smartweed Dodder	G5	S1	E	
<i>Cuscuta rostrata</i>	Beaked Dodder	G4	S1	E	
<i>Cymophyllus fraserianus</i>	Fraser's Sedge	G4	S1	E	
<i>Cyperus dentatus</i>	Toothed Sedge	G4	SH	X	
<i>Cyperus diandrus</i>	Low Cyperus	G5	SU		
<i>Cyperus haspan</i>	Sheathed Flatsedge	G5	S1?		
<i>Cyperus houghtonii</i>	Houghton's Umbrella-sedge	G4?	S1		
<i>Cyperus lancastriensis</i>	Lancaster's Sedge	G5	SU		
<i>Cyperus plukenetii</i>	Plukenet's Cyperus	G5	SH	X	
<i>Cyperus refractus</i>	Reflexed Cyperus	G5	S2?		
<i>Cyperus retrofractus</i>	Rough Cyperus	G5	S2		
<i>Cypripedium candidum</i>	Small White Lady's Slipper	G4	S1	E	
<i>Cypripedium reginae</i>	Showy Lady's Slipper	G4	SU	X	
<i>Cystopteris bulbifera</i>	Bulblet Fern	G5	S3		
<i>Cystopteris tennesseensis</i>	Tennessee Bladder-fern	G5	S1		
<i>Delphinium exaltatum</i>	Tall Larkspur	G3	S1	E	
<i>Delphinium tricorne</i>	Dwarf Larkspur	G5	S3		
<i>Deschampsia cespitosa</i>	Tufted Hairgrass	G5	S1	E	
<i>Desmodium canadense</i>	Showy Tick-trefoil	G5	S3		
<i>Desmodium cuspidatum</i>	Large-bracted Tick-trefoil	G5	S1		
<i>Desmodium humifusum</i>	Trailing Tick-trefoil	G1G2Q	SH	X	
<i>Desmodium laevigatum</i>	Smooth Tick-trefoil	G5	S3S4		
<i>Desmodium lineatum</i>	Linear-leaved Tick-trefoil	G5	S1	E	
<i>Desmodium nuttallii</i>	Nuttall's Tick-trefoil	G5	SU		
<i>Desmodium ochroleucum</i>	Cream-flowered Tick-trefoil	G1G2	S1	E	
<i>Desmodium pauciflorum</i>	Few-flowered Tick-trefoil	G5	S1	E	
<i>Desmodium rigidum</i>	Rigid Tick-trefoil	GNRQ	S1	E	
<i>Desmodium sessilifolium</i>	Sessile-leaved Tick-trefoil	G5	SH	X	
<i>Desmodium strictum</i>	Stiff Tick-trefoil	G4	S1	E	
<i>Desmodium viridiflorum</i>	Velvety Tick-trefoil	G5?	S3S4		
<i>Dicentra eximia</i>	Wild Bleeding-heart	G4	S2	T	
<i>Dichanthelium aciculare</i>	Bristling Panicgrass	G5	S2?		
<i>Dichanthelium boreale</i>	Northern Panicgrass	G5	SU	X	
<i>Dichanthelium laxiflorum</i>	Lax-flowered Witchgrass	G5	S1?		
<i>Dichanthelium leucothrix</i>	Roughish Panicgrass	G4?Q	SU		
<i>Dichanthelium oligosanthes</i>	Few-flowered Panicgrass	G5	S2S3		
<i>Dichanthelium ravenelii</i>	Ravenel's Witchgrass	G5	S3		
<i>Dichanthelium scabriusculum</i>	Tall Swamp Panicgrass	G4	S1	E	
<i>Dichanthelium wrightianum</i>	Wright's Panicgrass	G4	S1	E	
<i>Digitaria villosa</i>	Shaggy Crabgrass	G5	SU	X	
<i>Dioscorea hirticaulis</i>	Wild Yam	G3Q	SH		

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<i>Diplazium pycnocarpon</i>	Glade Fern	G5	S2	T	
<i>Dirca palustris</i>	Leatherwood	G4	S2	T	
<i>Dodecatheon meadia</i>	Shooting-star	G5	S3		
<i>Doellingeria infirma</i>	Cornel-leaf Aster	G5	S3		
<i>Drosera capillaris</i>	Pink Sundew	G5	S1	E	
<i>Drosera rotundifolia</i>	Round-leaved Sundew	G5	S3		
<i>Dryopteris campyloptera</i>	Mountain Wood-fern	G5	S1	E	
<i>Dryopteris celsa</i>	Log Fern	G4	S3		
<i>Dryopteris clintoniana</i>	Clinton's Wood-fern	G5	S1	E	
<i>Dryopteris goldiana</i>	Goldie's Wood-fern	G4	S2		
<i>Echinodorus cordifolius</i>	Upright Burhead	G5	S1	E	
<i>Elatine americana</i>	American Waterwort	G4	S3		
<i>Elatine minima</i>	Small Waterwort	G5	S1	E	
<i>Eleocharis albida</i>	White Spikerush	G4G5	S2	T	
<i>Eleocharis compressa</i>	Flattened Spikerush	G4	S1	E	
<i>Eleocharis engelmannii</i>	Engelmann's Spikerush	G4G5Q	S3		
<i>Eleocharis equisetoides</i>	Knotted Spikerush	G4	S1	E	
<i>Eleocharis erythropoda</i>	Bald Spikerush	G5	SU		
<i>Eleocharis geniculata</i>	Capitate Spikerush	G5	SU		
<i>Eleocharis halophila</i>	Salt-marsh Spikerush	G4	S1	E	
<i>Eleocharis intermedia</i>	Matted Spikerush	G5	S1	E	
<i>Eleocharis melanocarpa</i>	Black-fruited Spikerush	G4	S1	E	
<i>Eleocharis robbinsii</i>	Robbins' Spikerush	G4G5	S1	E	
<i>Eleocharis rostellata</i>	Beaked Spikerush	G5	S2?		
<i>Eleocharis tortilis</i>	Twisted Spikerush	G5	S3		
<i>Eleocharis tricostata</i>	Three-ribbed Spikerush	G4	S1	E	
<i>Elephantopus tomentosus</i>	Tobaccoweed	G5	S1?	E	
<i>Epilobium ciliatum</i>	Northern Willowherb	G5	S1	E	
<i>Epilobium leptophyllum</i>	Linear-leaved Willowherb	G5	S2S3		
<i>Epilobium strictum</i>	Downy Willowherb	G5?	S1	E	
<i>Equisetum fluviatile</i>	Water Horsetail	G5	S1	E	
<i>Equisetum sylvaticum</i>	Wood Horsetail	G5	S1	E	
<i>Eragrostis refracta</i>	Meadow Lovegrass	G5	S3S4		
<i>Erigenia bulbosa</i>	Harbinger-of-spring	G5	S3		
<i>Erigeron pulchellus</i> var. <i>brauniae</i>	Lucy Braun's Robin Plantain	G5T4	S1		
<i>Eriocaulon aquaticum</i>	Seven-angled Pipewort	G5	S1	E	
<i>Eriocaulon compressum</i>	Flattened Pipewort	G5	S2		
<i>Eriocaulon decangulare</i>	Ten-angled Pipewort	G5	S2		
<i>Eriocaulon parkeri</i>	Parker's Pipewort	G3	S2	T	
<i>Eriophorum gracile</i>	Slender Cottongrass	G5	S1	E	
<i>Eriophorum virginicum</i>	Tawny Cottongrass	G5	S3		
<i>Eryngium yuccifolium</i>	Tall Rattlesnake Master	G5	SH	X	
<i>Erythronium albidum</i>	White Trout Lily	G5	S2	T	
<i>Eupatorium altissimum</i>	Tall Boneset	G5	S3		
<i>Eupatorium leucolepis</i>	White-bracted Boneset	G5	S2S3	T	
<i>Eupatorium maculatum</i>	Spotted Joe-pye-weed	G5	SU	X	
<i>Euphorbia obtusata</i>	Blunt-leaved Spurge	G5	S1	E	
<i>Euphorbia pubentissima</i>	Flowering Spurge	G5	SU		
<i>Euphorbia purpurea</i>	Darlington's Spurge	G3	S1	E	
<i>Eurybia radula</i>	Rough-leaved Aster	G5	S1	E	

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<i>Eurybia spectabilis</i>	Showy Aster	G5	S1	E	
<i>Festuca paradoxa</i>	Cluster Fescue	G5	SU	X	
<i>Filipendula rubra</i>	Queen-of-the-prairie	G4G5	S1	E	
<i>Fimbristylis annua</i>	Baldwin's Fimbristylis	G5	S3		
<i>Fimbristylis caroliniana</i>	Carolina Fimbry	G4	S1S2		
<i>Fimbristylis perpusilla</i>	Harper's Fimbristylis	G2	S2	E	
<i>Fimbristylis puberula</i>	Hairy Fimbristylis	G5	SU		
<i>Fraxinus nigra</i>	Black Ash	G5	S3		
<i>Fuirena pumila</i>	Smooth Fuirena	G4	S2S3		
<i>Galactia volubilis</i>	Downy Milk Pea	G5	S3		
<i>Galium boreale</i>	Northern Bedstraw	G5	S1	E	
<i>Galium concinnum</i>	Shining Bedstraw	G5	S3		
<i>Galium hispidulum</i>	Coast Bedstraw	G5	S1	E	
<i>Galium latifolium</i>	Purple Bedstraw	G5	S3		
<i>Galium trifidum</i>	Small Bedstraw	G5	SU		
<i>Gaultheria hispidula</i>	Creeping Snowberry	G5	S1	E	
<i>Gaylussacia brachycera</i>	Box Huckleberry	G3	S1	E	
<i>Gentiana andrewsii</i>	Fringe-tip Closed Gentian	G5?	S2	T	
<i>Gentiana linearis</i>	Narrow-leaved Gentian	G4G5	S3		
<i>Gentiana puberulenta</i>	Downy Gentian	G4G5	SH	X	
<i>Gentiana villosa</i>	Striped Gentian	G4	S1	E	
<i>Gentianella quinquefolia</i>	Stiff Gentian	G5	S1	E	
<i>Gentianopsis crinita</i>	Fringed Gentian	G5	S1	E	
<i>Geranium robertianum</i>	Herb-robert	G5	S1		
<i>Geum aleppicum</i>	Yellow Avens	G5	S1	E	
<i>Geum laciniatum</i>	Rough Avens	G5	S3		
<i>Glaux maritima</i>	Sea Milkwort	G5	SH	X	
<i>Glyceria acutiflora</i>	Sharp-scaled Mannagrass	G5	S1	E	
<i>Glyceria grandis</i>	American Mannagrass	G5	S1	E	
<i>Goodyera repens</i>	Dwarf Rattlesnake-plantain	G5	SH	X	
<i>Goodyera tessellata</i>	Tesselated Rattlesnake-plantain	G5	SH	X	
<i>Gratiola ramosa</i>	Branching Hedge-hyssop	G4G5	SH	X	
<i>Gratiola viscidula</i>	Short's Hedge-hyssop	G4G5	S1	E	
<i>Gymnocarpium dryopteris</i>	Oak Fern	G5	S1	E	
<i>Gymnocladus dioicus</i>	Kentucky Coffee-tree	G5	S1		
<i>Gymnopogon brevifolius</i>	Broad-leaved Beardgrass	G5	S1	E	
<i>Hasteola suaveolens</i>	Sweet-scented Indian-plantain	G4	S1	E	
<i>Helianthemum bicknellii</i>	Hoary Frostweed	G5	S1	E	
<i>Helianthus hirsutus</i>	Hirsute Sunflower	G5	SU		
<i>Helianthus laevigatus</i>	Smooth Sunflower	G4	S1	E	
<i>Helianthus microcephalus</i>	Small-headed Sunflower	G5	S1	E	
<i>Helianthus occidentalis</i>	Mcdowell's Sunflower	G5	S1	T	
<i>Helonias bullata</i>	Swamp Pink	G3	S2	E	LT
<i>Heracleum lanatum</i>	Cow-parsnip	G5	S3		
<i>Heuchera pubescens</i>	Downy Heuchera	G4?	S3		
<i>Heuchera villosa</i>	Rough Heuchera	G5	SH	X	
<i>Hexalectris spicata</i>	Crested Coralroot	G5	SH	X	
<i>Hexastylis virginica</i>	Virginia Heartleaf	G4	S1	E	
<i>Hibiscus laevis</i>	Halberd-leaved Rose-mallow	G5	S3		
<i>Hierochloa odorata</i>	Holy Grass	G5	S1	E	

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<i>Honckenya peploides</i>	Sea-beach Sandwort	G5	S1	E	
<i>Hottonia inflata</i>	Featherfoil	G4	S1	E	
<i>Houstonia serpyllifolia</i>	Thyme-leaved Bluets	G4?	S3		
<i>Houstonia tenuifolia</i>	Slender-leaved Bluets	G4G5	S1		
<i>Hudsonia ericoides</i>	Golden-heather	G4	S1	E	
<i>Huperzia porophila</i>	Rock Clubmoss	G4	SX		
<i>Hybanthus concolor</i>	Green Violet	G5	S3		
<i>Hydrastis canadensis</i>	Goldenseal	G4	S2	T	
<i>Hydrophyllum macrophyllum</i>	Large-leaved Waterleaf	G5	S2	T	
<i>Hypericum adpressum</i>	Creeping St. John's-wort	G3	S1	E	
<i>Hypericum denticulatum</i>	Coppery St. John's-wort	G5	S2	T	
<i>Hypericum drummondii</i>	Drummond's St. John's-wort	G5	SH	X	
<i>Hypericum ellipticum</i>	Pale St. John's-wort	G5	SU		
<i>Hypericum gymnanthum</i>	Clasping-leaved St. John's-wort	G4	S3		
<i>Hypericum pyramidatum</i>	Great St. John's-wort	G4	SH	X	
<i>Ilex decidua</i>	Deciduous Holly	G5	S2		
<i>Iresine rhizomatosa</i>	Bloodleaf	G5	S1	E	
<i>Iris cristata</i>	Crested Iris	G5	S1	E	
<i>Iris prismatica</i>	Slender Blue Flag	G4G5	S1	E	
<i>Iris verna</i>	Dwarf Iris	G5	S1	E	
<i>Iris virginica</i>	Virginia Blue Flag	G5	S3		
<i>Isoetes engelmannii</i>	Appalachian Quillwort	G4	S3		
<i>Isoetes riparia</i>	Riverbank Quillwort	G5?	SU		
<i>Isotria medeoloides</i>	Small Whorled Pogonia	G2	SH	X	LT
<i>Juglans cinerea</i>	Butternut	G4	S2S3		
<i>Juncus articulatus</i>	Jointed Rush	G5	S1		
<i>Juncus balticus</i>	Baltic Rush	G5	SH	X	
<i>Juncus brachycarpus</i>	Short-fruited Rush	G4G5	SU		
<i>Juncus brachycephalus</i>	Small-headed Rush	G5	SH	X	
<i>Juncus brevicaudatus</i>	Narrow -panicked Rush	G5	S2		
<i>Juncus caesariensis</i>	New Jersey Rush	G2	S1	E	
<i>Juncus longii</i>	Long's Rush	G3Q	S1	E	
<i>Juncus megacephalus</i>	Big-headed Rush	G4G5	SH	X	
<i>Juncus militaris</i>	Bayonet Rush	G4	SH	X	
<i>Juncus pelocarpus</i>	Brown-fruited Rush	G5	S1	E	
<i>Juncus torreyi</i>	Torrey's Rush	G5	S1	E	
<i>Juncus trifidus</i>	Highland Rush	G5	S1	E	
<i>Juniperus communis</i>	Juniper	G5	SH	X	
<i>Kalmia angustifolia</i>	Sheep-laurel	G5	S3S4		
<i>Krigia biflora</i>	Two-flowered Cynthia	G5	S3		
<i>Krigia dandelion</i>	Potato Dandelion	G5	S1	E	
<i>Kyllinga pumila</i>	Thin-leaved Flatsedge	G5	S1	E	
<i>Lachnanthes carolina</i>	Red-root	G4	S1	E	
<i>Lactuca hirsuta</i>	Hairy Lettuce	G5?	SH	X	
<i>Larix laricina</i>	Larch	G5	S1	E	
<i>Lathyrus palustris</i>	Vetchling Peavine	G5	S1	E	
<i>Lathyrus venosus</i>	Veiny Pea	G5	S3		
<i>Lechea maritima</i>	Beach Pinweed	G5	S3		
<i>Lechea tenuifolia</i>	Narrow -leaved Pinweed	G5	SH	X	
<i>Leersia hexandra</i>	Club-headed Cutgrass	G5	S1	E	

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<i>Leersia lenticularis</i>	Catchfly-grass	G5	S1	E	
<i>Lemna trisulca</i>	Star Duckweed	G5	S1	E	
<i>Leptochloa fusca</i> ssp. <i>fascicularis</i>	Long-awned Diplachne	G5T5	SU		
<i>Lespedeza frutescens</i>	Violet Bushclover	G5	S3		
<i>Lespedeza stuevei</i>	Downy Bushclover	G4?	S3		
<i>Liatris spicata</i>	Spiked Blazing-star	G5	S1		
<i>Liatris squarrosa</i>	Scaly Blazing-star	G5	S1	E	
<i>Liatris turgida</i>	Robust Blazing-star	G3	SH	X	
<i>Ligusticum canadense</i>	American Lovage	G4	SH	X	
<i>Lilium philadelphicum</i>	Wood Lily	G5	SH	X	
<i>Limnobiium spongia</i>	American Frog's-bit	G4	S1	E	
<i>Limosella australis</i>	Mudwort	G4G5	S2	E	
<i>Linnaea borealis</i>	Twinflower	G5	SU	X	
<i>Linum floridanum</i>	Florida Yellow Flax	G5?	SH	X	
<i>Linum intercursum</i>	Sandplain Flax	G4	S2	T	
<i>Linum sulcatum</i>	Grooved Flax	G5	S1	E	
<i>Liparis liliifolia</i>	Large Twayblade	G5	S2S3		
<i>Liparis loeselii</i>	Loesel's Twayblade	G5	S1S2		
<i>Lipocarpha micrantha</i>	Small-flowered Hemicarpha	G5	S1	E	
<i>Listera australis</i>	Southern Twayblade	G4	S3		
<i>Listera cordata</i>	Heartleaf Twayblade	G5	SH	X	
<i>Listera smallii</i>	Appalachian Twayblade	G4	S1	E	
<i>Lithospermum latifolium</i>	American Gromwell	G4	S1	E	
<i>Litsea aestivalis</i>	Pondspice	G3	S1	E	
<i>Lobelia canbyi</i>	Canby's Lobelia	G4	S1	E	
<i>Lobelia elongata</i>	Elongated Lobelia	G4G5	S3		
<i>Lonicera canadensis</i>	Canada Honeysuckle	G5	S1	E	
<i>Ludwigia brevipes</i>	Creeping Ludwigia	G2G3	SU		
<i>Ludwigia decurrens</i>	Primrose Willow	G5	S2S3		
<i>Ludwigia glandulosa</i>	Cylindric-fruited Seedbox	G5	S1	E	
<i>Ludwigia hirtella</i>	Hairy Ludwigia	G5	S1	E	
<i>Lupinus perennis</i>	Wild Lupine	G5	S2	T	
<i>Lycopodiella caroliniana</i>	Carolina Clubmoss	G5	S1	E	
<i>Lycopodiella inundata</i>	Bog Clubmoss	G5	S2		
<i>Lycopodium tristachyum</i>	Ground-cedar	G5	S3		
<i>Lycopus amplexans</i>	Sessile-leaved Water-horehound	G5	S1	E	
<i>Lygodium palmatum</i>	Climbing Fern	G4	S2	T	
<i>Lysimachia hybrida</i>	Lowland Loosestrife	G5	S2	T	
<i>Lysimachia lanceolata</i>	Lance-leaved Loosestrife	G5	S3		
<i>Lysimachia thyrsoiflora</i>	Tufted Loosestrife	G5	S1	E	
<i>Lythrum alatum</i>	Winged Loosestrife	G5	S1	E	
<i>Magnolia tripetala</i>	Umbrella Magnolia	G5	S3		
<i>Malus angustifolia</i>	Narrow-leaved Wild Crab	G5?	S3		
<i>Manfreda virginica</i>	False Aloe	G5	SU		
<i>Marshallia grandiflora</i>	Large-flowered Barbara's Buttons	G2	SU	X	
<i>Matelea carolinensis</i>	Anglepod	G4	S1	E	
<i>Matelea decipiens</i>	Old-field Milkvine	G5	SH	X	
<i>Matelea gonocarpos</i>	Angular-fruited Milkvine	G5	S1?		
<i>Matelea obliqua</i>	Climbing Milkweed	G4?	S1	E	
<i>Matteuccia struthiopteris</i>	Ostrich Fern	G5	S2		

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<i>Mecardonia acuminata</i>	Erect Water-hyssop	G5	S1	E	
<i>Melanthium latifolium</i>	Broad-leaved Bunchflower	G5	S1	E	
<i>Melanthium virginicum</i>	Virginia Bunchflower	G5	S3		
<i>Melica mutica</i>	Two-flowered Melicgrass	G5	S1	T	
<i>Melica nitens</i>	Three-flowered Melicgrass	G5	S2	T	
<i>Melothria pendula</i>	Creeping Cucumber	G5?	S1	E	
<i>Menyanthes trifoliata</i>	Buckbean	G5	S1	E	
<i>Micranthemum micranthemoides</i>	Nuttall's Micranthemum	GH	SH	X	
<i>Milium effusum</i>	Millet Grass	G5	S3		
<i>Minuartia caroliniana</i>	Carolina Sandwort	G5	S1	E	
<i>Minuartia glabra</i>	Mountain Sandwort	G4	S1	E	
<i>Minuartia michauxii</i>	Rock Sandwort	G5	S2	T	
<i>Moehringia lateriflora</i>	Grove Sandwort	G5	S1	E	
<i>Monarda clinopodia</i>	Basal Bee-balm	G5	S3		
<i>Monarda media</i>	Purple Bergamot	G4?	SU		
<i>Monotropsis odorata</i>	Sweet Pinesap	G3	S1	E	
<i>Morella caroliniensis</i>	Evergreen Bayberry	G5	S1	E	
<i>Muhlenbergia capillaris</i>	Long-awned Hairgrass	G5	S1	E	
<i>Muhlenbergia glabrifloris</i>	Hair Grass	G4?	SU		
<i>Muhlenbergia glomerata</i>	Marsh Muhly	G5	SU		
<i>Muhlenbergia sylvatica</i>	Woodland Dropseed	G5	S3		
<i>Muhlenbergia torreyana</i>	Torrey's Dropseed	G3	S1	E	
<i>Myosotis macrosperma</i>	Large-seeded Forget-me-not	G5	S2S3		
<i>Myosotis verna</i>	Spring Forget-me-not	G5	S3		
<i>Myriophyllum heterophyllum</i>	Broadleaf Water-milfoil	G5	S1		
<i>Myriophyllum tenellum</i>	Slender Water-milfoil	G5	SH	X	
<i>Myriophyllum verticillatum</i>	Whorled Water-milfoil	G5	SU		
<i>Najas flexilis</i>	Slender Naiad	G5	S3		
<i>Najas gracillima</i>	Thread-like Naiad	G5?	SU	X	
<i>Najas guadalupensis</i>	Southern Naiad	G5	S3		
<i>Napaea dioica</i>	Glade Mallow	G4	S1	E	
<i>Nelumbo lutea</i>	American Lotus	G4	S2		
<i>Nemopanthus mucronatus</i>	Mountain Holly	G5	S3		
<i>Nemophila aphylla</i>	Small-flowered Baby-blue-eyes	G5	S1		
<i>Nymphoides aquatica</i>	Larger Floating-heart	G5	S1	E	
<i>Nymphoides cordata</i>	Floating-heart	G5	S1	E	
<i>Oenothera argillicola</i>	Shale-barren Primrose	G3G4	S3		
<i>Oldenlandia uniflora</i>	Clustered Bluets	G5	S3		
<i>Oligoneuron rigidum</i>	Hard-leaved Goldenrod	G5	SH	X	
<i>Onosmodium molle</i>	Shaggy False-gromwell	G4G5	S1	E	
<i>Onosmodium virginianum</i>	Virginia False-gromwell	G4	S1	E	
<i>Orthilia secunda</i>	One-sided Pyrola	G5	SH	X	
<i>Oryzopsis asperifolia</i>	White-fruited Mountainrice	G5	S2	T	
<i>Oxydendrum arboreum</i>	Sourwood	G5	S1	E	
<i>Oxypolis canbyi</i>	Canby's Dropwort	G2	S1	E	LE
<i>Packera antennariifolia</i>	Shale-barren Ragwort	G4	S3		
<i>Packera paupercula</i>	Balsam Ragwort	G5	S3		
<i>Panax quinquefolius</i>	Ginseng	G3G4	S3		
<i>Panicum flexile</i>	Wiry Witch-grass	G5	S1	E	
<i>Panicum hemitomon</i>	Maidencane	G5?	S3		

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<i>Panicum philadelphicum</i>	Tuckerman's Panicgrass	G5	SU		
<i>Parnassia asarifolia</i>	Kidneyleaf Grass-of-parnassus	G4	S1	E	
<i>Paronychia virginica</i> var. <i>virginica</i>	Yellow Nailwort	G4T1Q	S1	E	
<i>Parthenium integrifolium</i>	American Feverfew	G5	S1	E	
<i>Paspalum dissectum</i>	Walter's Paspalum	G4?	S2	T	
<i>Paspalum fluitans</i>	Floating Paspalum	G5	S1	E	
<i>Paxistima canbyi</i>	Canby's Mountain Lover	G2	S1	E	
<i>Pedicularis lanceolata</i>	Swamp Lousewort	G5	S1	E	
<i>Pellaea glabella</i>	Smooth Cliffbrake	G5	S1	E	
<i>Penstemon laevigatus</i>	Smooth Beardtongue	G5	S3		
<i>Persea palustris</i>	Red Bay	G5	S1	E	
<i>Phacelia covillei</i>	Coville's Phacelia	G3	S2	E	
<i>Phacelia purshii</i>	Miami-mist	G5	S3		
<i>Phalaris caroliniana</i>	May Grass	G5?	SH	X	
<i>Phaseolus polystachios</i>	Wild Bean	G5	S3		
<i>Phegopteris connectilis</i>	Northern Beech Fern	G5	S2		
<i>Phlox glaberrima</i>	Smooth Phlox	G5	S1	E	
<i>Phlox latifolia</i>	Mountain Phlox	G4	SH	X	
<i>Phlox pilosa</i>	Downy Phlox	G5	S1	E	
<i>Photinia floribunda</i>	Purple Chokeberry	G4G5Q	S3		
<i>Phyllanthus caroliniensis</i>	Carolina Leaf-flower	G5	S3		
<i>Physalis virginiana</i>	Virginia Ground-cherry	G5	S3		
<i>Picea rubens</i>	Red Spruce	G5	S3		
<i>Pilea fontana</i>	Coolwort	G5	S3		
<i>Piptatherum racemosum</i>	Black-fruited Mountainrice	G5	S2	T	
<i>Plantago cordata</i>	Heart-leaved Plantain	G4	SH	X	
<i>Plantago pusilla</i>	Slender Plantain	G5	SH	X	
<i>Platanthera blephariglottis</i>	White Fringed Orchid	G4G5	S2	T	
<i>Platanthera ciliaris</i>	Yellow Fringed Orchid	G5	S2	T	
<i>Platanthera cristata</i>	Crested Yellow Orchid	G5	S3		
<i>Platanthera flava</i>	Pale Green Orchid	G4	S2		
<i>Platanthera grandiflora</i>	Large Purple Fringed Orchid	G5	S2	T	
<i>Platanthera peramoena</i>	Purple Fringeless Orchid	G5	S1	T	
<i>Platanthera psychodes</i>	Small Purple Fringed Orchid	G5	SH	X	
<i>Pleopeltis polypodioides</i>	Resurrection Fern	G5	S3		
<i>Pluchea camphorata</i>	Marsh Fleabane	G5	S1	E	
<i>Poa alsodes</i>	Grove Meadow -grass	G4G5	S2		
<i>Poa languida</i>	Weak Speargrass	G3G4Q	SU		
<i>Poa palustris</i>	Fowl Bluegrass	G5	SH		
<i>Poa saltuensis</i>	Drooping Bluegrass	G5	S1	E	
<i>Podostemum ceratophyllum</i>	Threadfoot	G5	S3		
<i>Pogonia ophioglossoides</i>	Rose Pogonia	G5	S3		
<i>Polanisia dodecandra</i>	Clammyweed	G5	S1	E	
<i>Polemonium vanbruntiae</i>	Jacob's-ladder	G3G4	S2	T	
<i>Polygala cruciata</i>	Cross-leaved Milkwort	G5	S2	T	
<i>Polygala incarnata</i>	Pink Milkwort	G5	S2S3		
<i>Polygala polygama</i>	Racemed Milkwort	G5	S1	T	
<i>Polygala senega</i>	Seneca Snakeroot	G4G5	S2	T	
<i>Polygonum careyi</i>	Carey's Knotweed	G4	SU		
<i>Polygonum cilinode</i>	Fringed Bindweed	G5	S3		

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<i>Polygonum glaucum</i>	Seaside Knotweed	G3	S1	E	
<i>Polygonum ramosissimum</i>	Bushy Knotweed	G5	SH	X	
<i>Polygonum robustius</i>	Stout Smartweed	G4G5	SU	X	
<i>Polygonum setaceum</i>	Bristly Smartweed	G5	SU		
<i>Porteranthus stipulatus</i>	American Ipecac	G5	SH	X	
<i>Potamogeton amplifolius</i>	Large-leaved Pondweed	G5	SH	X	
<i>Potamogeton foliosus</i>	Leafy Pondweed	G5	S1	E	
<i>Potamogeton illinoensis</i>	Illinois Pondweed	G5	S1		
<i>Potamogeton natans</i>	Floating Pondweed	G5	SU		
<i>Potamogeton perfoliatus</i>	Clasping-leaved Pondweed	G5	S2		
<i>Potamogeton pusillus</i>	Slender Pondweed	G5	S1		
<i>Potamogeton richardsonii</i>	Redheadgrass	G5	SH	X	
<i>Potamogeton robbinsii</i>	Robbins' Pondweed	G5	SH	X	
<i>Potamogeton spirillus</i>	Spiral Pondweed	G5	S1		
<i>Potamogeton zosteriformis</i>	Flatstem Pondweed	G5	S1	E	
<i>Potentilla arguta</i>	Tall Cinquefoil	G5	SU		
<i>Prenanthes autumnalis</i>	Slender Rattlesnake-root	G4G5	S1	E	
<i>Prunus alleghaniensis</i>	Alleghany Plum	G4	S2	T	
<i>Prunus maritima</i>	Beach Plum	G4	S1	E	
<i>Prunus pumila</i>	Eastern Dwarf Cherry	G5	SU		
<i>Psoralea psoraloides</i>	False Scurf-pea	G4?	SX		
<i>Ptelea trifoliata</i>	Wafer-ash	G5	S3		
<i>Ptilimnium nodosum</i>	Harperella	G2	S1	E	LE
<i>Pycnanthemum clinopodioides</i>	Basil Mountain-mint	G2	SH		
<i>Pycnanthemum pycnanthemoides</i>	Southern Mountain-mint	G5	SH	X	
<i>Pycnanthemum torrei</i>	Torrey's Mountain-mint	G2	S1	E	
<i>Pycnanthemum verticillatum</i>	Whorled Mountain-mint	G5	S1	E	
<i>Pycnanthemum virginianum</i>	Virginia Mountain-mint	G5	S2		
<i>Pyrola virens</i>	Greenish-flowered Pyrola	G5	SH	X	
<i>Quercus macrocarpa</i>	Mossy-cup Oak	G5	S1		
<i>Quercus prinoides</i>	Dwarf Chestnut Oak	G5	S3		
<i>Quercus shumardii</i>	Shumard's Oak	G5	S2	T	
<i>Ranunculus allegheniensis</i>	Mountain Crowfoot	G4G5	S3		
<i>Ranunculus ambigens</i>	Water-plantain Spearwort	G4	SH	X	
<i>Ranunculus carolinianus</i>	Carolina Buttercup	G5T5	SU	X	
<i>Ranunculus fascicularis</i>	Early Buttercup	G5	S1	E	
<i>Ranunculus flabellaris</i>	Yellow Water-crowfoot	G5	S1	E	
<i>Ranunculus hederaceus</i>	Long-stalked Crowfoot	G5	S1	E	
<i>Ranunculus laxicaulis</i>	Mississippi Buttercup	G5?	SU		
<i>Ranunculus pennsylvanicus</i>	Bristly Crowfoot	G5	SH	X	
<i>Ranunculus pusillus</i>	Low Spearwort	G5	SU		
<i>Ranunculus trichophyllus</i>	White Water-crowfoot	G5	S1	E	
<i>Rhododendron arborescens</i>	Smooth Azalea	G4G5	S3		
<i>Rhododendron calendulaceum</i>	Flame Azalea	G5	S1		
<i>Rhododendron canescens</i>	Hoary Azalea	G5	SU		
<i>Rhynchosia tomentosa</i>	Hairy Snoutbean	G5	S2	T	
<i>Rhynchospora alba</i>	White Beakrush	G5	S3		
<i>Rhynchospora cephalantha</i>	Capitate Beakrush	G5	S1	E	
<i>Rhynchospora globularis</i>	Grass-like Beakrush	G5?	S1	E	
<i>Rhynchospora glomerata</i>	Clustered Beakrush	G5	S3		

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SCIENTIFIC NAME	COMMON NAME	Global Rank	State Rank	State Status	Federal Status
<i>Rhynchospora harperi</i>	Harper's Beakrush	G4?	S1	T	
<i>Rhynchospora inundata</i>	Drowned Hornedrush	G4?	S1	E	
<i>Rhynchospora microcephala</i>	Tiny-headed Beakrush	G5	S2		
<i>Rhynchospora nitens</i>	Short-beaked Baldrush	G4?	S1	E	
<i>Rhynchospora oligantha</i>	Few-flowered Beaked-rush	G4	SH	X	
<i>Rhynchospora pallida</i>	Pale Beakrush	G3	SH	X	
<i>Rhynchospora rariflora</i>	Few-flowered Beakrush	G5	SU	X	
<i>Rhynchospora recognita</i>	Globe Beaksedge	G5?	S2		
<i>Rhynchospora scirpoides</i>	Long-beaked Baldrush	G4	S2	T	
<i>Rhynchospora torreyana</i>	Torrey's Beakrush	G4	S2	T	
<i>Ribes americanum</i>	Wild Black Currant	G5	SH	X	
<i>Ribes cynosbati</i>	Prickly Gooseberry	G5	S3		
<i>Ribes glandulosum</i>	Skunk Currant	G5	S3		
<i>Ribes hirtellum</i>	Low Wild Gooseberry	G5	S1		
<i>Rosa blanda</i>	Smooth Rose	G5	S1	E	
<i>Rudbeckia fulgida</i>	Orange Coneflower	G5	S3		
<i>Rudbeckia triloba</i>	Thin-leaved Coneflower	G5	S3		
<i>Ruellia humilis</i>	Hairy Wild-petunia	G5	S1	E	
<i>Ruellia purshiana</i>	Pursh's Ruellia	G3	S1	E	
<i>Ruellia strepens</i>	Rustling Wild-petunia	G4G5	S1	E	
<i>Rumex altissimus</i>	Tall Dock	G5	S1	E	
<i>Rumex hastatulus</i>	Engelmann's Dock	G5	SU		
<i>Sabatia campanulata</i>	Slender Marsh Pink	G5	S1	E	
<i>Sabatia difformis</i>	Lance-leaved Sabatia	G4G5	S1	E	
<i>Sabatia dodecandra</i>	Large Marsh Pink	G5?	S3		
<i>Saccharum alopecuroidum</i>	Woolly Beardgrass	G5	S1?		
<i>Saccharum baldwinii</i>	Narrow Plumegrass	G5	S1	E	
<i>Saccharum contortum</i>	Bent-awn Plumegrass	G5	S3S4		
<i>Sacciolepis striata</i>	Sacciolepis	G5	S1	E	
<i>Sagittaria australis</i>	Long-beaked Arrowhead	GNRQ	SU		
<i>Sagittaria calycina</i>	Spongy Lophotocarpus	G5	S2		
<i>Sagittaria engelmanniana</i>	Engelmann's Arrowhead	G5?	S2	T	
<i>Sagittaria graminea</i>	Grass-leaved Arrowhead	G5	SU		
<i>Sagittaria rigida</i>	Sessile-fruited Arrowhead	G5	S1	E	
<i>Sagittaria subulata</i>	Subulate Arrowhead	G4	SU		
<i>Salix bebbiana</i>	Bebb's Willow	G5	SH	X	
<i>Salix caroliniana</i>	Carolina Willow	G5	S3		
<i>Salix discolor</i>	Pussy Willow	G5	SU		
<i>Salix exigua</i>	Sandbar Willow	G5	S1	E	
<i>Salix humilis</i> var. <i>tristis</i>	Dwarf Prairie Willow	G5T4T5	S1		
<i>Salix lucida</i>	Shining Willow	G5	SH	X	
<i>Salvia urticifolia</i>	Nettle-leaved Sage	G5	SX	X	
<i>Sanguisorba canadensis</i>	Canada Burnet	G5	S2	T	
<i>Sanicula marilandica</i>	Sanicle	G5	S3		
<i>Sanicula trifoliata</i>	Three-leaved Snakeroot	G4	S3		
<i>Sarracenia purpurea</i>	Northern Pitcher-plant	G5	S2	T	
<i>Saxifraga micranthidifolia</i>	Lettuce-leaved Saxifrage	G5	S3		
<i>Schizachne purpurascens</i>	Purple Oat	G5	S1	E	
<i>Schoenoplectus etuberculatus</i>	Canby's Bulrush	G3G4	S1	E	
<i>Schoenoplectus novae-angliae</i>	Salt-marsh Bulrush	G5	S2		

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SCIENTIFIC NAME	COMMON NAME	Global Rank	State Rank	State Status	Federal Status
<i>Schoenoplectus smithii</i>	Smith's Clubrush	G5?	SU	X	
<i>Schoenoplectus subterminalis</i>	Water Clubrush	G4G5	S1	E	
<i>Schoenoplectus torreyi</i>	Torrey's Clubrush	G5?	SH	X	
<i>Schwalbea americana</i>	Chaffseed	G2G3	SX	X	LE
<i>Scirpus ancistrochaetus</i>	Northeastern Bulrush	G3	S1	E	LE
<i>Scirpus expansus</i>	Wood Bulrush	G4	S3		
<i>Scirpus pendulus</i>	Pendulous Bulrush	G5	S3		
<i>Scleria minor</i>	Slender Nutrush	G4	S1	E	
<i>Scleria muehlenbergii</i>	Muhlenberg's Nutrush	G5	S1S2		
<i>Scleria nitida</i>	Shining Nutrush	GNR	S1	E	
<i>Scleria pauciflora</i>	Papillose Nutrush	G5	S3		
<i>Scleria reticularis</i>	Reticulated Nutrush	G4	S2S3		
<i>Scleria triglomerata</i>	Tall Nutrush	G5	S1S2		
<i>Scleria verticillata</i>	Whorled Nutrush	G5	S1	E	
<i>Sclerolepis uniflora</i>	Pink Bog-button	G4	S2	T	
<i>Scrophularia lanceolata</i>	Hare Figwort	G5	S3		
<i>Scutellaria galericulata</i>	Common Skullcap	G5	S1		
<i>Scutellaria incana</i>	Downy Skullcap	G5	S3		
<i>Scutellaria leonardii</i>	Leonard's Skullcap	G4	S2	T	
<i>Scutellaria nervosa</i>	Veined Skullcap	G5	S1	E	
<i>Scutellaria ovata</i>	Heart-leaved Skullcap	G5	S3		
<i>Scutellaria parvula</i>	Small Skullcap	G4	SH	X	
<i>Scutellaria saxatilis</i>	Rock Skullcap	G3	S1	E	
<i>Scutellaria serrata</i>	Showy Skullcap	G4G5	S3		
<i>Sedum glaucophyllum</i>	Cliff Stonecrop	G4	S1	E	
<i>Sesuvium maritimum</i>	Sea-purslane	G5	S1	E	
<i>Sida hermaphrodita</i>	Virginia Mallow	G3	S1	E	
<i>Silene nivea</i>	Snowy Campion	G4?	S1	E	
<i>Silphium trifoliatum</i>	Three-leaved Rosinweed	G4?	S3		
<i>Sisyrinchium fuscatum (arenicola)</i>	Coastal Plain Blue-eyed Grass	G5?	S1	E	
<i>Smilacina stellata</i>	Star-flowered False Solomon's-seal	G5	S1	E	
<i>Smilax bona-nox</i>	Bullbrier	G5	S3		
<i>Smilax ecirrata</i>	Upright Smilax	G5?	SU		
<i>Smilax pseudochina</i>	Halberd-leaved Greenbrier	G4G5	S2	T	
<i>Solidago arguta</i> var. <i>arguta</i>	Late Goldenrod	G5T4T5	S1?		
<i>Solidago arguta</i> var. <i>harrisii</i>	Cut-leaved Goldenrod	G5T4	S3		
<i>Solidago curtisii</i>	Curtis' Goldenrod	G4G5	S1	E	
<i>Solidago hispida</i>	Hairy Goldenrod	G5	SH	X	
<i>Solidago latissimifolia</i>	Elliott's Goldenrod	G5	S3		
<i>Solidago patula</i>	Sharp-leaved Goldenrod	G5	S3		
<i>Solidago roanensis</i>	Mountain Goldenrod	G4G5	S1?	E	
<i>Solidago rupestris</i>	Rock Goldenrod	G4?	SH	X	
<i>Solidago simplex</i> var. <i>racemosa</i>	Riverbank Goldenrod	G5T3?	S1	T	
<i>Solidago speciosa</i>	Showy Goldenrod	G5	S2	T	
<i>Solidago stricta</i>	Wandlike Goldenrod	G5	SU		
<i>Solidago uliginosa</i>	Bog Goldenrod	G4G5	S3		
<i>Sorbus americana</i>	American Mountain-ash	G5	S3		
<i>Sorghastrum elliotii</i>	Long-bristled Indian-grass	G5	S1	E	
<i>Sparganium androcladum</i>	Branching Bur-reed	G4G5	S3		
<i>Sparganium erectum</i>	Green-fruited Bur-reed	G5	S3		

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SCIENTIFIC NAME	COMMON NAME	Global Rank	State Rank	State Status	Federal Status
<i>Sparganium eurycarpum</i>	Broad-fruited Bur-reed	G5	S3		
<i>Spermacoce glabra</i>	Buttonweed	G4G5	S1	E	
<i>Sphenopholis pensylvanica</i>	Swamp-oats	G4	S2	T	
<i>Spiraea betulifolia</i>	Corymbid Spiraea	G5	S3		
<i>Spiranthes laciniata</i>	Lace-lip Ladys' Tresses	G4G5	SU		
<i>Spiranthes lucida</i>	Wide-leaved Ladys' Tresses	G5	S1	E	
<i>Spiranthes ochroleuca</i>	Yellow Nodding Ladys' Tresses	G4	S1	E	
<i>Spiranthes odorata</i>	Sweet-scented Ladys' Tresses	G5	SH	X	
<i>Spiranthes praecox</i>	Grass-leaved Ladys' Tresses	G5	S1		
<i>Spiranthes tuberosa</i>	Little Ladys' Tresses	G5	S3		
<i>Sporobolus asper</i>	Long-leaved Rushgrass	G5	S1		
<i>Sporobolus clandestinus</i>	Rough Rushgrass	G5	S2	T	
<i>Sporobolus heterolepis</i>	Northern Dropseed	G5	S1	E	
<i>Sporobolus neglectus</i>	Small Rushgrass	G5	S1?	X	
<i>Stachys aspera</i>	Rough Hedge-nettle	G4?	S1	E	
<i>Stachys hyssopifolia</i>	Hyssop-leaved Hedge-nettle	G4G5	SU		
<i>Stachys latidens</i>	Broad-toothed Hedge-nettle	G4G5	S1		
<i>Stachys nuttallii</i>	Nuttall's Hedge-nettle	G5?	S1		
<i>Stellaria alsine</i>	Trailing Stitchwort	G5	S1	E	
<i>Stenanthium gramineum</i>	Featherbells	G4G5	S1	T	
<i>Stenanthium leimanthoides</i>	Death-camas	G4Q	S1		
<i>Streptopus roseus</i>	Rose Twisted-stalk	G5	S1S2	T	
<i>Suaeda linearis</i>	Tall Sea-blite	G5	S3		
<i>Symphoricarpos albus</i>	Snowberry	G5	S1	T	
<i>Symphotrichum concolor</i>	Silvery Aster	G5	S1	E	
<i>Symphotrichum depauperatum</i>	Serpentine Aster	G2	S1	E	
<i>Symphotrichum drummondii</i>	Drummond Aster	G5	S1		
<i>Symphotrichum laeve</i> var. <i>concinnum</i>	Steele's Aster	G5T4	SH	X	
<i>Symphotrichum praealtum</i>	Willow Aster	G5	S1		
<i>Symphotrichum shortii</i>	Short's Aster	G5	S3		
<i>Symplocos tinctoria</i>	Sweetleaf	G5	S3		
<i>Taenidia montana</i>	Mountain Pimpernel	G3	S2	T	
<i>Talinum teretifolium</i>	Fameflower	G4	S1	T	
<i>Taxus canadensis</i>	American Yew	G5	S2	T	
<i>Tephrosia spicata</i>	Southern Goat's Rue	G4G5	S1	E	
<i>Thaspium trifoliatum</i>	Purple Meadow -parsnip	G5	S1	E	
<i>Thelypteris simulata</i>	Bog Fern	G4G5	S2	T	
<i>Thuja occidentalis</i>	Arbor-vitae	G5	S1	T	
<i>Tillandsia usneoides</i>	Spanish Moss	G5	SX		
<i>Tofieldia racemosa</i>	Coastal False Asphodel	G5	SX	X	
<i>Torreyochloa pallida</i> var. <i>pallida</i>	Pale Mannagrass	G5T5?	S3		
<i>Torreyochloa pallida</i> var. <i>fernaldii</i>	Fernald's Mannagrass	G5T4Q	S1		
<i>Trachelospermum difforme</i>	Climbing Dogbane	G4G5	S1	E	
<i>Trautvetteria caroliniensis</i>	Carolina Tassel-rue	G5	S3		
<i>Triadenum tubulosum</i>	Large Marsh St. John's -wort	G4?	S1		
<i>Trichoporum planifolium</i>	Bashful Bulrush	G4G5	S2S3		
<i>Trichostema brachiatum</i>	False Pennyroyal	G5	S3		
<i>Trichostema setaceum</i>	Narrow -leaved Bluecurls	G5	S1		
<i>Tridens flavus</i> var. <i>chapmanii</i>	Chapman's Redtop	G5T3	S1		
<i>Trifolium reflexum</i>	Buffalo Clover	G3G4	SH	X	

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<i>Trifolium virginicum</i>	Kate's-mountain Clover	G3	S2S3	T	
<i>Triglochin striata</i>	Three-ribbed Arrow-grass	G5	S1	E	
<i>Trillium cernuum</i>	Nodding Trillium	G5	S3		
<i>Trillium flexipes</i>	Drooping Trillium	G5	S1	E	
<i>Trillium nivale</i>	Snow Trillium	G4	S1	E	
<i>Trillium pusillum</i> (var. <i>virginianum</i>)	Dwarf Trillium	G3T2	S2	T	
<i>Triosteum angustifolium</i>	Narrow-leaved Horse-gentian	G5	S1	E	
<i>Triphora trianthophora</i>	Nodding Pogonia	G3G4	S1	E	
<i>Typha domingensis</i>	Southern Cattail	G4G5	S3		
<i>Utricularia cornuta</i>	Horned Bladderwort	G5	SH		
<i>Utricularia inflata</i>	Swollen Bladderwort	G5	S1	E	
<i>Utricularia purpurea</i>	Purple Bladderwort	G5	S1	T	
<i>Utricularia resupinata</i>	Reversed Bladderwort	G4	S1	E	
<i>Utricularia striata</i>	Fibrous Bladderwort	G4G5	S1	E	
<i>Utricularia subulata</i>	Zig-zag Bladderwort	G5	S3		
<i>Uvularia grandiflora</i>	Large-flowered Bellwort	G5	S1		
<i>Vaccinium macrocarpon</i>	Large Cranberry	G4	S3		
<i>Vaccinium myrtilloides</i>	Velvetleaf Blueberry	G5	S3		
<i>Vaccinium oxycoccos</i>	Small Cranberry	G5	S2	T	
<i>Valeriana pauciflora</i>	Valerian	G4	S1	E	
<i>Valerianella chenopodiifolia</i>	Goose-foot Cornsalad	G5	S1	E	
<i>Valerianella umbilicata</i>	Tall Cornsalad	G3G5	SH	X	
<i>Vernonia gigantea</i>	Giant Ironweed	G5	SU		
<i>Veronica scutellata</i>	Marsh Speedwell	G5	S1	E	
<i>Viburnum lentago</i>	Nannyberry	G5	S1		
<i>Vicia americana</i>	Purple Vetch	G5	SU	X	
<i>Viola appalachensis</i>	Appalachian Blue Violet	G3	S2		
<i>Viola blanda</i> var. <i>palustriformis</i>	Large-leaved White Violet	G4G5T4T5	S1		
<i>Viola rostrata</i>	Long-spurred Violet	G5	S3		
<i>Viola septentrionalis</i>	Northern Blue Violet	G5	SU		
<i>Vitis cinerea</i>	Graybark	G4G5	SU		
<i>Vitis novae-angliae</i>	New England Grape	G4G5Q	SH	X	
<i>Vitis rupestris</i>	Sand Grape	G3	S1		
<i>Wolffia columbiana</i>	Columbian Water-meal	G5	S3		
<i>Wolffia papulifera</i>	Water-meal	G4	S2		
<i>Wolffia punctata</i>	Dotted Water-meal	G5	S2		
<i>Wolffiella floridana</i>	Wolffiella	G5	SH	X	
<i>Woodsia ilvensis</i>	Rusty Woodsia	G5	S1	T	
<i>Xyris fimbriata</i>	Fringed Yelloweyed-grass	G5	S1	E	
<i>Xyris smalliana</i>	Small's Yelloweyed-grass	G5	S1	E	
<i>Zanthoxylum americanum</i>	Northern Prickly-ash	G5	S1	E	
<i>Zephyranthes atamasca</i>	Atamasco Lily	G4G5	S1	E	
<i>Zizaniopsis miliacea</i>	Southern Wildrice	G5	S1	E	
<i>Zizia aurea</i>	Golden Alexanders	G5	S3		

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APPENDIX I

CHANGES TO STATE RANKS AND STATUSES SINCE LAST PUBLISHED LIST (November 2007)

Scientific Name	Common Name	Current Rank	Former Rank	State Status	Former Status
<i>Agalinis fasciculata</i>	Fascicled Gerardia	SH	S1	-	E
<i>Amelanchier obovalis</i>	Coastal Juneberry	S4	SR		
<i>Aristida curtissii</i>	Curtiss' Three-awn	S4	SU		
<i>Axonopus furcatus</i>	Big Carpet Grass	S2?	SU	-	X
<i>Azolla caroliniana</i>	Mosquito Fern	SE	SU		
<i>Bidens discoidea</i>	Swamp Beggar-ticks	S4	S3		
<i>Bromus ciliatus</i>	Fringed Brome	S1?	SU	-	X
<i>Bromus nottowanus</i>	Nottoway's Brome	S1S2	SU	-	X
<i>Chimaphila umbellata</i>	Prince's Pine	S3	S1?		
<i>Desmodium cuspidatum</i>	Large-bracted Tick-trefoil	S1	SU		
<i>Dichanthelium aciculare</i>	Bristling Panicgrass	S2?	SU		
<i>Dichanthelium laxiflorum</i>	Lax-flowered Witchgrass	S1?	SU		
<i>Dryopteris clintoniana</i>	Clinton's Wood-fern	S1	S1	E	-
<i>Eleocharis fallax</i>	Creeping Spikerush	SRF	S3		
<i>Eleocharis flavescens</i>	Pale Spikerush	SRF	S1		
<i>Fraxinus profunda</i>	Pumpkin Ash	S4	S2S3		
<i>Juncus polycephalus</i>	Many-headed Rush	SR	SU		
<i>Liparis liliifolia</i>	Large Twayblade	S2S3	NEW		
<i>Liparis loeselii</i>	Loesel's Twayblade	S1S2	S3		
<i>Lobelia glandulosa</i>	Glandular Lobelia	SRF	SU	-	X
<i>Passiflora incarnata</i>	Purple Passionflower	SE	SU		
<i>Phacelia covillei</i>	Coville's Phacelia	S2	S1	E	
<i>Platanthera psycodes</i>	Small Purple Fringed Orchid	SH	SU	X	X
<i>Polygonum densiflorum</i>	Dense-flowered Knotweed	SNA	S1?	-	E
<i>Polygonum robustius</i>	Stout Smartweed	SU	S1?	X	X
<i>Pycnanthemum clinopodioides</i>	Basil Mountain-mint	SH	S1S2		
<i>Ranunculus carolinianus</i>	Carolina Buttercup	SU	S1?	X	X
<i>Ranunculus hederaceus</i>	Long-stalked Crowfoot	S1	S1	E	X
<i>Rhynchospora microcephala</i>	Tiny-headed Beakrush	S2	S2S3		
<i>Rhynchospora rariflora</i>	Few-flowered Beakrush	SU	S1	X	X
<i>Rhynchospora recognita</i>	Globe Beaksedge	S2	NEW		
<i>Scleria muehlenbergii</i>	Muhlenberg's Nutrush	S1S2	NEW		
<i>Scleria reticularis</i>	Reticulated Nutrush	S2S3	S2		
<i>Solidago rupestris</i>	Rock Goldenrod	SH	S1	X	X
<i>Stenanthium leimanthoides</i>	Death-camas	S1	NEW		
<i>Symphotrichum lowrieanum</i>	Lowrie's Aster	S5	S3		
<i>Torreyochloa pallida</i> var. <i>pallida</i>	Pale Mannagrass	S3	S1S2	-	E

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APPENDIX II

CROSS REFERENCE OF PLANT SYNONYM NAMES

Synonym Name	Current Name
<i>Agalinis decemloba</i>	<i>Agalinis obtusifolia</i>
<i>Agalinis virgata</i>	<i>Agalinis fasciculata</i>
<i>Agave virginica</i>	<i>Manfreda virginica</i>
<i>Agropyron trachycaulum</i>	<i>Elymus trachycaulus</i>
<i>Amelanchier spicata</i>	<i>Amelanchier stolonifera</i>
<i>Ammannia teres</i>	<i>Ammannia latifolia</i>
<i>Anemone virginiana</i> var. <i>riparia</i>	<i>Anemone riparia</i>
<i>Arabis perstellata</i> var. <i>shortii</i>	<i>Arabis shortii</i>
<i>Arctostaphylos alpina</i>	<i>Arctostaphylos uva-ursi</i>
<i>Arctostaphylos rubra</i>	<i>Arctostaphylos uva-ursi</i>
<i>Arenaria caroliniana</i>	<i>Minuartia caroliniana</i>
<i>Arenaria groenlandica</i> var. <i>glabra</i>	<i>Minuartia glabra</i>
<i>Arenaria lateriflora</i>	<i>Moehringia lateriflora</i>
<i>Arenaria peploides</i>	<i>Honckenya peploides</i>
<i>Arenaria stricta</i>	<i>Minuartia michauxii</i>
<i>Aristida purpurascens</i> var. <i>virgata</i>	<i>Aristida virgata</i>
<i>Aristolochia durior</i>	<i>Aristolochia macrophylla</i>
<i>Armoracia aquatica</i>	<i>Armoracia lacustris</i>
<i>Arnoglossum muehlenbergii</i>	<i>Cacalia muehlenbergii</i>
<i>Aronia prunifolia</i>	<i>Photinia floribunda</i>
<i>Asarum virginicum</i>	<i>Hexastylis virginica</i>
<i>Asplenium cryptolepis</i>	<i>Asplenium ruta-muraria</i>
<i>Aster concinnus</i>	<i>Symphotrichum laeve</i> var. <i>concinnum</i>
<i>Aster concolor</i>	<i>Symphotrichum concolor</i>
<i>Aster depauperatus</i>	<i>Symphotrichum depauperatum</i>
<i>Aster drummondii</i>	<i>Symphotrichum drummondii</i>
<i>Aster infirums</i>	<i>Doellingeria infirma</i>
<i>Aster laevis</i> var. <i>concinnum</i>	<i>Symphotrichum laeve</i> var. <i>concinnum</i>
<i>Aster nemoralis</i>	<i>Oclemena nemoralis</i>
<i>Aster praealtus</i>	<i>Symphotrichum praealtum</i>
<i>Aster radula</i>	<i>Eurybia radula</i>
<i>Aster shortii</i>	<i>Symphotrichum shortii</i>
<i>Aster spectabilis</i>	<i>Eurybia spectabilis</i>
<i>Aster steeleorum</i>	<i>Symphotrichum laeve</i> var. <i>concinnum</i>
<i>Athyrium pycnocarpon</i>	<i>Diplazium pycnocarpon</i>
<i>Bacopa acuminata</i>	<i>Mecardonia acuminata</i>
<i>Bacopa stragula</i>	<i>Bacopa in nominata</i>
<i>Botrychium dissectum</i> forma <i>oneidense</i>	<i>Botrychium oneidense</i>
<i>Botrychium lanceolatum</i>	<i>Botrychium lanceolatum</i> ssp. <i>angustisegmentum</i>
<i>Cacalia suaveolens</i>	<i>Hasteola suaveolens</i>
<i>Calopogon pulchellus</i>	<i>Calopogon tuberosus</i>
<i>Carex amphibola</i> var. <i>amphibolia</i> Fernald	<i>Carex planispicata</i>
<i>Carex aquatilis</i> var. <i>substricta</i>	<i>Carex aquatilis</i>
<i>Carex breviar</i> , in part.	<i>Carex molesta</i>
<i>Carex cephalantha</i>	<i>Carex echinata</i>

2010 Rare, Threatened, and Endangered Plants of Maryland

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Synonym Name	Current Name
<i>Carex copulata</i>	<i>Carex laxiculmis</i> var. <i>copulata</i>
<i>Carex crinita</i> var. <i>mitchelliana</i>	<i>Carex mitchelliana</i>
<i>Carex filiformis</i>	<i>Carex lasiocarpa</i>
<i>Carex lanuginosa</i>	<i>Carex pellita</i>
<i>Carex pennsylvanica</i> var. <i>distans</i>	<i>Carex lucorum</i>
<i>Carex ritchei</i>	<i>Carex straminea</i>
<i>Cassia fasciculata</i> var. <i>macrosperma</i>	<i>Chamaecrista fasciculata</i> var. <i>macrosperma</i>
<i>Centunculus minimus</i>	<i>Anagallis minima</i>
<i>Ceratophyllum echinatum</i>	<i>Ceratophyllum echinatum</i>
<i>Chenopodium hybridum</i> var. <i>gigantospermum</i>	<i>Chenopodium gigantospermum</i>
<i>Chenopodium hybridum</i> var. <i>standleyanum</i>	<i>Chenopodium standleyanum</i>
<i>Cimicifuga americana</i>	<i>Actaea podocarpa</i>
<i>Clematis verticillaris</i>	<i>Clematis occidentalis</i>
<i>Convolvulus spithameus</i>	<i>Calystegia spithamea</i>
<i>Coptis groenlandica</i>	<i>Coptis trifolia</i>
<i>Cymophyllus fraseri</i>	<i>Cymophyllus fraserianus</i>
<i>Cyperus aristatus</i>	<i>Cyperus squarrosus</i>
<i>Cyperus inflexus</i>	<i>Cyperus squarrosus</i>
<i>Cyperus tenuifolius</i>	<i>Kyllinga pumila</i>
<i>Dichanthelium aciculare</i> var. <i>aciculare</i>	<i>Dichanthelium aciculare</i>
<i>Digitaria filiformis</i> var. <i>villosa</i>	<i>Digitaria villosa</i>
<i>Dioscorea villosa</i> var. <i>hirticaulis</i>	<i>Dioscorea hirticaulis</i>
<i>Diplachne fascicularis</i>	<i>Leptochloa fusca</i> ssp. <i>fascicularis</i>
<i>Dryopteris cristata</i> var. <i>clintoniana</i>	<i>Dryopteris clintoniana</i>
<i>Dryopteris disjuncta</i>	<i>Gymnocarpium dryopteris</i>
<i>Dryopteris spinulosa</i> var. <i>americana</i>	<i>Dryopteris campyloptera</i>
<i>Eleocharis calva</i>	<i>Eleocharis erythropoda</i>
<i>Epilobium glandulosum</i> var. <i>adenocaulon</i>	<i>Epilobium ciliatum</i>
<i>Eragrostis virginica</i>	<i>Eragrostis refracta</i>
<i>Erianthus alopecuroides</i>	<i>Saccharum alopecuroidum</i>
<i>Erianthus contortus</i>	<i>Saccharum contortum</i>
<i>Erianthus strictus</i>	<i>Saccharum baldwinii</i>
<i>Eriocaulon septangulare</i>	<i>Eriocaulon aquaticum</i>
<i>Eupatoriadelphus maculatus</i>	<i>Eupatorium maculatum</i>
<i>Euphorbia vermiculata</i>	<i>Chamaesyce vermiculata</i>
<i>Euthamia minor</i>	<i>Euthamia tenuifolia</i> var. <i>tenuifolia</i>
<i>Festuca shortii</i>	<i>Festuca paradoxa</i>
<i>Fimbristylis baldwiniana</i>	<i>Fimbristylis annua</i>
<i>Galax urceolata</i>	<i>Galax aphylla</i>
<i>Gentiana crinita</i>	<i>Gentianopsis crinita</i>
<i>Gentiana puberula</i>	<i>Gentiana puberulenta</i>
<i>Gentiana quinquefolia</i>	<i>Gentianella quinquefolia</i>
<i>Gerardia auriculata</i>	<i>Agalinis auriculata</i>
<i>Gerardia laevigata</i>	<i>Aureolaria laevigata</i>
<i>Gillenia stipulata</i>	<i>Porteranthus stipulatus</i>
<i>Glyceria fernaldii</i>	<i>Torreyochloa pallida</i> var. <i>fernaldii</i>
<i>Glyceria pallida</i>	<i>Torreyochloa pallida</i> var. <i>pallida</i>
<i>Habenaria blephariglottis</i>	<i>Platanthera blephariglottis</i>
<i>Habenaria ciliaris</i>	<i>Platanthera ciliaris</i>
<i>Habenaria cristata</i>	<i>Platanthera cristata</i>

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Synonym Name	Current Name
Habenaria fimbriata	Platanthera grandiflora
Habenaria flava	Platanthera flava
Habenaria grandiflora	Platanthera grandiflora
Habenaria peramoena	Platanthera peramoena
Habenaria psychodes	Platanthera psychodes
Habenaria psychodes var. grandiflora	Platanthera grandiflora
Habenaria viridis var. bracteata	Coeloglossum viride
Hedyotis michauxii	Houstonia serpyllifolia
Hedyotis uniflora	Oldenlandia uniflora
Hemicarpha micrantha	Lipocarpha micrantha
Heracleum maximum	Heracleum lanatum
Hibiscus militaris	Hibiscus laevis
Hypericum ascyron	Hypericum pyramidatum
Hypericum tubulosum	Triadenum tubulosum
Isanthus brachiatus	Trichostema brachiatum
Jussiaea decurrens	Ludwigia decurrens
Lachnanthes caroliniana	Lachnanthes caroliniana
Leptochloa fascicularis	Leptochloa fusca ssp. fascicularis
Limosella subulata	Limosella australis
Lophotocarpus calycina	Sagittaria calycina
Lycopodium carolinianum	Lycopodiella caroliniana
Lycopodium inundatum	Lycopodiella inundata
Lycopodium porophyllum	Huperzia porophila
Maianthemum stellatum	Smilacina stellata
Manisuris rugosa	Coelorachis rugosa
Melanthium hybridum	Melanthium latifolium
Myrica heterophylla	Morella caroliniensis
Nemophila microcalyx	Nemophila aphylla
Nymphaea tuberosa	Nymphaea odorata ssp. tuberosa
Onosmodium hispidissimum	Onosmodium molle
Orbexilum pedunculatum var. psoralioides	Psoralea psoralioides
Oryzopsis racemosa	Piptatherum racemosum
Pachistima canbyi	Paxistima canbyi
Panicum aciculare	Dichantherium aciculare
Panicum angustifolium	Dichantherium aciculare
Panicum boreale	Dichantherium boreale
Panicum ensifolium	Dichantherium dichotomum var. ensifolium
Panicum laxiflorum	Dichantherium laxiflorum
Panicum leucothrix	Dichantherium leucothrix
Panicum oligosanthes	Dichantherium oligosanthes
Panicum ravenelii	Dichantherium ravenelii
Panicum scabriusculum	Dichantherium scabriusculum
Panicum tuckermanii	Panicum philadelphicum
Panicum wrightianum	Dichantherium wrightianum
Persea borbonia	Persea palustris
Phlox ovata	Phlox latifolia
Polemonium van-bruntiae	Polemonium vanbruntiae
Polygonum opelousanum	Polygonum hydropiperoides var. opelousanum

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Synonym Name	Current Name
Polypodium polypodioides	Pleopeltis polypodioides
Pseudotaenidia montana	Taenidia montana
Psilocarya nitens	Rhynchospora nitens
Psilocarya scirpoides	Rhynchospora scirpoides
Pteretis pensylvanica	Matteuccia struthiopteris
Ptilimnium fluviatile	Ptilimnium nodosum
Puccinellia fernaldii	Torreyochloa pallida var. fernaldii
Puccinellia pallida	Torreyochloa pallida
Pyrola chlorantha	Pyrola virens
Pyrola secunda	Orthilia secunda
Ranunculus aquatilis	Ranunculus trichophyllus
Ranunculus hispidus var. nitidus	Ranunculus carolinianus
Rhynchospora globularis (in part)	Rhynchospora recognita
Rhynchospora globularis var. recognita	Rhynchospora recognita
Rumex floridanus	Rumex verticillatus
Saccharum alopecuroides	Saccharum alopecuroidum
Saccharum brevibarbe var. contortum	Saccharum contortum
Sagittaria longirostra	Sagittaria australis
Sagittaria spathulata	Sagittaria calycina
Salix humilis	Salix humilis var. tristis
Salix humilis var. microphylla	Salix humilis var. tristis
Salix interior	Salix exigua
Scirpus acutus	Schoenoplectus acutus
Scirpus cylindricus	Schoenoplectus novae-angliae
Scirpus etuberculatus	Schoenoplectus etuberculatus
Scirpus maritimus var. fernaldi	Schoenoplectus novae-angliae
Scirpus smithii	Schoenoplectus smithii
Scirpus subterminalis	Schoenoplectus subterminalis
Scirpus torreyi	Schoenoplectus torreyi
Scirpus verecundus	Trichophorum planifolium
Scleria reticularis (in part)	Scleria muehlenbergii
Scleria reticularis var. pubescens	Scleria muehlenbergii
Scutellaria epilobiifolia	Scutellaria galericulata
Scutellaria parvula var. leonardii	Scutellaria leonardii
Senecio antennarifolius	Packera antennariifolia
Senecio pauperculus	Packera paupercula
Senna marilandica	Cassia marilandica
Silphium asteriscus	Silphium trifoliatum
Sisyrinchium arenicola	Sisyrinchium fuscatum
Smilax tamnifolia	Smilax pseudochina
Solidago elliotii	Solidago latissimifolia
Solidago microcephala	Euthamia tenuifolia var. tenuifolia
Solidago racemosa	Solidago simplex var. racemosa
Solidago rigida	Oligoneuron rigidum
Solidago spathulata	Solidago simplex var. racemosa
Solidago tarda	Solidago arguta var. arguta
Spiraea corymbosa	Spiraea betulifolia
Spiranthes cernua var. ochroleuca	Spiranthes ochroleuca
Stachys cordata	Stachys nuttallii
Stachys hyssopifolia var. ambigua	Stachys aspera

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Synonym Name	Current Name
Stachys riddellii	Stachys nuttallii
Stachys tenuifolia var latidens	Stachys latidens
Synosma suaveolens	Hasteola suaveolens
Thelypteris phegopteris	Phegopteris connectilis
Tillaea aquatica	Crassula aquatica
Tomanthera auriculata	Agalinis auriculata
Tridens chapmanii	Tridens flavus var. chapmanii
Trisetum pensylvanicum	Sphenopholis pensylvanica
Utricularia fibrosa	Utricularia striata
Utricularia gibba	Utricularia biflora
Vernonia altissima	Vernonia gigantea
Viola incognita	Viola blanda var. palustriformis
Xanthoxylum americanum	Zanthoxylum americanum

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APPENDIX III

PLANT SPECIES UNDER REVIEW FOR INCLUSION ON LIST

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK
<i>Desmodium fernaldii</i>	Fernald's tick-trefoil	G4	S?
<i>Gaylussacia dumosa</i>	Dwarf Huckleberry	G5	S?
<i>Hypericum virgatum</i>	Coppery St. Johnswort	G4?	S?
<i>Rhamnus alnifolia</i>	Alderleaf Buckthorn	G5	S?
<i>Rhynchospora inexpansa</i>	Nodding Beakrush	G5	S?
<i>Spartina pectinata</i>	Fresh Water Cordgrass	G5	S?

2010 Rare, Threatened, and Endangered Plants of Maryland

APPENDIX IV

PLANT SPECIES REPORTED, FALSELY REPORTED, OR POTENTIALLY OCCURRING IN MARYLAND

The following species do not regularly occur in Maryland based on currently available information. Although not exhaustive, the list is included to provide clarification for those species whose rank in Maryland may be unclear due to conflicting reports or vague published accounts. For those species with a rank of SR, only unverified reports exist. Species with a rank of SRF have been falsely reported, and the error may persist in the literature. The list is also provided to bring attention to those species that potentially occur in Maryland (SP) and, if documented, their presence could have significant conservation value.

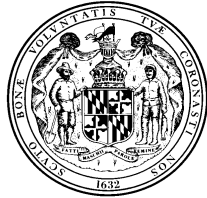
SCIENTIFIC NAME	COMMON NAME	STATE RANK
<i>Aconitum reclinatum</i>	White Monkshood	SRF
<i>Agalinis linifolia</i>	Flax-leaved Gerardia	SP
<i>Anemone riparia</i>	Large White Anemone	SRF
<i>Carex foenea</i>	Dry-spike Sedge	SRF
<i>Carex novae-angliae</i>	New England Sedge	SRF
<i>Carex retrorsa</i>	Retorse Sedge	SP
<i>Carex rostrata</i>	Beaked Sedge	SRF
<i>Carex verrucosa</i>	A Sedge	SRF
<i>Collinsonia verticillata</i>	Whorled Horse-balm	SR
<i>Corydalis aurea</i>	Golden Corydalis	SR
<i>Crataegus flabellata</i>	A Hawthorn	SRF
<i>Croton monanthogynus</i>	Prairie-tea	SR
<i>Diarrhena americana</i>	Twin Oats	SRF
<i>Eleocharis fallax</i>	Creeping Spikerush	SRF
<i>Eleocharis flavescens</i>	Pale Spikerush	SRF
<i>Elymus trachycaulus</i>	Slender Wild Rye	SR
<i>Galax aphylla</i>	Galax	SR
<i>Juncus polycephalus</i>	Many-headed Rush	SR
<i>Lobelia glandulosa</i>	Glandular Lobelia	SRF
<i>Lycopodium sabinifolium</i>	Ground-fir	SRF
<i>Narthecium americanum</i>	Bog Asphodel	SRF
<i>Paspalum boscianum</i>	Bull Paspalum	SR
<i>Poa chapmaniana</i>	Chapman Bluegrass	SR
<i>Populus balsamifera</i>	Balsam Poplar	SRF
<i>Quercus laurifolia</i>	Laurel-leaved Oak	SRF
<i>Rhexia aristosa</i>	Awed Meadow-beauty	SRF
<i>Rhynchospora knieskernii</i>	Knieskern's Beaksedge	SRF
<i>Sagittaria teres</i>	Slender Arrowhead	SRF
<i>Spigelia marilandica</i>	Indian-pink	SRF
<i>Stachys clingmanii</i>	Clingman's Hedge-nettle	SRF
<i>Streptopus amplexifolius</i>	White Mandarin	SR
<i>Thalictrum dasycarpum</i>	Purple Meadowrue	SRF
<i>Thalictrum macrostylum</i>	Piedmont Meadowrue	SRF
<i>Thalictrum subtrotundum</i>	Reclined Meadowrue	SRF
<i>Tofieldia glutinosa</i>	False Asphodel	SR
<i>Triglochin maritima</i>	Seaside Arrow-grass	SR
<i>Trillium pusillum</i> var. <i>pusillum</i>	Least Trillium	SRF
<i>Verbesina virginica</i>	White Crownbeard	SRF

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SCIENTIFIC NAME	COMMON NAME	STATE RANK
Xerophyllum asphodeloides	Eastern Turkeybeard	SRF

Maryland Department of Natural Resources Wildlife and Heritage Service Natural Heritage Program



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New England/Mid-Atlantic Coast Bird Conservation Region Birds of Conservation Concern 2008.

Red-throated Loon (nb)	Short-billed Dowitcher (nb)
Pied-billed Grebe	Least Tern (c)
Horned Grebe (nb)	Gull-billed Tern
Greater Shearwater (nb)	Black Skimmer
Audubon's Shearwater (nb)	Short-eared Owl (nb)
American Bittern	Whip-poor-will
Least Bittern	Red-headed Woodpecker
Snowy Egret	Loggerhead Shrike
Bald Eagle (b)	Brown-headed Nuthatch
Peregrine Falcon (b)	Sedge Wren
Black Rail	Wood Thrush
Wilson's Plover	Blue-winged Warbler
American Oystercatcher	Golden-winged Warbler
Solitary Sandpiper (nb)	Prairie Warbler
Lesser Yellowlegs (nb)	Cerulean Warbler
Upland Sandpiper	Worm-eating Warbler
Whimbrel (nb)	Kentucky Warbler
Hudsonian Godwit (nb)	Henslow's Sparrow
Marbled Godwit (nb)	Nelson's Sharp-tailed Sparrow
Red Knot (<i>rufa</i> ssp.) (a) (nb)	Saltmarsh Sharp-tailed Sparrow
Semipalmated Sandpiper (Eastern) (nb)	Seaside Sparrow (c)
Purple Sandpiper (nb)	Rusty Blackbird (nb)
Buff-breasted Sandpiper (nb)	

(a) ESA candidate, (b) ESA delisted, (c) non-listed subspecies or population of threatened or endangered species, (d) MBTA protection uncertain or lacking, (nb) non-breeding in this bird conservation region
Source: USFWS 2008

EXPLANATION OF SPECIES RANK AND STATUS CODES

STATE RANK

S1 = Highly State rare. Critically imperiled in Maryland because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres in the State) or because of some factor(s) making it especially vulnerable to extirpation.

S2 = State rare. Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated.

S3 = Watch List. Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Species with this rank are not actively tracked by the Wildlife and Heritage Service.

S3.1 = A Watch List species that is actively tracked by the Wildlife and Heritage Service because of the global significance of Maryland occurrences. For instance, a G3 S3 species is globally rare to uncommon, and although it may not be currently threatened with extirpation in Maryland, its occurrences in Maryland may be critical to the long term security of the species. Therefore, its status in the State is being monitored.

S4 = Apparently secure in Maryland with typically more than 100 occurrences in the State or may have fewer occurrences if they contain large numbers of individuals. It is apparently secure under present conditions, although it may be restricted to only a portion of the State.

S5 = Demonstrably secure in Maryland under present conditions.

SH = Historically known from Maryland, but not verified for an extended period (usually 20 or more years), with the expectation that it may be rediscovered.

SNA = Species is not a suitable conservation target

S? = The species has not yet been ranked.

_B = A qualifier at the end of a rank. This species is a migrant and the subrank refers only to the breeding status of the species in Maryland. This species may have a different subrank for nonbreeding populations.

_N = A qualifier at the end of a rank. This species is a migrant and the subrank refers only to the nonbreeding status of the species in Maryland. This species may have a different subrank for breeding populations.

STATE STATUS

State status is the legal protection status of a species as determined by the Maryland Department of Natural Resources in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

E = Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.

T = Threatened; a species of flora or fauna that appears likely, within the foreseeable future, to become endangered in the State.

I = In Need of Conservation; an animal species whose population is limited or declining in the State such that it may become threatened in the foreseeable future if current trends or conditions persist.

X = Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.

FEDERAL STATUS

Federal Status is the legal protection status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CFR 17.

LE = Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.

LT = Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

C = Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

Birds of USNA, North Severn, and the USNA Dairy Farm

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
SEABIRDS/SHOREBIRDS/WADERS						
Cormorants						
<i>Phalacrocorax auritus</i>	Double-crested Cormorant					
Grebes						
<i>Podilymbus podiceps</i>	Pie-billed Grebe		S2B			
<i>Podiceps auritus</i>	Horned Grebe					
Gulls/Terns						
<i>Larus argentatus</i>	Herring Gull					
<i>Larus marinus</i>	Great Black-backed Gull					
<i>Larus delawarensis</i>	Ring-billed Gull					
<i>Larus atracilla</i>	Laughing Gull		S1B			
<i>Sterna antillarum</i>	Least Tern		S2B		T	
<i>Sterna hirundo</i>	Common Tern					
<i>Sterna caspia</i>	Caspian Tern					
<i>Sterna maxima</i>	Royal Tern					
<i>Sterna forsteri</i>	Forster's Tern					
<i>Larus philadelphia</i>	Bonaparte's Gull					
Hérons						
<i>Ardea herodias</i>	Great Blue Heron					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Ardea alba</i>	Great Egret					
<i>Butorides virescens</i>	Green Heron					
<i>Nycticorax nycticorax</i>	Black-crowned Night Heron					
<i>Egretta thula</i>	Snowy Egret					
Killdeer						
<i>Charadrius vociferus</i>	Killdeer					
Loons						
<i>Gavia stellata</i>	Red-throated Loon					
<i>Gavia immer</i>	Common Loon					
Plovers						
<i>Charadrius semipalmatus</i>	Semipalmated Plover					
Rails						
<i>Fulica americana</i>	American Coot					
Sandpipers						
<i>Actitis macularia</i>	Spotted Sandpiper		S3S4B			
<i>Calidris mauri</i>	Western Sandpiper					
<i>Tringa flavipes</i>	Lesser Yellowlegs					
<i>Tringa melanoleuca</i>	Greater Yellowlegs					
<i>Limnodromus sp.</i>	Dowitcher sp.					
Ducks, Geese, Swans						
<i>Aix sponsa</i>	Wood Duck					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Anas clypeata</i>	Northern Shoveler					
<i>Anas platyrhynchos</i>	Mallard					
<i>Anas rubripes</i>	American Black Duck					
<i>Anas strepera</i>	Gadwall		S2B			
<i>Aythya affinis</i>	Lesser Scaup					
<i>Aythya americana</i>	Redhead					
<i>Aythya marila</i>	Greater Scaup					
<i>Aythya valisineria</i>	Canvasback					
<i>Branta canadensis</i>	Canada Goose					
<i>Bucephala clangula</i>	Common Goldeneye					
<i>Bucephala albeola</i>	Bufflehead					
<i>Clangula hyemalis</i>	Long-tailed Duck (Oldsquaw)					
<i>Cygnus columbianus</i>	Mute Swan					
<i>Cygnus olor</i>	Tundra Swan					
<i>Lophodytes cucullatus</i>	Hooded Merganser		S1B			
<i>Melanitta perspicillata</i>	Surf Scoter					
<i>Mergus serrator</i>	Red-breasted Merganser					
<i>Oxyura jamaicensis</i>	Ruddy Duck					
QUAIL						
<i>Colinus virginianus</i>	Northern Bobwhite					
RAPTORS						

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
Eagles, Falcon, Hawks						
<i>Accipiter cooperii</i>	Cooper's Hawk					
<i>Accipiter striatus</i>	Sharp-shinned Hawk		S1S2B			
<i>Buteo jamaicensis</i>	Red-tailed Hawk					
<i>Buteo lineatus</i>	Red-shouldered Hawk					
<i>Buteo platypterus</i>	Broad-winged Hawk					
<i>Circus cyaneus</i>	Northern Harrier		S2B			
<i>Falco columbarius</i>	Merlin					
<i>Falco peregrinus</i>	Peregrine Falcon		S2		I	not nesting
<i>Falco sparverius</i>	American Kestrel					
<i>Haliaeetus leucocephalus</i>	Bald Eagle		S3.1B			not nesting
<i>Pandion haliaetus</i>	Osprey					
Vultures						
<i>Cathartes aura</i>	Turkey Vulture					
<i>Coragyps atratus</i>	Black Vulture					
WOODPECKERS						
<i>Colaptes auratus</i>	Northern Flicker/Common Flicker					
<i>Melanerpes carolinus</i>	Red-bellied Woodpecker					
<i>Picoides pubescens</i>	Downy Woodpecker					
<i>Picoides villosus</i>	Hairy Woodpecker					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Sphyrapicus varius</i>	Yellow-bellied Sapsucker		SHB			
CUCKOOS						
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo					
DOVES						
<i>Columba livia</i>	Rock Pigeon					
<i>Zenaida macroura</i>	Mourning dove					
HUMMINGBIRDS/SWIFTS						
<i>Archilochus colubris</i>	Ruby Throated Hummingbird					
<i>Chaetura pelagica</i>	Chimney Swift					
KINGFISHERS						
<i>Ceryle alcyon</i>	Belted Kingfisher					
OWLS						
<i>Asio flammeus</i>	Short-eared Owl		S1B		E	no nests spotted
<i>Bubo virginianus</i>	Great Horned Owl					
<i>Otus asio</i>	Eastern Screech Owl					
<i>Strix varia</i>	Barred Owl					
PERCHING BIRDS						
Blackbirds, Orioles						
<i>Agelaius phoeniceus</i>	Red-winged Blackbird					
<i>Dolichonyx oryzivorus</i>	Bobolink					
<i>Icterus galbula</i>	Baltimore Oriole					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Icterus spurius</i>	Orchard Oriole					
<i>Molothrus ater</i>	Brown-headed Cowbird					
<i>Quiscalus quiscula</i>	Common Grackle					
<i>Sturnella magna</i>	Eastern Meadowlark					
Buntings, Grosbeaks						
<i>Cardinalis cardinalis</i>	Northern Cardinal					
<i>Guiraca caerulea</i>	Blue Grosbeak					
<i>Passerina cyanea</i>	Indigo Bunting					
Chickadees, Titmice						
<i>Baeolophus bicolor</i>	Tufted Titmouse					
<i>Poecile carolinensis</i>	Carolina Chickadee					
Creepers						
<i>Certhia americana</i>	Brown Creeper					
Crows, Jays						
<i>Corvus brachyrhynchos</i>	American Crow					
<i>Corvus ossifragus</i>	Fish Crow					
<i>Cyanocitta cristata</i>	Blue Jay					
Finches						
<i>Carpodacus mexicanus</i>	House Finch					
Flycatchers						
<i>Contopus virens</i>	Eastern Wood Pewee					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Empidonax flaviventris</i>	Yellow-bellied Flycatcher					
<i>Empidonax traillii</i>	Willow Flycatcher/Trail's Flycatcher					
<i>Empidonax virescens</i>	Acadian Flycatcher					
<i>Myiarchus crinitus</i>	Great Crested Flycatcher					
<i>Sayornis phoebe</i>	Eastern Phoebe					
<i>Tyrannus tyrannus</i>	Eastern Kingbird					
Gnatcatchers						
<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher					
Kinglets						
<i>Regulus satrapa</i>	Golden-crowned Kinglet		S2B			
<i>Regulus calendula</i>	Ruby-crowned Kinglet					
Mimics, Thrashers						
<i>Mimus polyglottos</i>	Northern Mockingbird					
<i>Dumetella carolinensis</i>	Gray Catbird					
<i>Toxostoma rufum</i>	Brown Thrasher					
Nuthatches						
<i>Sitta canadensis</i>	Red-breasted Nuthatch		S1B			
<i>Sitta carolinensis</i>	White-breasted Nuthatch					
Old World Sparrows						
<i>Passer domesticus</i>	House Sparrow					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
Pipits						
<i>Anthus rubescens</i>	American Pipit					
Towhees, Sparrows						
<i>Ammodramus savannarum</i>	Grasshopper Sparrow					
<i>Junco hyemalis</i>	Dark-Eyed Junco		S2B			
<i>Melospiza georgiana nigrscens</i>	Coastal Plain Swamp Sparrow		S2B		I	
<i>Melospiza lincolni</i>	Lincoln's Sparrow					
<i>Melospiza melodia</i>	Song Sparrow					
<i>Passerculus sandwichensis</i>	Savannah Sparrow		S3S4B			
<i>Pipilo erythrophthalmus</i>	Rufous-sided Towhee					
<i>Pipilo erythrophthalmus</i>	Eastern Towhee					
<i>Spizella arborea</i>	American Tree Sparrow					
<i>Spizella passerina</i>	Chipping Sparrow					
<i>Spizella pusilla</i>	Field Sparrow					
<i>Zonotrichia albicollis</i>	White-throated Sparrow					
<i>Zonotrichia leucophrys</i>	White-crowned Sparrow					
Shrikes						
<i>Lanius ludovicianus</i>	Loggerhead Shrike		S1B		E	no nests spotted
Starling						
<i>Sturnus vulgaris</i>	European Starling					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
Swallows						
<i>Hirundo rustica</i>	Barn Swallow					
<i>Progne subis</i>	Purple Martin					
<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow					
<i>Tachycineta bicolor</i>	American Tree Swallow					
Tanagers						
<i>Piranga olivacea</i>	Scarlet Tanager					
Thrushes						
<i>Catharus fuscescens</i>	Veery					
<i>Catharus guttatus</i>	Hermit Thrush		S3S4B			
<i>Hylocichla mustelina</i>	Wood Thrush					
<i>Sialia sialis</i>	Eastern Bluebird					
<i>Turdus migratorius</i>	American Robin					
Vireos						
<i>Vireo griseus</i>	White-eyed Vireo					
<i>Vireo olivaceus</i>	Red-eyed Vireo					
Warblers						
<i>Dendroica coronata</i>	Yellow-rumped Warbler					
<i>Dendroica magnolia</i>	Magnolia Warbler		S3S4B			
<i>Dendroica petechia</i>	Yellow Warbler					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Dendroica pinus</i>	Pine Warbler					
<i>Dendroica striata</i>	Blackpoll Warbler					
<i>Geothlypis trichas</i>	Common Yellowthroat					
<i>Icteria virens</i>	Yellow-breasted Chat					
<i>Mniotilta varia</i>	Black-and-white Warbler					
<i>Oporornis philadelphia</i>	Mourning Warbler		S1B		E	no nests spotted
<i>Parula americana</i>	Northern Parula					
<i>Seiurus aurocapillus</i>	Oven Bird					
<i>Setophaga ruticilla</i>	American Redstart					
<i>Vermivora ruficapilla</i>	Nashville Warbler		S1S2B		I	
<i>Wilsonia canadensis</i>	Canada Warbler		S3B			
Waxwings						
<i>Bombycilla cedrorum</i>	Cedar Waxwing					
Wrens						
<i>Cistothorus palustris</i>	Marsh Wren					
<i>Thryothorus ludovicianus</i>	Carolina Wren					
<i>Troglodytes aedon</i>	House Wren					
<i>Troglodytes troglodytes</i>	Winter Wren		S2B			

¹Surveys primarily occurred on North Severn with occasional surveys at USNA.

²No comprehensive surveys have been conducted. These data represent incidental observations only.

Sources: Anne Arundel Bird Club Observers 1999; Bystrack 2002, 2003; Environmental Systems Analysis, Inc. 2005; Haury et al. 1996; Haury A. and S. Ricciardi 1997; Haury A. 2004; Ricciardi S. 1998; Sprenger A. 2005, 2006; USFWS 2000b. U.S. Navy 1997; U.S. Navy 2001c., MDNR 2010a

Fish of USNA, North Severn, and the USNA Dairy Farm

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
CRABS						
<i>Callinectes sapidus</i>	Blue Crab	SR				
CARPS/MINNOWS						
<i>Cyprinus carpio</i>	Carp	SR, GP				
<i>Notropis hudsonius</i>	Spottail Shiner	SR				
CATFISH						
<i>Ameiurus catus</i>	White Catfish	GP	SU			
FLATFISH/FLOUNDERS						
<i>Paralichthys dentatus</i>	Summer Flounder	SR				
<i>Pseudopleuronectes americanus</i>	Winter Flounder	SR				
<i>Trinectes maculatus</i>	Hogchoker	SR				
FRESHWATER EELS						
<i>Anguilla rostrata</i>	American Eel	SR, GP				
HERRINGS						
<i>Alosa aestivalis</i>	Blueback Herring	SR				
<i>Alosa pseudoharengus</i>	Alewife	SR				
<i>Anchoa hepsetus</i>	Striped Anchovy	SR				
<i>Anchoa mitchilli</i>	Bay Anchovy	SR				
<i>Brevoortia tyrannus</i>	Atlantic Menhaden	SR				

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Dorosoma cepedianum</i>	Gizzard Shad	SR				
KILLIFISHES						
<i>Cyprinodon variegatus</i>	Sheepshead Minnow	SR				
<i>Fundulus diaphanus</i>	Banded Killifish	SR				
<i>Fundulus heteroclitus</i>	Mummichog	SR				
<i>Fundulus majalis</i>	Striped Killifish	SR				
<i>Lucania parva</i>	Rainwater Killifish	SR				
LIZARDFISHES						
<i>Synodus foetens</i>	Inshore Lizardfish	SR				
NEEDLEFISHES						
<i>Strongylura marina</i>	Atlantic Needlefish	SR				
PERCHES/SUNFISH/TEMPERATE BASSES						
<i>Chasmodes bosquianus</i>	Striped Blenny	SR				
<i>Cynoscion regalis</i>	Weakfish	SR				
<i>Etheostoma vitreum</i>	Glassy Darter	DF	S1S2		T	
<i>Gobiosox strumosus</i>	Skillet Fish	SR				
<i>Gobiosoma bosc</i>	Naked Goby	SR				
<i>Leiostomus xanthurus</i>	Spot	SR				
<i>Lepomis gibbosus</i>	Pumpkinseed	SR				
<i>Lepomis</i> sp.	Bluegill	GP				

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Micropogonias undulatus</i>	Atlantic Croaker	SR				
<i>Morone americana</i>	White Perch	SR				
<i>Morone saxatilis</i>	Striped Bass	SR				
<i>Parablennius marmoreus</i>	Seaweed Blenny	SR				
<i>Perca flavescens</i>	Yellow Perch	SR				
<i>Pomatomus saltatrix</i>	Bluefish	SR				
<i>Pomoxis nigromaculatus</i>	Black Crappie	GP				
PICKERELS						
<i>Esox niger</i>	Chain Pickerel	SR				
RAYS						
<i>Rhinoptera bonasus</i>	Cownose Ray	SR				
SILVERSIDES						
<i>Membras martinica</i>	Rough Silverside	SR				
<i>Menidia beryllina</i>	Inland Silverside	SR				
<i>Menidia menidia</i>	Atlantic Silverside	SR				
STICKLEBACKS/PIPEFISH						
<i>Apeltes quadracus</i>	Fourspine Stickleback	SR				
<i>Gasterosteus aculeatus</i>	Threespine Stickleback	SR				
<i>Syngnathus fuscus</i>	Northern Pipefish	SR				
TOADFISHES						

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Opsanus tau</i>	Oyster Toadfish	SR				

SR = Severn River

GP = U.S. Naval Station area manmade freshwater pond at Greenbury Point

DF = Little Patuxent River at the Dairy Farm

Sources: MDNR 1994, 2008; U.S. Navy 1985, MDNR 2010a

Reptiles and Amphibians of USNA, North Severn, and the USNA Dairy Farm

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
AMPHIBIANS						
Frogs						
<i>Hyla versicolor</i>	Gray Treefrog					
<i>Pseudacris crucifer</i>	Spring Peeper					
<i>Rana catesbeiana</i>	Bullfrog					
<i>Rana clamitans melanota</i>	Green Frog					
<i>Rana palustris</i>	Pickerel Frog					
<i>Rana sphenoccephala</i> (<i>R. utricularia</i>)	Southern Leopard Frog					
<i>Rana sylvatica</i>	Wood frog					
Salamanders						
<i>Plethodon cinereus</i>	Redback Salamander					
Toads						
<i>Bufo americanus</i>	American Toad					
REPTILES						
Snakes						
<i>Carphophis amoenus</i>	Eastern Worm Snake					
<i>Coluber constrictor</i>	Northern Black Racer					
<i>Elaphe obsoleta</i>	Black Rat Snake					
<i>Heterodon platyrhinos</i>	Eastern Hognose Snake					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Nerodia erythrogaster</i>	Red-belly Water Snake					
<i>Nerodia sipedon</i>	Northern Water Snake					
<i>Thamnophis sirtalis</i>	Eastern Garter Snake					
Skinks						
<i>Eumeces fasciatus</i>	Five-lined Skink					
Turtles						
<i>Chelydra serpentina</i>	Common Snapping Turtle					
<i>Malaclemys terrapin</i>	Northern Diamondback Terrapin					
<i>Kinosternon subrubrum</i>	Eastern Mud Turtle					
<i>Chrysemys picta</i>	Eastern Painted Turtle					
<i>Terrapene carolina</i>	Eastern Box Turtle					

Sources: Environmental Systems Analysis, Inc., 2005; U.S. Navy 1985, 1997; Wood R. 1998

Mammals of USNA, North Severn, and the USNA Dairy Farm

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
DEER						
<i>Odocoileus virginianus</i>	White-tailed Deer					
FOXES/RACCOONS						
<i>Procyon lotor</i>	Raccoon					
<i>Urocyon cinereoargenteus</i>	Gray Fox					
<i>Vulpes vulpes</i>	Red Fox					
BATS						
<i>Myotis lucifugus</i>	Little Brown Bat					
OPOSSUMS						
<i>Didelphis marsupialis</i>	Opossum					
MOLES/SHREWS						
<i>Blarina brevicauda</i>	Short-tailed Shrew					
<i>Scalopus aquaticus</i>	Eastern Mole					
RABBITS						
<i>Sylvilagus floridiana</i>	Eastern Cottontail					
RODENTS						
Mice, Rats						
<i>Microtis pennsylvanicus</i>	Meadow Vole					
<i>Mus musculus</i>	House mouse					

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Ondatra zibethicus</i>	Muskrat					
<i>Peromyscus leucopus</i>	White-footed Mouse					
<i>Peromyscus maniculatus</i>	Deer Mouse					
<i>Rattus norvegicus</i>	Norway Rat					
Chipmunks, Squirrels, Woodchucks						
<i>Marmota monax</i>	Woodchuck					
<i>Sciurus carolinensis</i>	Gray Squirrel					
<i>Tamias striatus</i>	Chipmunk					

Sources: Environmental Systems Analysis, Inc. 2005; Healey, S. 2008; U.S. Navy 1985, 1997, 2001c; Wood, R. 1998.

Moths and Butterflies of USNA, North Severn, and the USNA Dairy Farm

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
BRUSH-FOOTED BUTTERFLIES						
<i>Boloria bellona</i>	Meadow Fritillary	GP				
<i>Cercyonis pegala</i>	Common Wood Nymph	GP				
<i>Danaus plexippus</i>	Monarch	GP				
<i>Euptoieta claudia</i>	Variegated Fritillary	GP				
<i>Junonia coenia</i>	Common Buckeye	GP				
<i>Limenitis archippus</i>	Viceroy	GP				
<i>Limenitis arthemis astyanax</i>	Red-spotted Purple	GP				
<i>Megisto cymela</i>	Little Wood Satyr	GP				
<i>Nymphalis antiopa</i>	Mourning Cloak	GP				
<i>Phyciodes tharos</i>	Pearl Crescent	GP				
<i>Polygonia interrogationis</i>	Question Mark	GP				
<i>Speyeria cybele</i>	Great Spangled Fritillary	GP				
<i>Vanessa atalanta</i>	Red Admiral	GP				
<i>Vanessa cardui</i>	Painted Lady	GP				
<i>Vanessa virginiensis</i>	American Lady/American Painted Lady	GP				
GOSSAMER-WING BUTTERFLIES						
Coppers		GP				

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Lycaena phlaeas</i>	American Copper/Little Copper	GP				
Blues						
<i>Celastrina ladon</i>	Spring Azure	GP				
<i>Cupido comyntas</i>	Eastern Tailed-Blue	GP				
Hairstreaks						
<i>Calycopis cecrops</i>	Red-banded Hairstreak	GP				
<i>Parrhasius m-album</i>	White M Hairstreak	GP				
<i>Satyrium titus</i>	Coral Hairstreak	GP				
<i>Strymon melinus</i>	Gray Hairstreak	GP				
SKIPPERS						
<i>Ancyloxypha numitor</i>	Least Skipper	GP				
<i>Atalopedes campestris</i>	Sachem	GP				
<i>Epargyreus clarus</i>	Silver-spotted Skipper	GP				
<i>Erynnis baptisiae</i>	Wild Indigo Duskywing	GP				
<i>Erynnis horatius</i>	Horace's Duskywing	GP				
<i>Euphyes vestris</i>	Dun Skipper	GP				
<i>Hylephila phyleus</i>	Fiery Skipper	GP				
<i>Lerema accius</i>	Clouded Skipper	GP				
<i>Nastra Iherminier</i>	Swarthy Skipper	GP				
<i>Panoquina ocola</i>	Ocola Skipper	GP				

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Pholisora catullus</i>	Common Sootywing	GP				
<i>Poanes aaroni</i>	Aaron's Skipper	GP				
<i>Poanes viator</i>	Broad-winged Skipper	GP				
<i>Poanes zabulon</i>	Zabulon Skipper	GP				
<i>Polites origenes</i>	Crossline Skipper	GP				
<i>Polites peckius</i>	Peck's Skipper	GP				
<i>Polites themistocles</i>	Tawny-edged Skipper	GP				
<i>Pompeius verna</i>	Little Glassywing	GP				
<i>Pyrgus communis</i>	Common Checkered-Skipper	GP				
<i>Staphylus hayhurstii</i>	Hayhurst's Scallopwing	GP				
<i>Thorybes bathyllus</i>	Southern Cloudywing	GP				
<i>Thymelicus lineola</i>	European Skipper	GP				
<i>Urbanus proteus</i>	Long-tailed Skipper	GP				
<i>Wallengrenia egeremet</i>	Northern Broken Dash	GP				
SWALLOWTAILS		GP				
<i>Battus philenor</i>	Pipevine Swallowtail	GP				
<i>Papilio glaucus</i>	Eastern Tiger Swallowtail	GP				
<i>Papilio polyxenes</i>	Black Swallowtail	GP				
<i>Papilio troilus</i>	Spicebush Swallowtail	GP				
SULPHURS/WHITES		GP				
Sulphurs						

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Notes
<i>Abaeis nicippe</i>	Sleepy Orange	GP				
<i>Colias eurytheme</i>	Orange Sulphur	GP				
<i>Colias philodice</i>	Clouded Sulphur	GP				
<i>Phoebis sennae</i>	Cloudless Sulphur	GP				
<i>Pyrisitia lisa</i>	Little Yellow	GP				
Whites						
<i>Anthocharis midea</i>	Falcate Orangetip	GP				
<i>Colias eurytheme</i>	Alfalfa Butterfly	GP				
<i>Pieris rapae</i>	Cabbage White	GP				

GP = Greenbury Point

Source: Haury, A. 2004; U.S. Navy 2001c; Wierenga, H. 1997, 1998.

Plants of USNA, North Severn, and the USNA Dairy Farm

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Abutilon theophrasti</i>	Velvetleaf					I
<i>Acer negundo</i>	Boxelder					N
<i>Acer platanoides</i>	Norway Maple					I
<i>Acer rubrum</i>	Red Maple					N
<i>Acer saccharinum</i>	Silver Maple					N
<i>Achillea millefolium</i>	Yarrow					N/I
<i>Acorus calamus</i>	Sweet Flag					N
<i>Agrimonia parviflora</i>	Small-flowered Agrimony					N
<i>Agrostis hyemalis</i>	Ticklegrass					N
<i>Agrostis stolonifera</i>	Redtop					N
<i>Ailanthus altissima</i>	Tree of Heaven					I
<i>Albizia julibrissin</i>	Mimosa					I
<i>Alisma plantago-aquatica</i>	Water Plantain					I
<i>Allium vineale</i>	Onion Grass					I
<i>Ambrosia artemisiifolia</i>	Common Ragweed					N
<i>Ambrosia trifida</i>	Giant Ragweed	DF				N
<i>Amelanchier</i> sp.	Serviceberry	DF				N
<i>Amorpha fruticosa</i>	False Indigo					N
<i>Andropogon gerardii</i>	Big Blue Stem					N

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Andropogon virginicus</i>	Broomsedge	DF				N
<i>Antennaria neglecta</i>	Field-pussytoes					N
<i>Antennaria plantaginifolia</i>	Plantain-leaved Pussytoes					N
<i>Anthoxanthum odoratum</i>	Sweet Vernal Grass					I
<i>Apocynum cannabinum</i>	Indian Hemp					N
<i>Aralia spinosa</i>	Devil's Walkingstick					N
<i>Arisaema triphyllum</i>	Jack-in-the-Pulpit					N
<i>Aristida dichotoma</i>	Church-mouse Three-awn					N
<i>Aristida obliquantha</i>	Prairie Three-awn					N
<i>Artemisia vulgaris</i>	Mugwort					I
<i>Asclepias amplexicaulis</i>	Clasping Milkweed					N
<i>Asclepias incarnata</i>	Swamp Milkweed	DF				N
<i>Asclepias syriaca</i>	Common Milkweed					N
<i>Asclepias tuberosa</i>	Butterflyweed					N
<i>Asclepias viridiflora</i>	Green Milkweed					N
<i>Asparagus officinalis</i>	Asparagus					I
<i>Baccharis halimifolia</i>	Groundsel Tree					N
<i>Bambusa</i> spp.	Bamboo	DF				I
<i>Barbarea vulgaris</i>	Common Wintercress					I
<i>Betula nigra</i>	River Birch	DF				N
<i>Bidens cernua</i>	Nodding Beggartick					N

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Bidens mitis</i>	Smallfruit Beggartick	DF	S1		E	N
<i>Bidens polylepis</i>	Tickseed Sunflower					N
<i>Boehmeria cylindrica</i>	False Nettle					N
<i>Bromus commutatus</i>	Hairy Chess					I
<i>Bromus</i> sp.	A Brome Grass					N/I
<i>Campsis radicans</i>	Trumpet Creeper	DF				N
<i>Carex crinita</i>	Fringed Sedge					N
<i>Carex frankii</i>	Frank's Sedge					N
<i>Carex longii</i>	Long's Sedge					N
<i>Carex lurida</i>	Lurid Sedge					N
<i>Carex pensylvanica</i>	Pennsylvania Sedge					N
<i>Carex swanii</i>	Swan's Sedge					N
<i>Carex tribuloides</i>	Blunt Broom Sedge					N
<i>Carex vulpinoidea</i>	Foxtail Sedge					N
<i>Carpinus caroliniana</i>	Musclewood	DF				N
<i>Carya alba</i>	Mockernut Hickory					N
<i>Carya cordiformis</i>	Bitternut Hickory					N
<i>Carya glabra</i>	Pignut Hickory					N
<i>Carya ovata</i>	Shagbark Hickory					N
<i>Carya pallida</i>	Sand Hickory					N
<i>Catalpa bignonioides</i>	Southern Catalpa					N

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Celastrus orbiculatus</i>	Oriental Bittersweet	DF				I
<i>Centaurea jacea</i>	Brown Knapweed					I
<i>Cephalanthus occidentalis</i>	Buttonbush					N
<i>Cercis canadensis</i>	Redbud					N
<i>Chamaecrista fasciculata</i>	Partridge Pea					N
<i>Chenopodium album</i>	Lamb's-quarters					N/I
<i>Chrysanthemum leucanthemum</i>	Ox-eye Daisy					I
<i>Cichorium intybus</i>	Chicory					I
<i>Cinna arundinacea</i>	Sweet Woodreed	DF				N
<i>Cirsium arvense</i>	Canada Thistle					I
<i>Cirsium vulgare</i>	Bull Thistle					I
<i>Clematis</i> sp.	A Clematis					N/I
<i>Commelina communis</i>	Asiatic Dayflower					I
<i>Convolvulus arvensis</i>	Field Bindweed					I
<i>Conyza canadensis</i>	Horseweed					N
<i>Cornus florida</i>	Flowering Dogwood					N
<i>Cornus sericea</i>	Redosier Dogwood	DF				N
<i>Coronilla</i> sp.	Crown Vetch					N/I
<i>Cortaderia selloana</i>	Pampas Grass					I
<i>Cynanchum laeve</i>	Honeyvine					N

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Cynodon dactylon</i>	Bermuda Grass					I
<i>Cyperus lancastricensis</i>	Lancaster's Sedge		SU			N
<i>Cyperus strigosus</i>	Straw-colored Nutsedge					I
<i>Danthonia spicata</i>	Povertygrass					N
<i>Datura stramonium</i>	Jimsonweed					I
<i>Daucus carota</i>	Queen Anne's Lace					I
<i>Deschampsia flexuosa</i>	Hairgrass					N
<i>Desmodium ciliare</i>	Small-leaved Tick-trefoil					N
<i>Desmodium paniculatum</i>	Panicled Tick-trefoil					N
<i>Desmodium perplexum</i>	Beggar's-lice					N
<i>Dichanthelium acuminatum</i>	Tapered Rosette Grass					N
<i>Dichanthelium clandestinum</i>	Deer's-tongue Panic Grass	DF				N
<i>Dichanthelium scoparium</i>	Velvet Panicum					N
<i>Digitaria cognata</i>	Fall Witchgrass					N
<i>Digitaria ischaemum</i>	Smooth Crabgrass					I
<i>Digitaria sanguinalis</i>	Crabgrass					I
<i>Diospyros virginiana</i>	Persimmon	DF				N
<i>Draba verna</i>	Whitlow Mustard					I
<i>Duchesnea indica</i>	Indian Strawberry					I
<i>Echinochloa crusgalli</i>	Barnyard Grass	DF				I

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Echinocystis lobata</i>	Spiny Cucumber					N
<i>Elaeagnus angustifolia</i>	Russian Olive	DF				I
<i>Elaeagnus umbellata</i>	Autumn Olive					I
<i>Eleocharis obtusa</i>	Blunt Spikerush					N
<i>Eleusine indica</i>	Quackgrass					I
<i>Elymus virginicus</i>	Virginia Wildrye	DF				N
<i>Eragrostis curvula</i>	Weeping Lovegrass					I
<i>Eragrostis pectinacea</i>	Carolina Lovegrass					N
<i>Eragrostis spectabilis</i>	Purple Lovegrass					N
<i>Erechtites hieracifolia</i>	Fireweed					N
<i>Erigeron annuus</i>	Daisy Fleabane					N
<i>Euonymus americanus</i>	Strawberry Bush					N
<i>Eupatoriadelphus fistulosus</i>	Joe-pye Weed					N
<i>Eupatorium hyssopifolium</i>	Hyssop-leaved Thoroughwort					N
<i>Eupatorium serotinum</i>	Late-flowering Thoroughwort					N
<i>Euphorbia maculata</i>	Milk Purslane					N
<i>Euphorbia nutans</i>	Eyebane					N
<i>Euthamia graminifolia</i>	Grass-leaved Goldenrod					N
<i>Fagus grandifolia</i>	American Beech	DF				N
<i>Festuca rubra</i>	Red Fescue					N

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Fragaria vesca</i>	Woodland Strawberry					I
<i>Fragaria virginiana</i>	Virginia Strawberry					N
<i>Fraxinus pennsylvanica</i>	Green Ash	DF				N
<i>Galium tinctorium</i>	Clayton's Bedstraw					N
<i>Gamochaeta purpurea</i>	Purple Cudweed					N
<i>Gaylussacia frondosa</i>	Huckleberry					N
<i>Glechoma hederacea</i>	Ground Ivy					I
<i>Hamamelis virginiana</i>	Witchhazel					N
<i>Hedera helix</i>	English Ivy					I
<i>Hemerocallis fulva</i>	Common Daylily					I
<i>Hesperis matronalis</i>	Dame's Rocket					I
<i>Heterotheca subaxillaris</i>	Camphorweed					N
<i>Hibicus moscheutos</i>	Marsh Mallow					N
<i>Hieracium gronovii</i>	Hairy Hawkweed					N
<i>Hypericum punctatum</i>	Spotted St. Johnswort					N
<i>Ilex opaca</i>	American Holly	DF				N
<i>Ilex verticillata</i>	Winterberry	DF				N
<i>Impatiens capensis</i>	Spotted Jewelweed	DF				N
<i>Ipomoea pandurata</i>	Wild Potato Vine					N
<i>Iris pseudacorus</i>	Yellow Flag					N
<i>Juglans nigra</i>	Black Walnut	DF				I

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Juncus canadensis</i>	Canada Rush					N
<i>Juncus effusus</i>	Soft Rush					N
<i>Juncus marginatus</i>	Grass-leaved Rush					N
<i>Juncus tenuis</i>	Path Rush					N
<i>Juniperus virginiana</i>	Eastern Redcedar	DF				N
<i>Kalmia latifolia</i>	Mountain Laurel					N
<i>Lactuca canadensis</i>	Wild Lettuce					I
<i>Lamium purpureum</i>	Purple Dead Nettle					I
<i>Laportea canadensis</i>	Canadian Woodnettle	DF				N
<i>Lepidium virginicum</i>	Wild Peppergrass					N
<i>Lespedeza angustifolia</i>	Narrow-leaved Lespedeza					N
<i>Lespedeza bicolor</i>	Bicolor Lespedeza					I
<i>Lespedeza capitata</i>	Round-headed Bushclover					N
<i>Lespedeza cuneata</i>	Chinese Lespedeza					I
<i>Lespedeza striata</i>	Japanese Clover					I
<i>Lespedeza virginica</i>	Slender Bushclover					N
<i>Ligustrum</i> spp.	Privet					I
<i>Ligustrum vulgare</i>	European Privet					I
<i>Linaria canadensis</i>	Blue Toadflax					N
<i>Linaria vulgaris</i>	Butter-and-eggs					I
<i>Lindera benzoin</i>	Spicebush					N

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Liquidambar styraciflua</i>	Sweetgum	DF				N
<i>Liriodendron tulipifera</i>	Tuliptree	DF				N
<i>Lolium perenne</i>	Perennial Ryegrass					I
<i>Lonicera japonica</i>	Japanese Honeysuckle	DF				I
<i>Lonicera tatarica</i>	Tatarian Honeysuckle					I
<i>Ludwigia alternifolia</i>	Seedbox					N
<i>Ludwigia palustris</i>	Marsh Seedbox	DF				N
<i>Lychnis alba</i>	White Campion					I
<i>Maianthemum racemosum</i>	False Solomon's Seal					N
<i>Malus</i> sp.	Apple	DF				I
<i>Medicago lupulina</i>	Black Medic					I
<i>Melilotus officinalis</i>	Yellow Sweet Clover					I
<i>Microstegium vimineum</i>	Japanese Stiltgrass	DF				I
<i>Miscanthus sinensis</i>	Chinese Miscanthus					I
<i>Monarda punctata</i>	Spotted Horsemint					N
<i>Morus rubra</i>	Red Mulberry					N
<i>Myosotis arvensis</i>	Field Scorpion-grass					I
<i>Myosotis scorpioides</i>	True Forget-me-not					I
<i>Myrica pensylvanica</i>	Northern Bayberry					N
<i>Nyssa sylvatica</i>	Black Gum	DF				N
<i>Oenothera biennis</i>	Common Evening Primrose					I

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Oenothera fruticosa</i>	Sundrops					N
<i>Onoclea sensibilis</i>	Sensitive Fern					N
<i>Ornithogalum umbellatum</i>	Star-of-Bethlehem					I
<i>Osmunda regalis</i>	Royal Fern					N
<i>Oxalis</i> sp.	A Wood Sorrel					N/I
<i>Panicum amarum</i>	Beachgrass					N
<i>Panicum dichotomiflorum</i>	Fall Panic Grass					N
<i>Panicum virgatum</i>	Switchgrass	DF				N
<i>Parthenocissus quinquefolia</i>	Virginia Creeper	DF				N
<i>Paspalum floridanum</i>	Florida Paspalum					N
<i>Paspalum setaceum</i>	Beadgrass					N
<i>Paulownia tomentosa</i>	Princess Tree					I
<i>Phalaris arundinacea</i>	Reed Canarygrass	DF				N
<i>Phleum pratense</i>	Timothy Grass	DF				I
<i>Photinia pyrifolia</i>	Red Chokeberry	DF				N
<i>Photinia melanocarpa</i>	Black Chokeberry	DF				N
<i>Phragmites australis</i>	Common Reed					I
<i>Physalis longifolia</i>	Smooth Ground Cherry					N
<i>Phytolacca americana</i>	Pokeweed	DF				N
<i>Picea abies</i>	Norway Spruce					I

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Pinus rigida</i>	Pitch Pine					N
<i>Pinus strobus</i>	White Pine					N
<i>Pinus taeda</i>	Loblolly Pine					N
<i>Pinus virginiana</i>	Virginia Pine					N
<i>Plantago aristata</i>	Bracted Plantain					N
<i>Plantago lanceolata</i>	English Plantain					I
<i>Plantago rugelii</i>	Broad-leaved Plantain					N
<i>Plantago virginica</i>	Virginia Plantain					N
<i>Platanus occidentalis</i>	Sycamore	DF				N
<i>Poa annua</i>	Annual Bluegrass					I
<i>Poa compressa</i>	Canada Bluegrass					I
<i>Poa pratensis</i>	Kentucky Bluegrass					N/I
<i>Podophyllum peltatum</i>	Mayapple					N
<i>Polygonum hydropiperoides</i>	Mild Waterpepper					N
<i>Polygonum pensylvanicum</i>	Pennsylvania Smartweed					N
<i>Polygonum persicaria</i>	Lady's-thumb	DF				I
<i>Polygonum sagittatum</i>	Arrowleaf Tearthumb	DF				N
<i>Pontederia cordata</i>	Pickerelweed					N
<i>Potamogeton perfoliatus</i>	Clasping-leaved Pondweed	SR	S2			N
<i>Prunella vulgaris</i>	Heal-all					I

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Prunus amygdalus</i>	Peach					I
<i>Prunus avium</i>	Sweet Cherry					I
<i>Prunus cerasus</i>	Sour Cherry					I
<i>Prunus serotina</i>	Wild Black Cherry	DF				N
<i>Pseudognaphalium obtusifolium</i>	Cudweed					N
<i>Pyrus calleryana</i>	Bradford Pear					I
<i>Pyrus coronaria</i>	Crabapple					N
<i>Quercus acutissima</i>	Sawtooth Oak					I
<i>Quercus alba</i>	White Oak	DF				N
<i>Quercus falcata</i>	Southern Red Oak					N
<i>Quercus palustris</i>	Pin Oak	DF				N
<i>Quercus phellos</i>	Willow Oak					N
<i>Quercus prinus</i>	Chestnut Oak					N
<i>Quercus rubra</i>	Northern Red Oak					N
<i>Quercus velutina</i>	Black Oak					N
<i>Rhus copallinum</i>	Winged Sumac					N
<i>Rhus glabra</i>	Smooth Sumac					N
<i>Rhus typhina</i>	Staghorn Sumac					N
<i>Robinia pseudoacacia</i>	Black Locust					N
<i>Rosa multiflora</i>	Multiflora Rose	DF				I

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Rubus argutus</i>	Tall Blackberry					N
<i>Rubus occidentalis</i>	Wild Black Raspberry					N
<i>Rubus pensilvanicus</i>	Pennsylvania Blackberry					N
<i>Rubus phoenicolasius</i>	Wineberry					I
<i>Rubus</i> sp.	Blackberry	DF				N/I
<i>Rudbeckia hirta</i>	Black-eyed Susan					N
<i>Rumex acetosella</i>	Sheep Sorrel					I
<i>Rumex</i> sp.	A Dock					N/I
<i>Ruppia maritima</i>	Widgeongrass	SR				N
<i>Sagittaria graminea</i>	Grass-leaved Arrowhead		SU			N
<i>Salix nigra</i>	Black Willow					N
<i>Sambucus nigra</i> ssp. <i>canadensis</i>	Elderberry	DF				N
<i>Sassafras albidum</i>	Sassafras					N
<i>Schedonorus phoenix</i>	Tall Fescue	DF				I
<i>Schedonorus pratensis</i>	Kentucky Fescue					I
<i>Schizachyrium scoparium</i>	Little Bluestem					N
<i>Scirpus cyperinus</i>	Woolgrass	DF				N
<i>Senna hebecarpa</i>	American Senna					N
<i>Setaria italica</i>	Millet Foxtail					I
<i>Setaria pumila</i> (<i>S. glauca</i>)	Yellow Foxtail					I

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Sisyrinchium angustifolium</i>	Blue-eyed Grass					N
<i>Smilax rotundifolia</i>	Common Greenbrier					N
<i>Solanum sp.</i>	Horse Nettle					N/I
<i>Solidago altissima</i>	Tall Goldenrod					N
<i>Solidago bicolor</i>	Silverrod					N
<i>Solidago juncea</i>	Early Goldenrod					N
<i>Solidago nemoralis</i>	Gray Goldenrod					N
<i>Solidago odora</i>	Sweet Goldenrod					N
<i>Solidago rugosa</i>	Rough Goldenrod					N
<i>Solidago sempervirens</i>	Seashore Goldenrod					N
<i>Sonchus asper</i>	Spiny-leaved Sow Thistle					I
<i>Sorghastrum nutans</i>	Indiangrass					N
<i>Sorghum halepense</i>	Johnsongrass					I
<i>Sparganium eurycarpum</i>	Broadfruit Bur-reed		S3			N
<i>Spartina alterniflora</i>	Smooth Cordgrass					N
<i>Spartina patens</i>	Salt-meadow Cordgrass	DF				N
<i>Stellaria media</i>	Common Chickweed					I
<i>Strophostyles helvola</i>	Trailing Wild Bean					N
<i>Symphyotrichum lanceolatum</i>	Tall White Aster					N
<i>Symphyotrichum puniceum</i>	Purple-stemmed Aster					N

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Symplocarpus foetidus</i>	Skunk Cabbage	DF				N
<i>Taraxacum officinale</i>	Dandelion					I
<i>Taxodium distichum</i>	Bald Cypress					N
<i>Thelypteris palustris</i>	Marsh Fern					N
<i>Tilia americana</i>	Basswood					N
<i>Toxicodendron radicans</i>	Poison Ivy	DF				N
<i>Tragopogon dubius</i>	Meadow Goat's-beard					I
<i>Tridens flavus</i>	Purpletop					N
<i>Trifolium aureum</i>	Yellow-hop Clover					I
<i>Trifolium campestre</i>	Low Hop Clover					I
<i>Trifolium incarnatum</i>	Crimson Clover					I
<i>Trifolium pratense</i>	Red Clover					I
<i>Trifolium repens</i>	White Clover					I
<i>Triodanis perfoliata</i>	Venus' Looking-glass					N
<i>Typha latifolia</i>	Broad-leaved Cattail	DF				N
<i>Ulmus americana</i>	American Elm					N
<i>Ulmus pumila</i>	Siberian Elm					I
<i>Vaccinium corymbosum</i>	Highbush Blueberry	DF				N
<i>Verbascum blattaria</i>	Moth Mullein					I
<i>Verbascum thapsus</i>	Common Mullein					I
<i>Verbena hastata</i>	Swamp Verbena	DF				N

Scientific Name	Common Name	Location	State Rank	Federal Status	State Status	Origin
<i>Verbena urticifolia</i>	White Vervain					N
<i>Verbesina alternifolia</i>	Wingstem					N
<i>Veronica agrestis</i>	Field Speedwell					I
<i>Veronica arvensis</i>	Corn Speedwell					I
<i>Veronica officinalis</i>	Common Speedwell					I
<i>Viburnum acerifolium</i>	Maple-leaf Viburnum					N
<i>Viburnum dentatum</i>	Arrowwood	DF				N
<i>Viburnum prunifolium</i>	Black Haw					N
<i>Viola papilionacea</i>	Common Blue Violet					N
<i>Vitis labrusca</i>	Fox Grape					N
<i>Vitis rotundifolia</i>	Muscadine Grape					N
<i>Vitis vulpina</i>	Frost Grape					N
<i>Vulpia myuros</i>	Rat-tail Fescue					I
<i>Wisteria sinensis</i>	Chinese Wisteria					I
<i>Zannichellia palustris</i>	Horned Pondweed	SR				N

N = Native

I = Introduced

DF = Dairy Farm

SR = Severn River and its tributaries

Sources: Environmental Systems Analysis, Inc. 2003, 2004, 2005; U.S. Navy 1997, 2000a, 2001c, 2003; Virginia Institute of Marine Science (VIMS) 2005., MDNR 2010b

Appendix 3

Tree Planting and Tree Care Standards

Native Plant Species for Landscaping

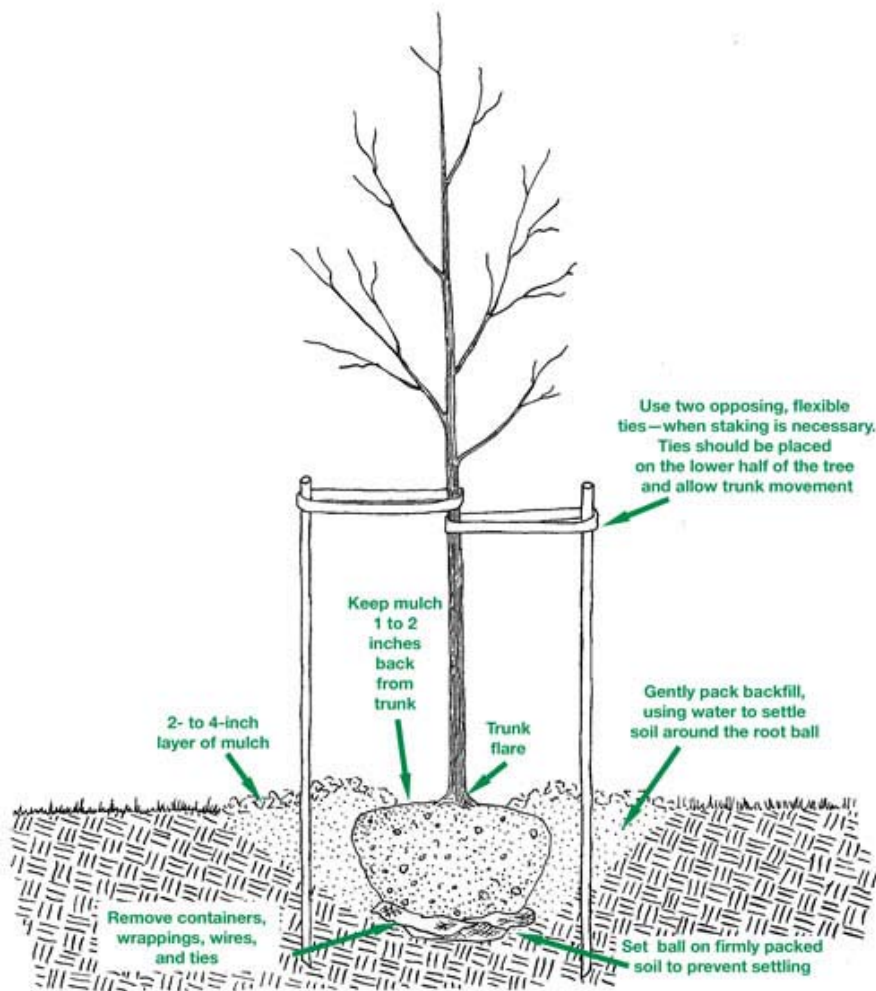
Landscaping Plants and Their Palatability to Deer

NEW TREE PLANTING

The ideal time to plant trees and shrubs is during the dormant season, in the fall after leaf drop or early spring before bud-break. Weather conditions are cool and allow plants to establish roots in the new location before spring rains and summer heat stimulate new top growth. However, trees properly cared for in the nursery or garden center, and given the appropriate care during transport to prevent damage, can be planted throughout the growing season. In either situation, proper handling during planting is essential to ensure a healthy future for new trees and shrubs. *Before you begin planting your tree, be sure you have had all underground utilities located prior to digging.*

If the tree you are planting is balled and burlapped, or bare rooted, it is important to understand that the tree's root system has been reduced by 90-95% of its original size during transplanting. As a result of the trauma caused by the digging process, trees will commonly exhibit what is known as transplant shock. Transplant shock is indicated by slow growth and reduced vigor following transplanting. Proper site preparation before and during planting, coupled with good follow up care will reduce the amount of time the plant experiences transplant shock and will allow the tree to quickly establish in its new location. Carefully follow eight simple steps and you can significantly reduce the stress placed on the plant at the time of planting.

1. **Dig a shallow, broad planting hole.** Make the hole wide, as much as three times the diameter of the root ball, but only as deep as the root ball. It is important to make the hole wide because the tree roots on the newly establishing tree must push through surrounding soil to establish. On most planting sites in new developments, the existing soils have been compacted and are unsuitable for healthy root growth. Breaking up the soil in a large area around the tree provides the newly emerging roots room to expand into loose soil to hasten establishment.
2. **Identify the trunk flare.** The trunk flare is where the roots spread at the base of the tree. This point should be partially visible after the tree has been planted (see diagram). If the trunk flare is not partially visible, you may have to remove some soil from the top of the root ball. Find it so you can determine how deep the hole needs to be for proper planting.
3. **Place the tree at the proper height.** Before placing the tree in the hole, check to see that the hole has been dug to the proper depth, and no more. The majority of the roots on the newly planted tree will develop in the top 12" of soil. If the tree is planted too deep, new roots will have difficulty developing due to a lack of oxygen. It is better to plant the tree a little high, 1-2" above the base of the trunk flare, than to plant it at or below the original growing level. This will allow for some settling (see diagram). To avoid damage when setting the tree in the hole, always lift the tree by the root ball, and never by the trunk.
4. **Straighten the tree in the hole.** Before you begin backfilling have someone view the tree from several directions to confirm the tree is straight. Once you begin backfilling it is difficult to reposition.



5. **Fill the hole, gently but firmly.** Fill the hole about 1/3 full and gently but firmly pack the soil around the base of the root ball. Then, if the tree is balled and burlapped, cut and remove the string and wire from around the trunk and top 1/3 of the root ball (see diagram). Be careful not to damage the trunk or roots in the process. Fill the remainder of the hole, taking care to firmly pack soil to eliminate air pockets that may cause roots to dry out. To avoid this problem, add the soil a few inches at a time and settle with water. Continue this process until the hole is filled and the tree is firmly planted. It is not recommended to apply fertilizer at the time of planting.
6. **Stake the tree, if necessary.** If the tree is grown and dug properly at the nursery, staking for support is not necessary in most home landscape situations. Studies have shown that trees will establish more quickly and develop stronger trunk and root systems if they are not staked at the time of planting. However, protective staking may be required on sites where lawn mower damage, vandalism or windy conditions are concerns. If staking is necessary for support, two stakes used in conjunction with a wide flexible tie material will hold the tree upright, provide flexibility, and

- minimize injury to the trunk (see diagram). Remove support staking and ties after the first year of growth. Leave protective staking in place as long as necessary.
7. **Mulch the base of the tree.** Mulch is simply organic matter applied to the area at the base of the tree. It acts as a blanket to hold moisture, protect against harsh soil temperatures, both hot and cold, and reduces competition from grass and weeds. Some good choices are leaf litter, pine straw, shredded bark, peat moss, or wood chips. A two to four inch layer is ideal. More than four inches may cause a problem with gas exchange. When placing mulch, care should be taken so that the actual trunk of the tree is not covered. This may cause decay of the living bark at the base of the tree. A mulch-free area, one to two inches wide at the base of the tree, is sufficient to avoid moist bark conditions and prevent decay.
 8. **Follow-up care.** Keep the soil moist but not soaked; overwatering will cause leaves to turn yellow or fall off. Water trees at least once a week, barring rain, and more frequently during hot weather. When the soil is dry below the surface of the mulch, it is time to water. Continue until mid-fall, tapering off for lower temperatures that require less frequent watering. Other follow-up care may include minor pruning of branches damaged during the planting process. Prune sparingly immediately after planting, and wait to begin necessary corrective pruning until after a full season of growth in the new location.

(From International Society Arboriculture at <http://www.isa-arbor.com/consumer/planting.html>)

PRUNING TREES

Pruning is the most common tree maintenance procedure. Although forest trees grow quite well with only nature's pruning, landscape trees require a higher level of care to maintain their safety and aesthetics. Pruning should be done with an understanding of how the tree responds to each cut. Improper pruning can cause damage that will last for the life of the tree, or worse, it will shorten the tree's life.

Reasons for Pruning

Since each cut has the potential to change the growth of the tree, no branch should be removed without a reason. Common reasons for pruning are to remove dead branches, to remove crowded or rubbing limbs, and to eliminate hazards. Trees may also be pruned to increase light and air penetration to the inside of the tree's crown or to the landscape below. In most cases, mature trees are pruned as a corrective or preventative measure.

When to Prune

Most routine pruning to remove weak, diseased or dead limbs can be accomplished at any time during the year with little effect on the tree. As a rule, growth is maximized and wound closure is fastest if pruning takes place before the spring growth flush. Some trees, such as maples and birches, tend to "bleed" if pruned early in the spring. This may be unsightly, but is of little consequence to the tree.

A few tree diseases, such as oak wilt, can be spread when pruning wounds allow spores access into the tree. Susceptible trees should not be pruned during active transmission periods.

Heavy pruning just after the spring growth flush should be avoided. This is when trees have just expended a great deal of energy to produce foliage and early shoot growth. Removal of a large percentage of foliage at this time can stress the tree.

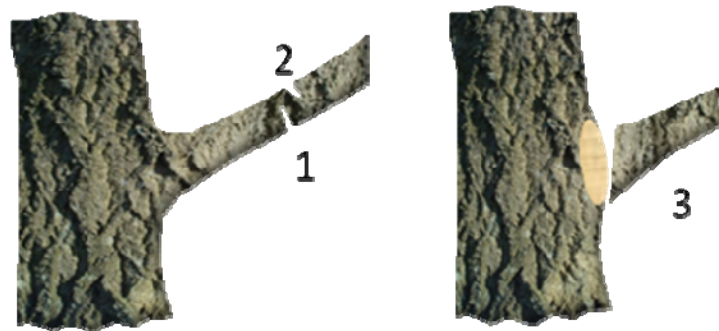
Making Proper Pruning Cuts to Mature Trees

Pruning cuts should be made just outside the branch collar. The branch collar contains trunk or parent branch tissue and should not be damaged or removed. If trunk collar has grown out on a dead limb to be removed, make the cut just beyond the collar. Do not cut the collar (see figure).



On a dead branch that has a collar of live wood, the final cut should be made just beyond the outer edge of the collar.

If a large limb is to be removed, its weight should first be reduced. This is done by making an undercut about 12-18 inches from the limb's point of attachment. A second cut is made from the top, directly above or a few inches further out on the limb. This removes the limb leaving the 12-18 inch stub. The stub is removed by cutting back to the branch collar. This technique reduces the possibility of tearing the bark



Use the 3-cut method to remove a large limb.

How Much Should be Pruned?

The amount of live tissue that should be removed depends on the tree size, species, and age, as well as the pruning objectives. Younger trees will tolerate the removal of a higher percentage of living tissue than mature trees. A common mistake is to remove too much inner foliage and small branches. It is important to maintain an even distribution of foliage along large limbs and in the lower portion of the crown. A widely accepted rule of thumb is never to remove more than one fourth of a tree's leaf bearing crown. In a mature tree, pruning even that much could have negative effects. Removing even a single, large-diameter limb can create a wound that the tree may not be able to close. The older and larger a tree becomes, the less energy it has in reserve to close wounds and defend against decay or insect attack. The pruning of large, mature trees is usually limited to the removal of dead or potentially hazardous limbs.

Wound Dressings

Wound dressings were once thought to accelerate wound closure, protect against insects and diseases, and reduce decay. However, research has shown that dressings do not reduce decay or speed closure, and rarely prevent insect or disease infestations. Most experts recommend that wound dressings not be used. If a dressing must be used for cosmetic purposes, then only a thin coating of a non-toxic material should be applied.

Newly Planted Trees

Pruning of newly planted trees should be limited to corrective pruning. Remove torn or broken branches. Save other pruning measures for the second or third year. The belief that trees should be pruned when planted to compensate for root loss is misguided. Trees need their leaves and shoot tips to provide food and the substances, which stimulate new root production. Unpruned trees establish faster, with a stronger root system than trees pruned at the time of planting.

(From International Society Arboriculture at <http://www.isa-arbor.com/consumer/pruning.html>)

RECOGNIZING HAZARDOUS TREES

Hazardous Trees & Utility Lines. Trees that fall into utility lines have additional serious consequences. Not only can they injure people or property near the line, but hitting a line may cause power outages, surges, fires and other damage. Downed lines still conducting electricity are especially dangerous. A tree with a potential to fall into a utility line is a very serious situation.

Tree Hazard Checklist

Consider these questions...

1. Are there large dead branches in the tree?
2. Are there detached branches hanging in the tree?
3. Does the tree have cavities or rotten wood along the trunk or in major branches?
4. Are mushrooms present at the base of the tree?
5. Are there cracks or splits in the trunk or where branches are attached?
6. Have any branches fallen from the tree?
7. Have adjacent trees fallen over or died?
8. Has the trunk developed a strong lean?
9. Do many of the major branches arise from one point on the trunk?
10. Have the roots been broken off, injured or damaged by lowering the soil level, installing pavement, repairing sidewalks or digging trenches?
11. Has the site recently been changed by construction, raising the soil level or installing lawns?
12. Have the leaves prematurely developed an unusual color or size?
13. Have trees in adjacent wooded areas been removed?
14. Has the tree been topped or otherwise heavily pruned?

Managing Tree Hazards

One of these treatments may help make your tree safer. Reducing the risk associated with hazardous trees can take many forms.

1. **Prune the tree.** Remove the defective branches of the tree. Since in appropriate pruning may also weaken a tree,
2. **Provide routine care.** Mature trees need routine care in the form of water, fertilizer (in some cases), mulch and pruning as dictated by the season and their structure.

A number of treatments are best done by a Certified Arborist

1. **Cable and brace the tree.** Provide physical support for weak branches and stems to increase their strength and stability.
2. **Remove the tree.** Some hazardous trees are best removed. If possible, plant a new tree in an appropriate place as a replacement.

(From International Society of Arboriculture at <http://www.isa-arbor.com/consumer/hazards.html>)

1
2

Native Plants for Landscaping and Site Reclamation

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
Late purple aster	<i>Symphyotrichum patens</i>	1'-4'	√	√			√	√	reclamation, wildflower meadow
New York aster	<i>Symphyotrichum 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
Threadleaf coreopsis	<i>Coreopsis verticillata</i>	2'	√				√	√	reclamation, wildflower meadow
Wand-like bushclover	<i>Lespedeza intermedia</i>	1'-3'	√	√			√	√	reclamation
Wild bergamot	<i>Monarda fistulosa</i>	<1'-3'	√					√	reclamation, wildflower meadow
Grasses									
Broomsedge	<i>Andropogon virginicus</i>	1'-3'	√	√			√	√	native warm-season grassland
Bushy broomsedge	<i>Andropogon glomeratus</i>	1.5' -5'		√	√		√	√	native warm-season grassland
Switchgrass	<i>Panicum virgatum</i>	3'-5'	√	√	√		√	√	native warm-season grassland

Common Name	Scientific Name	Height	Low Moisture	Moderate Moisture	High Moisture	Full Shade	Partial Sun	Full Sun	Suggested Uses
Little bluestem	<i>Schizachyrium scoparium</i>	2'-3'	√	√			√	√	native warm-season grassland
Eastern gamma grass	<i>Tripsacum dactyloides</i>		√	√			√	√	native warm-season grassland
Side-oats grama	<i>Bouteloua curtipendula</i>			√			√		native warm-season grassland
Indian grass	<i>Sorghastrum nutans</i>	5'-6'	√	√			√	√	native warm-season grassland
Shrubs									
Blueberry, highbush	<i>Vaccinium corymbosum</i>	2'-12'		√	√	√	√		riparian buffer
Blueberry, lowbush	<i>Vaccinium pallidum</i>	1'-1.5'	√	√		√	√		reclamation, wildlife
Buttonbush	<i>Cephalanthus occidentalis</i>	3'-7'			√	√	√		riparian buffer
Chokeberry, red	<i>Aronia arbutifolia</i>	3'-10'	√	√	√		√	√	riparian buffer, reclamation
Dogwood, graystem	<i>Cornus racemosa</i>	10'-15'	√	√	√	√	√	√	riparian buffer, reclamation
Dogwood, silky	<i>Cornus amomum</i>	6'-10'		√	√		√		riparian buffer
Hazel alder	<i>Alnus serrulata</i>	6'-15'		√	√	√	√		riparian buffer
Hazelnut	<i>Corylus americana</i>	6'-10'		√	√		√	√	reclamation, wildlife
Inkberry	<i>Ilex glabris</i>	2'-10'		√	√	√	√		riparian buffer, landscape
Mountain laurel	<i>Kalmia latifolia</i>	3'-10'	√	√		√	√		landscape
Serviceberry	<i>Amelanchier canadensis</i>	5'-15'		√					landscape, wildlife
Swamp azalea	<i>Rhododendron viscosum</i>	3'-8'		√	√	√	√		riparian buffer
Sweet pepperbush	<i>Clethra alnifolia</i>	3'-8'		√	√	√	√	√	riparian buffer, landscape
Viburnum, arrowwood	<i>Viburnum dentatum</i>	4'-8'		√	√		√	√	riparian buffer, landscape
Viburnum, blackhaw	<i>Viburnum prunifolium</i>	8'-15'	√	√	√	√	√		landscape, reclamation
Virginia sweetspire	<i>Itea virginica</i>	3'-5'		√	√	√	√	√	riparian buffer, landscape
Wax myrtle	<i>Morella (Myrica) cerifera</i>	2'-6'		√	√		√	√	riparian buffer
Winterberry	<i>Ilex verticillata</i>	4'-12'		√	√		√	√	riparian buffer
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

Common Name	Scientific Name	Height	Low Moisture	Moderate Moisture	High Moisture	Full Shade	Partial Sun	Full Sun	Suggested Uses
Serviceberry	<i>Amelanchier arboria</i>	15'-25'		√			√	√	landscape, wildlife
Sweetbay magnolia	<i>Magnolia virginiana</i>	15'-30'		√	√	√	√		riparian buffer, landscape
Medium to Large Trees									
America holly	<i>Ilex opaca</i>	40'-50'		√	√		√	√	landscape, wildlife
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
Eastern red cedar	<i>Juniperus virginiana</i>	45'-65'	√	√	√		√	√	visual screen
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, 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	<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
Sycamore	<i>Platanus occidentalis</i>	75'-120'		√	√		√	√	riparian buffer, landscape
Yellow poplar	<i>Leriodendron tulipifera</i>	100'-150'		√			√	√	landscape, reforestation

Whitetail Deer Resistant Plants

Scientific Name	Common name
<i>Plants Rarely Damaged:</i>	
<i>Betula papyrifera</i>	Paper Birch
<i>Buxus sempervirens</i>	Common Boxwood
<i>Ilex opaca</i>	American Holly
<i>Leucothoe</i> spp	Doghobble, Staggerbush, etc.
<i>Osmunda</i>	Ferns
<i>Plants Seldom Severely Damaged:</i>	
<i>Calastrus scandens</i>	American Bittersweet
<i>Cornus sericea</i>	Red Osier Dogwood
<i>Cornus florida</i>	Flowering Dogwood
<i>Crataegus</i> spp	Hawthorn species
<i>Gleditsia triacanthos</i>	Honey Locust
<i>Ilex glabra</i>	Inkberry
<i>Kalmia latifolia</i>	Mountain Laurel
<i>Pinus rigida</i>	Pitch Pine
<i>Salix</i> spp	Willows
<i>Sassafras albidum</i>	Common Sassafras
<i>Syringa vulgaris</i>	Common Lilac
<i>Plants Occasionally Severely Damaged:</i>	
<i>Acer rubrum</i>	Red Maple
<i>Acer saccharinum</i>	Silver Maple
<i>Acer saccharum</i>	Sugar Maple
<i>Aesculus hippocastanum</i>	Common Horsechestnut
<i>Amelanchier</i> spp	Serviceberries
<i>Campsis radicans</i>	Trumpet Creeper
<i>Cornus racemosa</i>	Panicled Dogwood
<i>Hamamelis virginiana</i>	Common Witchhazel
<i>Hydrangea</i> spp	Hydrangeas
<i>Juniperus virginiana</i>	Eastern Red Cedar
<i>Magnolia (x) soulangiana</i>	Saucer Magnolia
<i>Parthenocissus quinquefolia</i>	Virginia Creeper
<i>Pinus strobus</i>	Eastern White Pine
<i>Quercus</i> spp	Oaks
<i>Rhododendron</i> spp.	Deciduous Azaleas
<i>Rhus typhina</i>	Staghorn Sumac
<i>Rosa rugosa</i>	Rugosa Rose
<i>Salix</i> spp.	Willows
<i>Tilia americana</i>	Basswood
<i>Viburnum</i> spp	Viburnum spp
<i>Plants Frequently Severely Damaged:</i>	
<i>Cercis canadensis</i>	Eastern Redbud
<i>Chamaecyparis thyoides</i>	Atlantic White Cedar
<i>Clematis</i> spp.	Clematis
<i>Euonymus alatus</i>	Winged Euonymus

Whitetail Deer Resistant Plants (cont'd)

Scientific Name	Common name
<i>Euonymus fortunei</i>	Wintercreeper
<i>Hedera helix</i>	English Ivy
<i>Malus</i> spp,	Apples
<i>Prunus</i> spp.	Cherries, Plums
<i>Rhododendron</i> spp.	Rhododendrons
<i>Thuja occidentalis</i>	American Arborvitae

Source: Fargione et al. 1991

Appendix 4

Soil and Water Conservation Plan

**SOIL AND WATER CONSERVATION PLAN
FOR
LEASE AT
U.S. NAVAL ACADEMY DAIRY FARM**

14 November 2007

The LESSEE shall apply appropriate conservation measures and use the premises of the U.S. NAVAL ACADEMY (USNA) DAIRY FARM, Gambrills, Maryland (hereinafter referred to as "FARM") by following generally accepted local farming and grazing practices. **The LESSEE shall in no manner substantially change the contour or condition of land without expressed written authority from the NAVFAC WASHINGTON REAL ESTATE Contracting Officer (NFW RECO).**

In addition, opportunities exist to enhance natural resources while continuing FARM agricultural operations. The LESSEE through the NFW RECO shall coordinate farming and grazing practices on the FARM with NAVFAC WASHINGTON Natural Resources (NFW NR) personnel to facilitate the protection and enhancement of a diversity of natural ecological communities, including (1) fish and wildlife populations and their associated habitat; (2) wetlands, streams, and floodplains; and (3) rare, threatened, or endangered species. Management of the natural resources at the FARM also includes providing opportunities for enhanced recreational use and aesthetic value of wildlife resources.

1. **DESCRIPTION.** The USNA DAIRY FARM is an 857-acre farm located in Gambrills, MD (Appendix A, Conservation Plan Map). The use of the FARM is for farming, ranching, and associated holistic programs associated with agricultural uses. Of the 857 acres, 165 acres are available for pasture, 630 acres are available for crop production, 26 acres are improved, and 35 acres are identified as wetlands.
2. **USE.** The primary use of the FARM is for agricultural purposes (see Appendix A). The lease operation is authorized by section 2881 of H.R. 119, National Defense Authorization Act of FY 1998 and subject to the military requirements for the land. Typical crops grown on the FARM are grains, hay, vegetables, and other crops in support of dairy farming activities, as well as beef production. Fields available for planting of crops are identified in Appendix B. NFW RECO must approve any ornamental plantings. The planting of vineyard, orchard, rice crops, or sod farming is not permitted.
3. **NON-REIMBURSABLE WORK.** The GOVERNMENT will not provide any reimbursement for work (i.e. improvements, land management, conservation efforts, landscaping, etc.) conducted on the leased portion.
4. **SOILS.** The LESSEE shall apply prudent erosion control measures associated with normal farming operations to reduce soil loss as requested by the GOVERNMENT.

This includes potential erosion under fence lines and along stream banks. Several soil types exist at the FARM (see Appendix C), a description of the predominant soil types follows:

- a. Butlertown silt loam (BuA). A 0-2 percent slope is level and suited for small grains and corn.
- b. Butlertown silt loam (BuB2). A 2-5 percent slope is moderately eroded soils. Soils are deep and well drained. Erosion control is more important than drainage improvement.
- c. Butlertown silt loam (BuC3). A 5-10 percent slope is a moderately sloping soils that have retained little of its original surface layer thus being severely eroded. This soil is subject to compaction by grazing animals and farm machinery.
- d. Butlertown silt loam (BuD3). A 10-15 percent slope has little of its original surface layer. This soil often consists of loamy and clayey material and has reddish brown, gravelly subsoil with deep gullies. The soils are deep and well drained but exist on steep slopes. These soils are not suited for cultivation, but rather, for pasture, woodland, and well sodded orchards. Conservation measures applied for safely cultivating these soils may not be economically feasible.
- e. Sassafras fine sandy loam (SaD3). A 10-15 percent slope is unable to be cultivated due to high erosion potential. This soil needs permanent vegetation cover.
- f. Sassafras fine sandy loam (SaB2). A 2-5 percent slope is well suited to most crops but some erosion control measures are required due to potential erosion. When properly managed, these soils are well suited to truck crops, corn, small grains, hay, and pasture. Because these soils erode readily, a cover crop should be present at all times.
- g. Bibb silt loam (Bm). It is nearly level and is often associated with hydric soils. Erosion potential along stream banks and fields requires the attention of the LESSEE to ensure appropriate erosion control measures are implemented. Because the soils are considered hydric, State and local permits may be required for cultivation.

5. IRRIGATION.

- a. Irrigation Pipeline System. The LESSEE shall not be allowed to make any modifications, additions, or deletions in or to the GOVERNMENT owned irrigation system without written approval from NFW RECO. The LESSEE shall maintain the GOVERNMENT owned irrigation system in at least as

good a condition as received hereunder throughout the lease term. If the LESSEE desires to install a new or add upon an existing irrigation system the written approval of the NFW RECO is required. The GOVERNMENT will not approve the LESSEE to drill any new wells for the purpose of irrigation.

- b. Irrigation Ditches. The LESSEE shall maintain all irrigation ditches within the leased property essentially free of weeds, silt, debris, and refuse at the expense of the LESSEE. Drainage ditches within established natural areas shall not be maintained. The LESSEE shall obtain written approval from NFW RECO before dredging any drainage ditch at the FARM. All new ditches shall be constructed at least eight (8) feet from utility poles, survey monuments, and manholes. A utility survey shall be conducted prior to digging. The LESSEE shall immediately repair all leaking irrigation ditches to prevent soil erosion and to provide unimpaired vehicle access between parcels. Borders and/or furrows shall be constructed as needed for an efficient distribution of irrigation water.
6. FARMING PRACTICES. No clearing of land is permitted without the prior written authorization from the NFW RECO.
- a. Minimum Tillage. The LESSEE shall practice “minimum tillage” wherever practical and feasible. The LESSEE shall vary the depth of plowing from year to year to prevent plow pan from forming and to facilitate water infiltration. To reduce possible erosion, tillage operations shall be scheduled to minimize the time during which soil will be subject to wind erosion and dust production. Organic practices on the property are authorized.
 - b. Soil Ripping. Soil ripping/chiseling is a very beneficial practice for enhancing water infiltration and reducing toxic salt accumulations. The LESSEE shall be very careful when ripping/chiseling or slip plowing to avoid damaging GOVERNMENT improvements and/or utilities.
 - c. Planting Schedule. The LESSEE shall plan and implement a planting schedule so that all crops are harvested and removed from the parcel by termination date of the final lease year. The GOVERNMENT does not guarantee any extension of the lease term for the sole purpose of harvesting crops. The LESSEE shall rotate crops on an annual basis and submit a yearly crop planting schedule by 31 January to the NFW RECO. This schedule shall identify the previous year’s planting by parcel and the proposed planting for the next calendar year. Similar (e.g. legume to legume) crops may not be planted in the same field two years in a row. This restriction does not apply to cover crops.
 - d. Harvested Crop Storage. The LESSEE may store harvested crops only in areas designated by the NFW RECO. The LESSEE may not store harvested crops of other farmers on a reimbursable basis at the FARM.

- e. Fallow Cropland. If the LESSEE elects to lay fallow any portion of the leased cropland, the area shall have a cover crop, such as close-growing grasses, legumes, or small grain, applied for soil erosion reduction, soil improvement, and nutrient management purposes, until the land is again farmed.
 - f. Field Border. The LESSEE shall establish a field border of perennial vegetation no less than 10 inches in height on the edge of cropped fields. This border can be used for access to the field and will aid in reducing soil erosion transported off the field. Field borders throughout the FARM will vary in width depending on the topography of the field and its location on the FARM relative to surface water features. However, at a minimum, field borders will not be less than 5 feet in width.
7. GRAZING MANAGEMENT. No grazing shall be allowed in established riparian areas surrounding Towser's Branch or the unnamed tributary of Towser's Branch.
- a. Grazing Intensity. Grazing shall be allowed on the FARM, but shall not increase soil erosion, sediment production, or nutrient loading within the Little Patuxent River watershed. It is the expressed concern of the GOVERNMENT that the FARM not be overgrazed. Therefore, vegetation shall be maintained at an average minimum height of 3.0 inches, and a rotational grazing system with a permanent perimeter fence shall be established. If, in a given year, it is determined that there is not enough available forage area to graze the established acres under management, then the GOVERNMENT reserves the right to reduce the number of allowable acres under management in the lease year. The Navy may however, allow an increase in the grazing intensity, providing adequate forage area exists to support additional acres under management. Written permission from NFW RECO must be sought by the LESSEE prior to exceeding the established grazing intensity.
 - b. Season of Use. Year long grazing is allowed. The LESSEE shall utilize a pasture rotation system.
 - c. Livestock Distribution. If salt blocks and feed supplements are utilized, they shall be distributed evenly throughout the FARM. In addition, they shall not be located within a ¼ mile of watering areas.
 - d. Livestock Water Facilities. The LESSEE shall frequently inspect and maintain existing and future livestock watering facilities, including water storage tanks, wells, pipelines, and water troughs. Maintenance includes, but is not limited to, (1) maintaining water free of excessive amounts of algae, silt, and manure; (2) clearing obstructions away from drain and spillways; (3) repairing pipeline, float, and valve mechanisms; and (4) stabilizing reservoir slopes and spillways. The LESSEE shall not be permitted to drill new wells for the purposes of livestock watering.

- e. Livestock Fence and Gate Maintenance. The LESSEE shall repair and maintain in a livestock-tight condition all fences, gates, and other facilities associated with the FARM, in at least as good a condition as received hereunder. All material used in maintaining GOVERNMENT owned facilities shall be of at least the same type and quality as those used in original construction. All materials used for such repairs shall become the property of the GOVERNMENT and shall not be removed by the LESSEE upon termination of the lease. Every three years of the lease, all fences shall be tightened and all fence posts and braces shall be straightened to the satisfaction of NFW NR Personnel. If the LESSEE desires to change existing fence line patterns or add additional fencing written approval from the NFW RECO is required. All new fences become the property of the Government at the end of the lease. Vegetation maintenance surrounding fences shall be at the discretion of the LESSEE, given applicable restrictions in accordance with Section 9.
- f. Animal Health. The LESSEE shall comply with all Federal, state, and local animal health laws and regulations with respect to livestock grazing on the FARM.
- g. Livestock Processing. The LESSEE is not allowed to process livestock on the FARM for the purposes of human consumption.
- h. Removal of Dead Livestock. The LESSEE shall immediately dispose of any dead animals in a manner satisfactory to NFW RECO. The NFW NR will provide the LESSEE a map of pre-approved livestock disposal locations prior to lease execution. Upon discovery of dead livestock, disposal shall take place within 24 hours or sooner.
- i. Reporting Requirements. The LESSEE shall retain grazing records and upon NFW RECO request provide such records to the GOVERNMENT.

8. LAND MANAGEMENT.

- a. Riparian Buffers. The LESSEE shall maintain existing riparian buffers on land adjacent to water courses, waterbodies, and wetlands. The LESSEE shall coordinate with NFW NR to maintain riparian buffers at the FARM that serve to improve water quality, reduce undercutting of stream banks, and minimize sedimentation.
- b. Hayfields. The LESSEE shall set aside 50 contiguous acres, approximately 8% of the 630 acres are available for crop production, of hayfields where cutting is delayed (after July 15) for “conservation grasslands.” This will contribute to grassland breeding bird success and the LESSEE shall coordinate with NFW NR.

- c. Road Damage Prevention. The LESSEE shall not maneuver “track-laying” or “spike-wheeled” vehicles over the FARM’s roads unless adequate road protective measures are taken. The LESSEE shall be billed by the GOVERNMENT for any and all road damage repairs resulting from any activities of the LESSEE on the FARM.
 - d. Dust Control. The LESSEE shall control excessive dust generated from farming activities on the unpaved roads of the leased area through the application of water. The LESSEE shall take all appropriate actions to control excessive dust generated by the LESSEE activities.
 - e. Debris Removal. The LESSEE shall dispose of all debris generated at the FARM to the satisfaction of NFW RECO. Within 30 days of being notified, the LESSEE shall correct any deficiency noted by the GOVERNMENT.
 - f. Fire Prevention. The LESSEE shall comply with the Navy and USNA fire control and prevention regulations. The LESSEE shall be liable for any fire damage to GOVERNMENT owned structures and improvements and associated costs of fire suppression, which are a direct or indirect result of any activities of the LESSEE on the FARM.
 - i. Equipment. All engine driven equipment used by the LESSEE on the FARM shall be equipped with properly operating spark arresters, mufflers, and tailpipe assemblies. In addition, any vehicle having a catalytic converter shall not be driven through areas of dry, combustible material.
 - ii. Storage of Equipment and Flammable Materials. Equipment, fuel, and oil shall be stored only in the designated “LESSEE Storage Area”. The LESSEE shall obtain written approval from NFW RECO prior to storing equipment and flammable materials at the FARM.
 - iii. Spark-producing Equipment. Arc, gas, TIG (“Heli-Arc”) welders shall be used only with an adequate fire extinguisher readily accessible and only in the “LESSEE Storage Area”, or for repairs on a specific piece of equipment parked on and surrounded by a fire resistant area, as designated by NFW RECO.
9. PEST MANAGEMENT. The LESSEE shall control by mechanical means or by pesticide/herbicide/insecticide application all noxious weeds and undesirable weeds, rodents, insects, and other pests on the parcel. The term “pesticide” includes herbicides, insecticides, fungicides, rodenticides and algaecides. Pesticides, herbicides, and insecticides shall be used sparingly by the LESSEE in order to minimize chemical concentrations draining off the FARM into the Little Patuxent River watershed.

- a. Permits and Pest Management Plan. The LESSEE shall be responsible for complying with all federal, state, and local environmental standards, including obtaining required permits. At the beginning of each planting season, the LESSEE shall furnish NFW RECO with a Pest Management Plan (see Appendix D). This annual plan shall contain the following information regarding all pesticides that the LESSEE will use on the FARM: (1) common name; (2) concentration of the product; (3) product formula; (4) amount to be used; (5) target pest or weed; (6) crop and acreage to be treated; (6) application rate per acre; (7) time and frequency of application; and (8) Environmental Protection Agency (EPA) registration number. Changes in the LESSEE's pesticide application program, such as target pest, application time and frequency, name of pesticide, and total amount of the product to be used, must be reported to and approved by NFW RECO prior to application. The LESSEE shall not proceed with its application program until receipt of NFW RECO approval.
- b. Mosquito Abatement. In order to minimize mosquito breeding, the LESSEE shall not permit tail water or runoff to stand in ditches between irrigation operations. The LESSEE shall be responsible for the abatement of mosquitoes and shall be billed by the GOVERNMENT for any and all mosquito control expenses attributed to the farming activities of the LESSEE of the FARM. Any chemical use for mosquito control must be included in the Pest Management Plan. General guidelines for the control of mosquitoes on irrigated farmland shall be provided, if requested from NFW RECO.
- c. Rodent Control. Rodent control measures shall be undertaken by the LESSEE to prevent damage to the FARM. In no instance shall the LESSEE be allowed to use any chemical toxicant that has secondary poisoning effects. The LESSEE must have approval from NFW RECO prior to using any rodenticide in the leased premises and all rodenticides used shall be reported on the Pest Management Plan.
- d. Bird Control. All control measures initiated to protect crops from bird depredation shall be coordinated and approved by the NFW RECO. The LESSEE shall provide management plans to include bird species, control measures, and estimated number of birds to be taken. Also prior to any taking of birds, the LESSEE shall have the due diligence and financial burden of obtaining all appropriate permits.

10. NUTRIENT MANAGEMENT.

- a. Nutrient Management Plan. The LESSEE shall provide a Nutrient Management Plan within 45 days of lease award. To develop this plan the LESSEE shall work with Anne Arundel Soil Conservation District. Upon approval by a certified nutrient management consultant licensed by the

Maryland Department of Agriculture, this plan shall be submitted to NFW RECO for concurrence. Fields with a Phosphorus Fertility Index Value (FIV-P) greater than 150 shall be analyzed with the Maryland Phosphorus Site Index and addressed in the Nutrient Management Plan.

- b. Fertilizer Application. The LESSEE shall follow soil test requirements when planning the timing and application of crop fertilizers at the FARM. Application equipment shall be properly calibrated and maintained. Records shall be submitted to the Navy annually by 31 December detailing the planned and actual amount of fertilizer applied to each field, including the planned and actual date of application.
- c. Manure Stockpiles. The LESSEE shall ensure that manure (fertilizer) piles are not be stockpiled uncovered on the FARM, especially in areas above Towser's Branch and its tributary. This will minimize non-point source pollution, e.g. nutrient loading, to streams.

11. NOTIFICATION AND IDENTIFICATION.

- a. Coordination. The LESSEE shall closely coordinate farming operation with NFW RECO. The LESSEE shall be available at all times to correct emergency situations with regard to the FARM lease. The LESSEE shall provide NFW RECO with current emergency telephone numbers at which the LESSEE may be contacted during working and non-working hours.
- b. Vehicle Operation. Ingress and egress routes on and within the FARM shall be designated by NFW RECO. Vehicles used by the LESSEE and associated lease employees, contractors, and agents shall meet Maryland licensing requirements, Maryland vehicle safety standards, and Maryland vehicle insurance requirements. The lease document shall be presented when registering vehicles.
- c. Authorization. Visitors, other than GOVERNMENT personnel and LESSEE employees, must obtain a pass from the LESSEE. All migrant farm workers shall be properly authorized to work in the United States and authorized by the USNA Security Office. Any farm worker not properly authorized to work on the FARM will be held for the appropriate authorities.

12. DAMAGE TO GOVERNMENT PROPERTY. Information regarding the existence, location, and depth of underground utilities shall be obtained from the USNA. Other signs, poles, piezometers, survey markers, or structures adjacent to or included within the parcel shall not be damaged. The LESSEE shall be held liable for all damages to GOVERNMENT owned structures, utilities, monuments, and improvements, which result from lease activities. The LESSEE shall repair or replace damaged GOVERNMENT property, or the GOVERNMENT will bill the LESSEE for any and

all expenses for repairing damaged GOVERNMENT property that is required as a result of activities of the LESSEE.

13. TECHNICAL ASSISTANCE.

NAVFAC WASHINGTON
Environmental Division
Attn: Ms. Laura Muhs, Natural Resources Program Manager
1314 Harwood Street, S.E.
Washington, DC 20374
202-685-3447
Laura.muhs@navy.mil

U.S. NAVAL ACADEMY
Environmental Department
Attn: Mr. Jeff Morris, Director
181 Wainwright Road
Annapolis, MD 21402
410-293-1025
jwmorris@usna.edu

ANNE ARUNDEL SOIL CONSERVATION DISTRICT
U.S. Department of Agriculture
Attn: Mr. Bob Miller, District Manager
2662 Riva Road, Suite 150
Annapolis, MD 21401
410-571-6757

14. LEASE ADMINISTRATION ASSISTANCE.

NAVFAC WASHINGTON
Attn: Joan Markley, Real Estate Contracting Officer
1314 Harwood Street, S.E.
Washington, DC 20374
202-685-3069
Joan.markley@navy.mil

Appendix 5

Signed Findings of No Significant Impacts

**DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY**

**FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR ENVIRONMENTAL ASSESSMENT
(EA) ADDENDUM FOR UNITED STATES NAVAL ACADEMY (USNA) BRIGADE SPORTS
COMPLEX, ANNE ARUNDEL COUNTY, MARYLAND**

- Ref: (1) Environmental Assessment for the USNA Brigade Sports Complex at Annapolis, MD, April 2006
- (2) Department of Defense, Department of the Navy, Finding of No Significant Impact for Environmental Assessment for the USNA Brigade Sports Complex at Annapolis, MD, May 2006
- (3) Environmental Assessment Addendum for the USNA Sports Complex at Annapolis, MD, March 2009

Pursuant to the Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508) implementing the National Environmental Policy Act, and Chief of Naval Operations Instruction 5090.1C, the Department of the Navy (Navy) gives notice that an EA Addendum has been prepared and an Environmental Impact Statement (EIS) is not required.

Background: Reference (1) analyzed the environmental impacts of constructing and operating a Brigade Sports Complex that includes a 135,500 ft² building containing an indoor ice rink, six indoor tennis courts, and locker rooms; six outdoor tennis courts; a separate indoor hockey rink in another building; and parking spaces. Reference (2) was signed in May 2006.

After Reference (2) was signed, an outdoor artificial rugby field was determined to be required to elevate the rugby program to a Club "A" designation. Presently, multi-use fields are used for rugby, but a dedicated field is necessary for Club "A" designation. Therefore, Reference (3), has been prepared to assess the potential environmental issues and consequences that may be associated with the construction and operation of an outdoor rugby field in conjunction with the proposed action evaluated in Reference (1).

Proposed Action: The construction of an outdoor artificial turf rugby field.

Existing Conditions: The current facilities for the academy's ice hockey, tennis, and rugby programs are insufficient for Class "A" rugby, tennis, and hockey. The purpose of the proposed action is

**FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR ENVIRONMENTAL ASSESSMENT
(EA) ADDENDUM FOR UNITED STATES NAVAL ACADEMY (USNA) BRIGADE SPORTS
COMPLEX, ANNE ARUNDEL COUNTY, MARYLAND**

to provide the US Naval Academy (USNA) a consolidated sports complex. A portion of the preferred site includes a young forest within and outside of the tidal waters buffer.

The men's and women's rugby programs currently use on-site fields located on the main campus of the U.S. Naval Academy (Yard) for both practice and home games. With the competing field sports on-site, there is inadequate field space at the Yard, so a new field is needed. Both men's and women's rugby programs anticipate further growth and interest by the midshipmen. Rugby is further being elevated to a Club "A" designation, and a dedicated facility versus multi-use fields is necessary for this designation. With the extensive use of existing fields on the Yard, the supplemental field is critical to meeting the needs of the teams.

Alternatives Analyzed: Alternative 1-Adjacent to USNA Golf Course, Alternative 2-Composting Area, and the No Action Alternative were evaluated in Reference (1). Alternative 1-Adjacent to USNA Golf Course was identified as the preferred alternative per References (1) and (2). In Reference (3), the footprint of the alternatives increased from 20 to 24 acres to accommodate the rugby field.

Environmental Effects: There will be no significant impacts to any federally listed threatened or endangered species, critical habitat, essential fish habitat, or biological resources or archeological or historic resources. No federally listed threatened and endangered species are known to exist within the project impact area. An archeological survey has been completed with no significant findings. The final report was forwarded to the Maryland State Historical Preservation Officer (SHPO). The SHPO has provided their concurrence. Additionally, there will be no significant impacts to the health and safety of children or minority and low-income populations.

There will be no significant impacts to air quality. The proposed action will occur in an area designated in attainment for five of the six Criteria Pollutants and in severe non-attainment for ozone. An Applicability Analysis was performed in accordance with the General Conformity Rule of the Clean Air Act. The analysis

FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR ENVIRONMENTAL ASSESSMENT (EA) ADDENDUM FOR UNITED STATES NAVAL ACADEMY (USNA) BRIGADE SPORTS COMPLEX, ANNE ARUNDEL COUNTY, MARYLAND

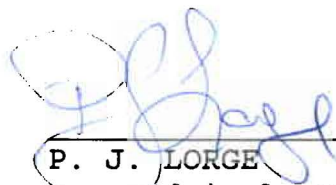
determined that potential emission levels to be produced during construction or operation of the complex were clearly below *de minimis* levels and, therefore, the proposed action is exempt from the Clean Air Act General Conformity Rule requirements.

There will be no significant impacts on water quality or wetlands. Additional tree planting on Greenbury Point will mitigate for forest lost. The Maryland Critical Area Commission and US Fish and Wildlife Service approved the forest mitigation plan. Mitigation for clearing forest for the original Brigade Sports Complex (Reference (1)) consisted of planting 9.22 acres with 805- 2" caliper canopy trees, 801 - 3 gallon container understory trees, 1608 seedlings, and 1210 - 3 gallon container shrubs. Mitigation for clearing forest for the rugby field combined with the original Brigade Sports Complex (Reference (3)) consisted of planting a total of 12.28 acres of forest: 1039 - 2" caliper canopy trees, 1039 - 3 gallon container understory trees, 2341 seedlings, and 1557 - 3 gallon container shrubs.

Finding: Based on the analysis presented in References (1) and (3), the Navy finds that the proposed construction and operation of the Brigade Sports Complex and rugby field at Naval Support Activity Annapolis will not significantly impact the quality of the human or natural environment or generate significant controversy.

Reference (3) prepared by the Navy addressing this action is on file and interested parties may obtain a copy from: Public Works Department Annapolis, Environmental Division, 181 Wainwright Road, Annapolis, MD 21402 (Attention: Kimberly Hickey, 410-293-1116). A limited number of copies of Reference (3) are available to fill single copy requests.

21 SEP 09
Date



P. J. LORGE
Rear Admiral, U.S. Navy
Commandant
Naval District Washington

DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY

FINDING OF NO SIGNIFICANT IMPACT FOR ENVIRONMENTAL ASSESSMENT
FOR CONSTRUCTION OF MORALE, WELFARE, AND RECREATION COTTAGES AT
NAVAL SUPPORT ACTIVITY ANNAPOLIS, NORTH SEVERN GREENBURY POINT,
ANNAPOLIS, MARYLAND

Pursuant to the Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508) implementing the National Environmental Policy Act (NEPA), and Chief of Naval Operations Instruction 5090.1C, the Department of the Navy (Navy) gives notice that an Environmental Assessment (EA) has been prepared and an Environmental Impact Statement (EIS) is not required for the construction and operation of 16 Morale, Welfare, and Recreation (MWR) Cottages at Naval Support Activity (NSA) Annapolis North Severn Greenbury Point.

Proposed Action: NSA Annapolis is proposing the construction of 16 cottages and necessary supporting infrastructure at Greenbury Point. The project would construct 16 free-standing cottages: 12 two-bedroom cottages of approximately 1,000 square feet each and 4 three-bedroom cottages of approximately 1,200 square feet each. There would be one or two covered outdoor pavilions as well as a 1,000 square-foot support building to house check-in and housekeeping functions sited near the proposed cottages. Two of the 16 cottages (1 two-bedroom and 1 three-bedroom) would meet minimum Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG) compliance requirements for access for individuals with disabilities.

An access road is proposed at one of the two sites under consideration; however, crushed shell aggregate topping on a stabilized base is planned for the cottage driveways/parking. This is intended to maintain the rustic setting within which the cabins should be set and avoid significantly increasing impermeable ground area. Necessary utility infrastructure would also be constructed.

Background: A Finding of No Significant Impact (FONSI) for the construction and operation of 16 MWR Cottages at NSA Annapolis was previously approved by Rear Admiral Handley on June 6, 2008. The previous FONSI selected the preferred Alternative Site A of the proposed action. This decision was based on the determination that the Alternative Site B location was too close to other potential land uses being considered at that time. Those uses are no longer being considered and the Alternative

FINDING OF NO SIGNIFICANT IMPACT FOR CONSTRUCTION OF MWR COTTAGES AT NSA ANNAPOLIS, NORTH SEVERN GREENBURY POINT, ANNAPOLIS, MARYLAND

Site B is now considered the most reasonable location for the proposed action.

Purpose and Need: The purpose and need for the proposed action is to provide additional on-base transient lodging options needed for visitors to the Naval Academy/Annapolis area by constructing 16 cottages on Greenbury Point. NSA Annapolis does not currently operate any cottage or cabin facilities.

Existing Conditions: The project site, approximately 3 acres in size, is located on the eastern shore of Greenbury Point, in the vicinity of Building NA255. Building NA05 is located to the southwest of the project site. The site has a vegetative cover consisting of scattered trees and shrubs and maintained lawn. The location of the proposed project is partially within the Critical Area, but is not within the 100-foot Critical Area Buffer, is outside the State regulated 25-foot nontidal wetlands buffer, and is not within 100 feet of jurisdictional waterways.

Alternatives Analyzed: Two action alternatives were considered, Alternatives A and B. As required by the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA, the No Action alternative was also analyzed.

Alternative A: South of Building NA05 - Under Alternative A, 16 cottages and a support building would be constructed at Greenbury Point, totaling approximately 17,800 square feet (1,654 m²) of building space and 4,600 square feet (427 m²) of associated walkways. The proposed facilities would be located on a 5-acre parcel of upland grassland and upland scrub/shrub habitat south of Building NA05. The proposed site would be set back 150 feet or more from the shore of the Chesapeake Bay and is currently accessible by a hard packed dirt road. Construction of a 900-foot all-weather, asphalt paved road is proposed for access that would add approximately 19,800 square feet of impervious surface.

There is a 15-percent impervious surface limit and forest clearing limitations that are applicable to development in Limited Development Areas and Resource Conservation Areas by Maryland law and regulations. Although impermeable ground area would increase from construction of the new access road, impermeable ground area would not increase from the construction of the cottage driveways, because the driveways would use crushed shell aggregate topping on a stabilized base.

FINDING OF NO SIGNIFICANT IMPACT FOR CONSTRUCTION OF MWR COTTAGES AT NSA ANNAPOLIS, NORTH SEVERN GREENBURY POINT, ANNAPOLIS, MARYLAND

Alternative B: Eastern Shore of Greenbury Point Adjacent to Building NA255 Site (Preferred Alternative) - Under Alternative B, the proposed facilities would be located on the eastern shore of Greenbury Point, in a 3-acre parcel adjacent to Building NA255. The scope of the project would be the same as for Alternative A: 16 cottages and a support building would be constructed totaling approximately 17,800 square feet (1,654 m²) of building space and 4,600 square feet (427 m²) of associated walkways. The project site would be set back 150 feet or more from the shore of the Chesapeake Bay. Because this site is already accessible by nearby asphalt paved roads, impermeable ground area would be increased primarily by the cottage footprints, as the proposed access driveways would use crushed shell aggregate topping on a stabilized base. No new asphalt paved roads would be constructed.

No Action Alternative: The proposed MWR Cottages and support facilities would not be constructed and current facilities would remain insufficient to satisfy demand.

Environmental Effects of the Proposed Action: No significant impacts would be expected to the natural and human environment. Minor impacts expected would include soil disturbance, a potential for increased stormwater runoff, an increase in noise during construction, vegetation removal, a small increase in traffic into Greenbury Point, and utility relocations and extensions. Handling of housekeeping materials in compliance with applicable regulations would ensure that impacts to human health and safety would be negligible.

Emissions associated with constructing and operating the proposed facilities, when compared to the de minimis values for an ozone and PM non-attainment area of 100 TPY for NO_x, VOC, PM_{2.5}, and SO₂ fall below the de minimis values even under the conservative assumptions that were employed. The alternatives are not subject to further analysis under the General Conformity Rule requirements and a Record of Non-Applicability has been prepared.

The State has concurred that the proposed action is consistent with the State's Coastal Zone Management Program, because it will not directly impact the 100-foot Critical Buffer Area, the State regulated 25-foot non-tidal wetlands buffer, or jurisdictional waterways. The proposed action will also be completed within the 15-percent impervious surface limit through the use of crushed shell aggregate topping on a stabilized base for cottage driveways.

FINDING OF NO SIGNIFICANT IMPACT FOR CONSTRUCTION OF MWR COTTAGES AT NSA ANNAPOLIS, NORTH SEVERN GREENBURY POINT, ANNAPOLIS, MARYLAND

Consultation with the State Historic Preservation Office (SHPO) found the alternative sites to be free of historic structures or archaeological sites. The SHPO concurred that no historic properties will be affected by the construction of the MWR cottages as proposed on either of the alternative sites. Best management practices (BMPS) would be employed to reduce or minimize any potential impacts. BMPs considered for use include, protective devices, erosion control matting, and sediment traps for erosion and sediment control; structural and nonstructural stormwater management practices; control measure for fugitive dust; and Low Impact Development (LID) measures for design of stormwater management measures.


The cumulative effects to NSA Annapolis Greenbury Point or the surrounding areas of the Alternatives also would not be expected to be significant.

Finding: Based on the analysis presented in the EA and consultation with the State of Maryland, the Navy finds that the proposed action would not have significant or controversial adverse impacts on the human environment. This FONSI will replace the previous FONSI for the proposed action signed on June 6, 2008.

The EA addressing this action is on file and interested parties may obtain a copy from: Mr. Jeff Gardner, Naval Facilities Engineering Command, Washington Navy Yard, Building 212, 1314 Harwood Street Southeast, Washington, DC 20374, or by email to: jeffrey.a.gardner2@navy.mil.

30 MAR 10

Date



P. J. LORGE
Rear Admiral, U.S. Navy
Commandant
Naval District Washington

**DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY**

**FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR ENVIRONMENTAL
ASSESSMENT (EA) FOR THE UNITED STATES NAVAL ACADEMY DAIRY FARM,
GAMBRILLS, MARYLAND**

Pursuant to the Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508) implementing the National Environmental Policy Act (NEPA), Navy regulations (32 CFR Part 775) and Chief of Naval Operations Instruction 5090.1C, the Department of the Navy (Navy) gives notice that an EA has been prepared and an Environmental Impact Statement (EIS) is not required for the United States Naval Academy (USNA) Dairy Farm in Gambrills, Maryland.

Proposed Action: The proposed action is to authorize certain rural and agricultural land uses and activities proposed by the long-term lessee of the USNA Dairy Farm, Anne Arundel County. The proposed action would include concepts similar to the U.S. Department of Agriculture's "Community Supported Agriculture Program", which consists of "a community of individuals who pledge support to a farm operation so that the farmland becomes, either legally or spiritually, the community's farm, with growers and consumers providing mutual support and sharing the risks and benefits of food production". Reuse of the Dairy Farm would be guided by the County's vision for the property, which is a combination of preservation, utilization, recreation, and education (PURE). The proposed action would also incorporate Low Impact Development (LID) features consistent with the goals of Section 438 of the Energy Independence and Security Act of 2007 to reduce stormwater runoff to protect water resources.

Purpose and Need: The purpose of the proposed action is to specify the activities and uses of the farm by the new lessee that are authorized by the Navy for the 30-year term of the lease. Federal law (10 U.S.C. §6976) mandates that the Naval Academy Dairy Farm shall be maintained in its rural and agricultural nature. The proposed action is needed because actions permitted under the lease must be authorized by the Navy before they can be implemented by the lessee.

All money received from a lease would be retained by the Superintendent of the Naval Academy and would be available to cover expenses related to the Naval Academy Dairy Farm property, including reimbursing non-appropriated fund instrumentalities of the Naval Academy (10 U.S.C. §6976). Proceeds from leasing the

FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR THE UNITED STATES NAVAL ACADEMY
DAIRY FARM, GAMBRILLS, MARYLAND

Dairy Farm are currently used and continue to be needed to support the Academy's Midshipmen Fund. A long-term lease of the farm would continue to generate proceeds and maximize results in support of the Midshipmen Fund.

Alternatives Analyzed: Two action alternatives were considered, Alternatives A and B. As required by the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA, the No Action alternative was also analyzed.

Under either action Alternative A or B, the proposed County use of the Dairy Farm would maintain the property in viable, sustainable agriculture production, with a continuation of all the existing types of recreational activities, including seasonal special events. Additionally, the County would consider holding two to four special events per year with a maximum attendance of approximately 300-500 people.

Under either Action Alternative A or B, existing picnic pavilions, the firehouse, stores, and buildings in the currently developed northern portion of the Farm (the Common Area) would be reused once these buildings are redeveloped or brought up to applicable safety standards. As the Farm is National Register of Historic Places (NRHP) eligible, activities related to contributing resources to the Historic District must meet Department of the Interior guidelines for NRHP-eligible structures. Such actions would be approved by the Navy and properly documented per NRHP guidelines.

In the first year of lease to Anne Arundel County, the farm would maintain its current farming operation. Future farming operations would be in accordance with environmental regulations and the USNA Integrated Natural Resources Management Plan (INRMP), and all farm tenants would continue to adhere to the Navy's Soil and Water Conservation Plan.

Any new non-farming uses of the land would be primarily focused on the western parcel of the property and have been grouped for implementation during two phases - Phases I and II. Alternative A would implement both Phases I and II, while Alternative B would implement only the Phase I actions.

Alternative A USNA Dairy Farm Reuse, Phases I and II (Preferred Alternative): Under Alternative A, both Phases I and II would be implemented. The proposed Phase I elements would be sited on approximately 110 acres of the western parcel and consist of

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construction of themed and formal gardens, hiking/biking trails, offshoot nature trails, a small picnic pavilion, a restroom, a sled run, a water quality demonstration system, a small visitor/interpretation center, access road improvements, and parking for 184. In addition, the County plans to improve the streambed corridor located on the western boundary of the property to double the existing forest buffer to approximately 300 feet. Phase II as currently planned would consist of additional gardens including a community garden, an area providing an exhibit of orchard-type agriculture, an additional picnic pavilion with restrooms and playground, 126 additional parking spaces, potentially the addition of an old barn, and an additional access roadway to the community garden.

Fencing would be installed around the proposed elements of Phase I to keep visitors from the farming operations. Land designated for Phase II could continue to be used for farming during Phase I, but all farming operations would be separated by fencing from the other areas once the Phase II elements are in place.

Alternative B USNA Dairy Farm Reuse, Phase I Only: Under Alternative B, only Phase I would be implemented; Phase II would not be implemented.

No Action Alternative: The proposed non-farming uses of the Dairy Farm would not be implemented for the reuse of the property and dairy and farming methods and activities on the property would continue to operate.

Environmental Effects: No significant impacts would be expected to the natural and human environment. Reuse of the Dairy Farm under either Alternative A or B would be expected to provide the facilities necessary to promote the land uses and activities proposed by Anne Arundel County. Minor impacts are expected that would include soil disturbance, a small increase in stormwater runoff, removal of vegetation, increased noise during construction, and minor increases in traffic. Construction related soil erosion would be minimized through the implementation of best management practices. Long-term stormwater impacts from the increase in impervious surfaces would be minimized through the use of LID features to reduce stormwater runoff and sediment and nutrient loads.

Air emissions analysis shows peak annual pollutant emissions would be below de minimis levels for this ozone and PM_{2.5} non-attainment area and are not regionally significant; therefore, alternatives are not subject to further analysis under the

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General Conformity Rule requirements. A Record of Non-Applicability has been prepared.

The Maryland Department of Environment indicated the state concurs with the Navy's determination that the proposed federal action is consistent with the Maryland Coastal Zone Management Program. The Maryland Historical Trust (MHT) concurred with the Navy's determination that the long-term lease of the Dairy Farm will have no adverse effect on historical properties, including archeological resources, and that a Programmatic Agreement would be the appropriate mechanism to address future Section 106 concerns. Coordination with the U.S. Fish and Wildlife Service and Maryland Department of Natural Resources has been completed. Their response was that except for occasional transient individuals, no federally proposed or listed endangered or threatened species were known to exist within the project area and no state-listed threatened species are known to exist at the site.

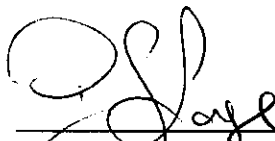
Through a Programmatic Agreement (PA), the Navy would continue to exercise appropriate stewardship over cultural resources (archeological sites and historic structures). The PA stipulations would be incorporated into the long-term lease between the Navy and Anne Arundel County ensuring adverse effects to cultural resources are avoided or mitigated. None of the other expected impacts would require mitigation to avoid being considered significant. However, a number of best management practices would be employed where appropriate to reduce or minimize impacts.

Finding: Based on the analysis presented in the EA and consultation with the State of Maryland, and with implementation of mitigation that has been coordinated and has received agreement from MHT for each action affecting cultural resources, the Department of the Navy finds that implementation of either Alternative A, the Preferred Alternative, or Alternative B would not have significant or controversial adverse impacts on the human environment.

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The EA addressing this action is on file and interested parties may obtain a copy from: Mr. Jeff Gardner, Naval Facilities Engineering Command, Washington Navy Yard, Building 212, 1314 Harwood Street Southeast, Washington, DC, 20374, or by email to: jeffrey.a.gardner2@navy.mil.

30 JUNE 2010
Date



P. J. LORGE
Rear Admiral, U.S. Navy
Commandant
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