Integrated Natural Resources Management Plan: 2003 through 2007

Final

U.S. Military Academy
West Point, New York

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN FOR THE UNITED STATES MILITARY ACADEMY

2003 - 2007

WEST POINT, NEW YORK

PREPARED FOR

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West Point, New York

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

2003 - 2007

UNITED STATES MILITARY ACADEMY WEST POINT, NEW YORK

This Integrated Natural Resources Management Plan has been developed by the United States Military Academy in cooperation with the United States Department of Interior, Fish and Wildlife Service and the New York State Department of Environmental Conservation. The signatures below indicate the mutual agreement of the parties concerning the conservation, protection and management of fish and wildlife resources as presented in the Plan.

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ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
AEHA	Army Environmental Hygiene Agency
AQCRs	Air Quality Control Regions
AR	Army Regulation
ATTACC	Army Training and Testing Area Carrying Capacity
BBS	bulletin board system
BOD	Biological Oxygen Demand
B.P.	before the present
CBT	Cadet Basic Training
CATS	Combined Arms Training Strategy
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CFT	Cadet Field Training
CHPPM	Army Center for Health Promotion and Preventive Medicine
CRD	Community Recreation Division
CRM	Cultural Resources Manager
CRO	Cultural Resources Office
CSBP	Cold Spring Battery Plant
dB	decibel
dbh	diameter at breast height
DCFA	Directorate of Community and Family Activities
DHPW	Directorate of Housing and Public Works
DMAP	Deer Management Assistance Permit
DMU	Deer Management Unit
DO	Dissolved Oxygen
DoD	Department of Defense
DPTM	Directorate of Plans, Training, and Mobilization
EA	Environmental Assessment (when referring to NEPA)
EA	Environmental Awareness (a component of the ITAM program)
EIS	Environmental Impact Statement
EMD	Environmental Management Division
EPR	Environmental Program Requirements
EPSD	Engineer Plans and Services Division
ESA	Endangered Species Act
ESMP	Endangered Species Management Plan
FESD	Fire and Emergency Services Division
FNSI	Finding of No Significant Impact
FY	Fiscal Year
GIS	geographic information system
gpd	gallons per day
gpm	gallons per minute
GPS	Global positioning system
HAPS/HAER	Historic American Buildings Survey/Historic American Engineering Record
HQDA	Headquarters, Department of Army
LCTA	Land Condition Trend Analysis
LOD	large organic debris

LRAM	Land Rehabilitation and Maintenance
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated Natural Resources Management Plan
IPM	Integrated Pest Management
ISR	Installation Status Report
ITAM	Integrated Training Area Management
ITT	Infantry Tactics Training
MACOM	Major Command
MAPS	Mapping Avian Productivity and Survivorship Program
METL	Mission Essential Task List
mgd	million gallons per day
MOU	Memorandum of Understanding
MPs	Military Police
MREs	Meals-ready to eat
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHLD	National Historic Landmark District
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRB	Natural Resources Branch
NRHP	National Register of Historic Places
NRCS	Natural Resources Conservation Service
NYNHP	New York Natural Heritage Program
NYSDS	New York State Department of State
NYSDEC	New York State Department of Environmental Conservation
O&R	Orange and Rockland Utilities Incorporated
OMB	Office of Management and Budget
ORISE	Oak Ridge Institute for Science and Education
PA	Programmatic Agreement
PATH	Port Authority Trans Hudson
PCBs	polychlorinated biphenyls
PEM	Palustrine Emergent
PFO	Palustrine Forested
PIP	Palisades Interstate Parkway
PMO	Provost Marshal=s Office
POLs	Petroleum, oil, and lubricants
ppm	parts per million
ppt	parts per thousand
psi	pounds per square inch
PSS	Palustrine Scrub Shrub
RBPs	Rapid Bioassessment Protocols
RFMSS	Range Facility Management Support System
ROTC	Reserve Officer Training Corps
RRD	Rose rosette disease
RSD	Relative stock density
RTLP	Range and Training Land Program
SHPO	State Historic Preservation Officer
STAS	Stewart Army Subpost
TA	Training Area

TDS	Total Dissolved Solids
TEAs	Training Exclusion Areas
TNC	The Nature Conservancy
TRI	Training Requirements Integration
TSI	Timber Stand Improvement
UCMJ	Uniform Code of Military Justice
USACE	United States Army Corps of Engineers
USACERL	United State Army Corps of Engineer Research Laboratory
USAEC	United States Army Environmental Center
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USMA	United States Military Academy
WMU	Wildlife Management Unit
WPMR	West Point Military Reservation
YABD	Yearling male antler beam diameter
YMDW	Yearling male dressed weight

EXECUTIVE SUMMARY

PURPOSE

The purpose of this Integrated Natural Resources Management Plan (INRMP) is to guide the natural resources management program at the United States Military Academy (USMA) from 2003 through 2007, and to provide a solid foundation from which to build the program beyond the year 2007. This INRMP will allow USMA to achieve its goal to ensure the sustainability of desired military training area conditions and maintain ecosystem viability. In addition, this INRMP will ensure that natural resources conservation measures and Army activities on USMA land are integrated and are consistent with Federal stewardship requirements.

This plan also contains the associated documentation required for compliance with the National Environmental Policy Act (NEPA), which requires Federal agencies to consider environmental consequences of major proposed actions. This NEPA documentation is in the form of an Environmental Assessment (EA), which analyzes the potential consequences of the proposed action to implement the USMA INRMP.

ENVIRONMENTAL COMPLIANCE

Under the Natural Resource Management on Military Lands Act of 1960 (16 U.S.C. ' 670a et seq.), commonly known as the Sikes Act, as amended according to the Sikes Act Improvement Act of 1997,

> The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation in the United States under the jurisdiction of the Secretary. Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out the program to provide for the conservation and rehabilitation of natural resources on military installations; the sustainable multipurpose use of the resources, which shall include hunting,

fishing, trapping, and nonconsumptive uses; and subject to safety requirements and military security, public access to military installations to facilitate the use.

Per 16 U.S.C. § 670a (b) of the Sikes Act Improvement Act of 1997, to the extent appropriate and applicable, this INRMP provides for:

- fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation;
- fish and wildlife habitat enhancement or modifications;
- wetland protection, enhancement, and restoration, where necessary for support of fish, wildlife, or plants;
- integration of, and consistency among, the various activities conducted under the plan;
- establishment of specific natural resource management goals and objectives and time frames for proposed action;
- sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources;
- public access to the military installation that is necessary or appropriate for the use described above, subject to requirements necessary to ensure safety and military security;
- enforcement of applicable natural resource laws (including regulations);
- no net loss in the capability of military installation lands to support the military mission of the installation; and
- such other activities as the Secretary of the military department determines appropriate.

Army Regulation (AR) 200-3 (*Natural Resources—Land, Forest, and Wildlife Management*) "sets forth policy, procedures and responsibilities for the conservation, management, and restoration of land and the natural resources thereon consistent with the military mission and in consonance with national policies. The scope includes the conservation, management, and utilization of the soils, vegetation, water resources, croplands, rangelands, forests, and fish and wildlife species."

32 CFR 651, *Environmental Analysis of Army Actions (AR200-2)* (29 March 2002), "sets forth policy, responsibilities, and procedures for integrating environmental considerations into Army planning and decision making" (FR, 2002). In particular, 32 CFR 651.12, Integration with Army Planning, states that "The Army goal to integrate environmental reviews concurrently with other Army planning and decisionmaking actions avoids delays in mission accomplishments. To achieve this goal, proponents should provide complete environmental documents for early inclusion with any recommendation or report to decisionmakers. These documents include the Natural Resource Management Plans." 32 CFR 651 (AR 200-2) also implements the Council on Environmental Quality's (CEQ) NEPA regulations, Executive Order 12114, and Department of Defense (DoD) Directives 6050.1 and 6050.7. The NEPA process involves an interdisciplinary assessment of reasonably foreseeable, potential environmental consequences of implementing a proposal.

Thus, in preparing this INRMP, USMA has maintained its commitment to ensure that environmental considerations are integral to the mission and has complied with AR 200-2 and AR 200-3 by integrating INRMPs and NEPA compliance documentation. In addition, this INRMP provides the guidance necessary for USMA to maintain compliance with the DoD Instruction 4715.3 (*Environmental Conservation Program*), HQDA's INRMP Policy Memorandum (21 March, 1997; *Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and Integrated Natural Resources Management Plans (INRMPs)*), Executive Order 11990 (Protection of Wetlands), the Clean Water Act, and the Endangered Species Act (ESA).

SCOPE

Maintaining optimal environmental conditions on the training lands is essential for the success of the military mission at USMA. Therefore, the focus of this INRMP will be on the management of the natural resources on the military reservation. The management measures have been developed based on the current conditions of the

resources, and the military mission and activities as they are anticipated. This INRMP will guide natural resources management at USMA for the next five years (i.e., 2003 through 2007) and provide a solid foundation from which to build the program beyond the year 2007.

The EA scope of analysis is based on identifying, documenting, and evaluating potential effects of implementing the INRMP for the USMA. The EA examines the Army's preferred alternative and the no action alternative. Implementation of the preferred alternative (i.e., proposed action) would mean that the selected management measures set forth in the INRMP would be adopted. The development of selected management measures for the INRMP involved a screening analysis of resource-specific management alternatives. The screening analysis involved the use of accepted criteria, standards, and guidelines (e.g., USEPA *Guidance Specifying Management Measures for Sources of Nonpoint Source Pollution in Coastal Waters*; USDA/NRCS *National Soils Handbook*; USEPA *Lake and Reservoir Restoration Guidance*; Commonwealth of Massachusetts' *Guidelines for Certification of Vernal Pool Habitat*; USEPA *Protecting Natural Wetlands: A Guide to Stormwater Best Management Practices*), when available, and best professional judgment to identify management practices for achieving USMA natural resource management objectives. Obviously, an infinite number of permutations of specific management alternatives are possible. Consistent with the intent of NEPA, this process focused on considering a reasonable range of resource-specific management alternatives and, from those, developing a plan that could be implemented, as a whole, in the foreseeable future. It then dropped from detailed analysis management alternatives deemed to be infeasible. Application of this screening process in developing the proposed action, i.e., adoption of the management measures contained in the INRMP, eliminated the need to define and evaluate hypothetical alternatives to plan implementation.

Implementation of the no action alternative means that the management measures set forth in the INRMP would not be implemented. Current management measures for natural resources would remain in effect, and existing conditions would continue as the status quo.

RELATIONSHIP TO THE MILITARY MISSION

The mission of USMA is "To educate, train, and inspire the Corps of Cadets so that each graduate is a commissioned leader of character committed to the values of Duty, Honor, Country; professional growth

throughout a career as an officer in the United States Army; and a lifetime of selfless service to the Nation" (HQDA, 2002). Although USMA's mission is to train the Corps of Cadets, Army reservists, Reserve Officer Training Corps (ROTC) students, active duty units, and other government agencies also conduct field training at West Point. Other users are prohibited from using West Point from May until August, the peak training period for the Corps of Cadets (USMA, 1994a).

The Army recognizes that a healthy and viable natural resource base is required to support the military mission. To be effective, the natural conditions of the training areas on West Point must be maintained to provide realism. Areas that are obviously degraded by previous training activity detract from the realism of the current training activity. This INRMP helps to ensure that environmental considerations are an integral part of planning activities at USMA and that natural resources are protected in accordance with Army regulations and policies.

PARTNERSHIPS

USMA has fostered a number of partnerships with various agencies that assist and participate in the natural resources management program. The primary partners involved in the implementation of this plan include the U.S. Fish and Wildlife Service (USFWS) and the New York State Department of Environmental Conservation (NYSDEC).

Other partners providing assistance include the U.S. Department of Agriculture's Natural Resources Conservation Service and the Forest Service, Palisades Interstate Park Commission, Black Rock Forest Consortium, Cornell University, Fordham University, and the University of Tennessee.

PLANNED MAJOR INITIATIVES

The natural resources management program will either implement or continue to conduct a number of significant projects (see section 6.3). Some of the higher priority projects include:

- Implement ecosystem principles in managing natural resources at USMA. (FY 03-07)

- Continue to implement the Integrated Training Area Management (ITAM) program. (FY 03-07)
- Continue to implement the LCTA program to monitor changes in training land condition. (FY 03-07)
- Continue to use the Land Rehabilitation and Maintenance (LRAM) program to repair degraded areas. (FY 03-07)
- Continue to implement the Environmental Awareness program, including updating outreach and training materials. (FY 03-07)
- Update geographic information systems (GIS) coverages for all natural resource areas as necessary. (FY 03-07)
- Monitor surface water quality. (FY 03-07)
- Conduct habitat assessments for all water bodies at USMA. (FY 03-07)
- Maintain protective vegetative buffer zones around streams, lakes, ponds, wetlands, and vernal pools. (FY 03-07)
- Protect Special Natural Areas (i.e., those with ecological and geological significance). (FY 03-07)
- Monitor bald eagle (*Haliaeetus leucocephalus*) activity on the reservation and Constitution Island. (FY 03-07)
- Continue the timber rattlesnake (*Crotalus horridus*) recovery and monitoring program. (FY 03-07)
- Increase natural and cultural resources law enforcement activities, including training. (FY 03-07)

COSTS AND BENEFITS

The benefits of this INRMP are numerous. For the military mission, the natural resources management program, as described in this INRMP, will ensure that the environmental conditions of the training lands continue to provide the continuous cover necessary for realistic military training. From an environmental perspective, implementation of this plan will maintain, protect, and enhance the ecological integrity of the training lands and the biological communities (particularly sensitive, rare, threatened and endangered species) inhabiting them. In addition, the natural resources management program described in this plan will protect ecosystems and their components from unacceptable damage or degradation, and identify and restore already degraded habitats.

This plan will ensure that a diverse assortment of quality outdoor recreational activities continues to be available. Also, users of the training lands will have an increased awareness of the potential for impacts to occur as a result of their activities. This heightened awareness will serve to minimize the possibility for impacts to occur, thereby decreasing the effort and costs that must be expended to mitigate those impacts.

The estimated average annual costs of implementing this INRMP by funding category are as follows:

- **Forestry:** $78,000
- **Fish and Wildlife:** $16,000
- **Environmental:** $239,200
- **Training:** $469,960

The total average annual funding necessary to implement this INRMP is $803,160 and the total cost over five years is $4,015,800.

NATIONAL ENVIRONMENTAL POLICY ACT

Under NEPA, federal agencies are required to consider the environmental consequences of major proposed actions. The intent of NEPA is to protect, restore, or enhance the environment through well-informed Federal

decisions. This act is premised on the assumption that providing information to the decision-maker, or proponent, and the public will improve the quality of final decisions.

Purpose of and Need for Proposed Action. USMA is proposing to implement the INRMP for the USMA. The purpose of the proposed action is to enable USMA to manage efficiently the use and condition of natural resources located on the installation in accordance with the INRMP to protect the natural setting for training purposes. Implementation would support the Army's underlying need to train cadets in a realistic environmental setting while meeting mission requirements and complying with environmental regulations.

Environmental Consequences. The EA assesses known, potential and reasonably foreseeable environmental consequences potential environmental consequences of implementing the proposed action and the no action alternative. Implementation of the proposed action, the Army's preferred alternative, would mean that the recommended management measures presented in Table 5-11 would be adopted. Under the no action alternative would mean that this INRMP would not be implemented and current natural resource management practices at USMA would continue "as is."

Other alternative management measures were considered in the development of the INRMP, but not selected based on their collective inability in meeting goals and objectives of the plan (such as economical, ecological impracticality or mission requirements). Section 5.0, *Natural Resources Management*, provides a description of the methods used to develop management measures for each resource area and the rationale for why certain management measures were selected. This process focused on considering a reasonable range of resource-specific management alternatives and, from those, developing a plan that could be implemented, as a whole, in the foreseeable future.

Potential environmental consequences of the preferred alternative, implementing the recommended management measures presented in the INRMP, are summarized in Table ES-1. There would be no significant effects. Additionally, no adverse effects would be expected. Potential consequences would result in either no effects or beneficial effects on each resource area.

Table ES-1
Summary of Potential Environmental Consequences

Resource Area/Environmental Condition[1]	Environmental Consequences	
	No Action	**Proposed Action**
Environmental Setting	None	Beneficial
Climate	None	None
Air Quality	None	None
Noise	None	None
Topography	None	Beneficial
Geology	None	Beneficial
Petroleum and Minerals	None	None
Soils	None	Beneficial
Water Resources	None	Beneficial
Wetlands	None	Beneficial
Vernal Pools	None	Beneficial
Aquatic Habitat	None	Beneficial
Riparian Habitat	None	Beneficial
Terrestrial Ecosystems	None	Beneficial
Special Natural Areas	None	Beneficial
Fauna	None	Beneficial
Endangered, Threatened, and Rare Species	Minor Adverse	Beneficial
Cultural Resources	None	Beneficial
Land Use	None	None
Facilities	None	None
Hazardous and Toxic Materials	None	None
Socioeconomic Resources	None	None
Environmental Justice	None	None
Cumulative Effects [2]	None	None

[1] Resource areas presented in this column are the same resource areas presented in Section 3.0, *Affected Environment.*
[2] Cumulative effects (see Section 7.3) have been added to this table for reader convenience.

SUMMARY

This document reflects the commitment set forth by the Army to conserve, protect, and enhance the natural resources necessary to provide realistic military training for the Corps of Cadets. The primary purpose and objective of this document is to present an implementable INRMP that guides USMA in meeting mission requirements, achieving natural resource management goals, and complying with environmental policies and regulations. In addition, the NEPA analysis required for undertaking this major federal action (i.e., implementation of this plan) is embodied within the INRMP. The resultant "planning assessment" includes a comprehensive description, evaluation, and assessment of environmental conditions and natural resources at USMA.

This INRMP is the final plan that will direct the natural resources management program at USMA from 2003 through 2007. An ecosystem approach was used to develop the management measures for each resource area. Implementation of the management measures will maintain, protect, and enhance the ecological integrity of the training lands and the biological communities inhabiting them. In addition, the natural resources management measures described in this plan will protect USMA ecosystems and their components from unacceptable damage or degradation and identify and restore previously degraded habitats.

Command support is essential for the implementation of this INRMP and is required for many of the natural resources management projects described herein. This INRMP has the support of the Garrison Commander and other personnel in decision-making positions at USMA.

NEPA Findings and Conclusions. Findings based on the EA indicate that, under the preferred alternative, potential consequences would result in either no effects or beneficial effects on each resource area. The affected environment would not be significantly affected by proceeding with the preferred alternative. No significant cumulative effects would be expected. Because no significant environmental impacts would result from implementation of the proposed action, preparation of an Environmental Impact Statement is not required and preparation of a Finding of No Significant Impact is appropriate.

SECTION 1.0:

INTRODUCTION

The Army will be a national leader in environmental and natural resource stewardship for present and future generations as an integral part of our mission.

(*U.S. Army Environmental Strategy into the 21st Century*, 1992)

The purpose of this Integrated Natural Resources Management Plan (INRMP) is to guide the natural resources management program on the West Point Military Reservation at the United States Military Academy (USMA) from 2003 through 2007, and to provide a solid foundation from which to build the program beyond the year 2007. This INRMP will allow USMA to achieve its goal to ensure the sustainability of desired military training area conditions and maintain ecosystem viability. In addition, this INRMP will ensure that natural resources conservation measures and Army activities on USMA land are integrated and are consistent with federal stewardship requirements.

Under the Natural Resource Management on Military Lands Act of 1960 (16 U.S.C. ' 670a et seq.), commonly known as the Sikes Act, as amended according to the Sikes Act Improvement Act of 1997,

> The Secretary of Defense shall carry out a program to provide for the conservation and rehabilitation of natural resources on military installations. To facilitate the program, the Secretary of each military department shall prepare and implement an integrated natural resources management plan for each military installation in the United States under the jurisdiction of the Secretary. Consistent with the use of military installations to ensure the preparedness of the Armed Forces, the Secretaries of the military departments shall carry out the program to provide for the conservation and rehabilitation of natural resources on military installations; the sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping, and nonconsumptive uses; and subject to safety requirements and military security, public access to military installations to facilitate the use.

Per 16 U.S.C. ' 670a (b) of the Sikes Act Improvement Act of 1997, to the extent appropriate and applicable, this INRMP provides for:

- fish and wildlife management, land management, forest management, and fish- and wildlife-oriented recreation;
- fish and wildlife habitat enhancement or modifications;
- wetland protection, enhancement, and restoration - where necessary - for support of fish, wildlife, or plants;
- integration of, and consistency among, the various activities conducted under the plan;
- establishment of specific natural resource management goals and objectives and time frames for proposed action;
- sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources;
- public access to the military installation that is necessary or appropriate for the use described above, subject to requirements necessary to ensure safety and military security;
- enforcement of applicable natural resource laws (including regulations);
- no net loss in the capability of military installation lands to support the military mission of the installation; and
- such other activities as the Secretary of the military department determines appropriate.

The Army's commitment to the conservation of its natural resources is further reflected in Army Regulation (AR) 200-3, *Natural Resources ¾ Land, Forest, and Wildlife Management* (28 February 1995) and HQDA's INRMP Policy Memorandum (21 March, 1997), entitled *Army Goals and Implementing Guidance for Natural Resources Planning Level Surveys (PLS) and Integrated Natural Resources Management Plan (INRMP)*. AR 200-3 "sets forth the policy, procedures, and responsibilities for the conservation, management, and restoration of land and

the natural resources thereon consistent with the military mission and in consonance with national policies" (HQDA, 1995b). The INRMP Policy Memorandum states that the purpose for completing planning level surveys and the INRMP is "to ensure that natural resource conservation measures and Army activities on mission land are integrated and are consistent with federal stewardship requirements" (HQDA, 1997).

32 CFR 651, *Environmental Analysis of Army Actions (AR200-2)* (29 March 2002), "sets forth policy, responsibilities, and procedures for integrating environmental considerations into Army planning and decision making" (FR, 2002). In particular, 32 CFR 651.12, Integration with Army Planning, states that "The Army goal to integrate environmental reviews concurrently with other Army planning and decisionmaking actions avoids delays in mission accomplishments. To achieve this goal, proponents should provide complete environmental documents for early inclusion with any recommendation or report to decisionmakers (Master Plan, Natural Resources Management Plan, Remedial Investigation, FS, etc.). The same documents will be forwarded to planners, designers, and/or implementers so that recommendations and mitigations on which the decision was based may be carried out."

This document reflects the commitment set forth by USMA to conserve, protect, and enhance the natural resources necessary to provide realistic military training for the Corps of Cadets. This INRMP is the plan that will direct the natural resources management program at USMA from 2003 through 2007. In accordance with the aforementioned regulations, the Army has integrated the installation's INRMP and the associated Environmental Assessment (EA) for implementing the INRMP into this single document.

1.1 GOALS AND POLICIES

The general goals of this INRMP for USMA conform to those outlined in the Army Environmental Strategic Action Plan. Those general goals include the following:

- To ensure the long-term sustainability of the lands to support the military mission.
- To protect the natural resources.
- To protect the cultural resources.
- To provide ample recreational opportunities.
- To accommodate multiple uses of the land.

The goals and objectives of the natural resources management program, as established by USMA, are provided in detail in Section 5.1, are to maintain ecosystem viability and ensure the sustainability of desired military training area conditions; to maintain, protect and improve ecological integrity; to protect and enhance biological communities, particularly sensitive, rare, threatened and endangered species; to protect the ecosystems and their components from unacceptable damage or degradation, and to identify and restore degraded habitats.

The ability to achieve these goals depends directly on the health and condition of the natural resources. The success of the military mission at USMA is dependent on the condition of the natural resources, as well. Protecting the ecological and biological integrity of the training lands ensures that the environmental conditions of the training lands continue to provide the vegetation, soil and water resources necessary for realistic military training. Popular outdoor recreational activities at USMA include hunting, fishing, swimming, boating, and hiking. Implementing ecosystem management principles will provide the quantity and diversity of fish and game for enjoyable hunting and fishing experiences. Proper management of the forested ecosystems will maintain the water quality at a level necessary to support fisheries, and that presents no potential risks to human health from swimming or boating.

To protect cultural resources, the military trainers and the natural resources staff will maintain adequate communication with the cultural resources staff. All activities on the reservation having the potential to impact cultural resources will be coordinated with the cultural resources staff.

The natural resources management program must remain flexible if it is to achieve long-term success. The natural resources management program will achieve and maintain this flexibility by incorporating adaptive management techniques into the program. Adaptive management is a process by which new information, from either monitoring data or scientific literature, is used to evaluate the success of the management measures currently in place. This information is then used to determine the necessary changes in the management approach to ensure the continued success of the program. The natural resources management program may also be required to adapt to unforeseen changes in military mission and legal requirements.

Maintaining optimal environmental conditions on the training lands is essential for the success of the military mission at USMA. Therefore, the focus of this INRMP will be on the management of the natural resources on the

military reservation. The management measures have been developed based on the current conditions of the resources, and the military mission and activities as they are anticipated. This INRMP will guide natural resources management at USMA for the next five years (i.e., 2003 through 2007) and provide a solid foundation from which to build the program beyond the year 2007.

1.2 BACKGROUND

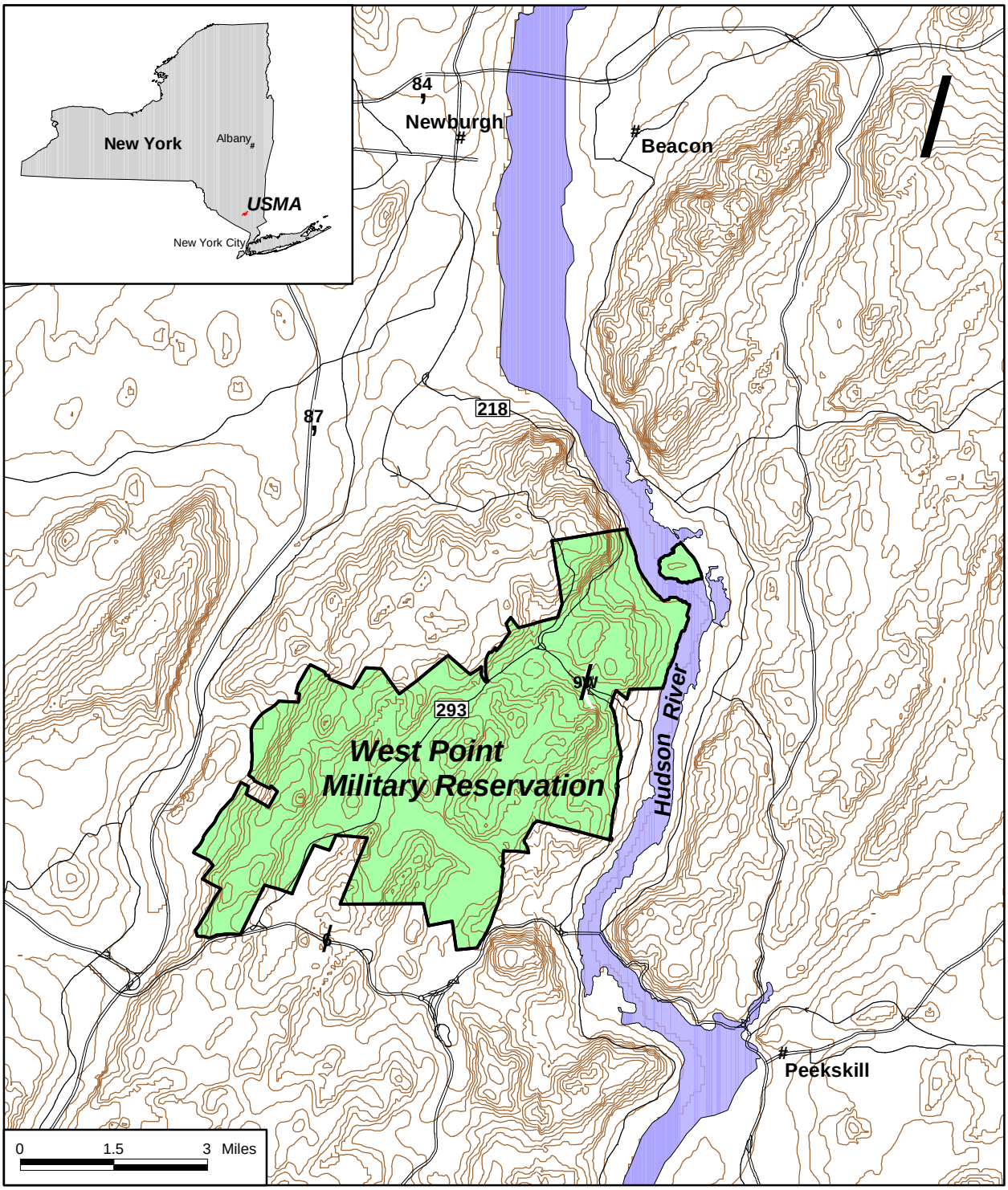
1.2.1 Location

USMA is located in southeastern New York State on the west side of the Hudson River, approximately 45 miles north of New York City and 100 miles south of Albany (Figure 1-1). The installation can be considered to consist generally of three parts: (1) Main Post, (2) the outlying reservation, and (3) Constitution Island (Figure 1-2). Main Post, or the cantonment, is approximately 2,500 acres and is the academic, administrative and community area along the Hudson River. Although the West Point Military Reservation technically includes Main Post, the reservation is generally considered to be the 14,000-acre area to the west of Main Post that serves as the field training facility for USMA.

Both the Main Post and reservation lie entirely in Orange County, New York. Directly across the Hudson River from the Main Post is Constitution Island, which is located in the township of Philipstown, Putnam County, New York. Constitution Island is bounded by the Hudson River on all of its borders except the eastern border, where it is bounded by Metro-North railroad tracks (USMA, 1994a).

1.2.2 Acreage and Acquisition

The first troops were stationed at West Point in 1778, which at the time was an outpost of 1,770 acres (USMA, 1994a). From its establishment until 1974, USMA acquired and excised lands to reach its current size of 15,973 acres. Approximately 1,325 acres of this land were obtained through donations; the remaining 14,648 acres were acquired through direct purchase (USMA, 1984). Table 1-1 shows the major land acquisitions and excisions that occurred from 1790 until 1974.

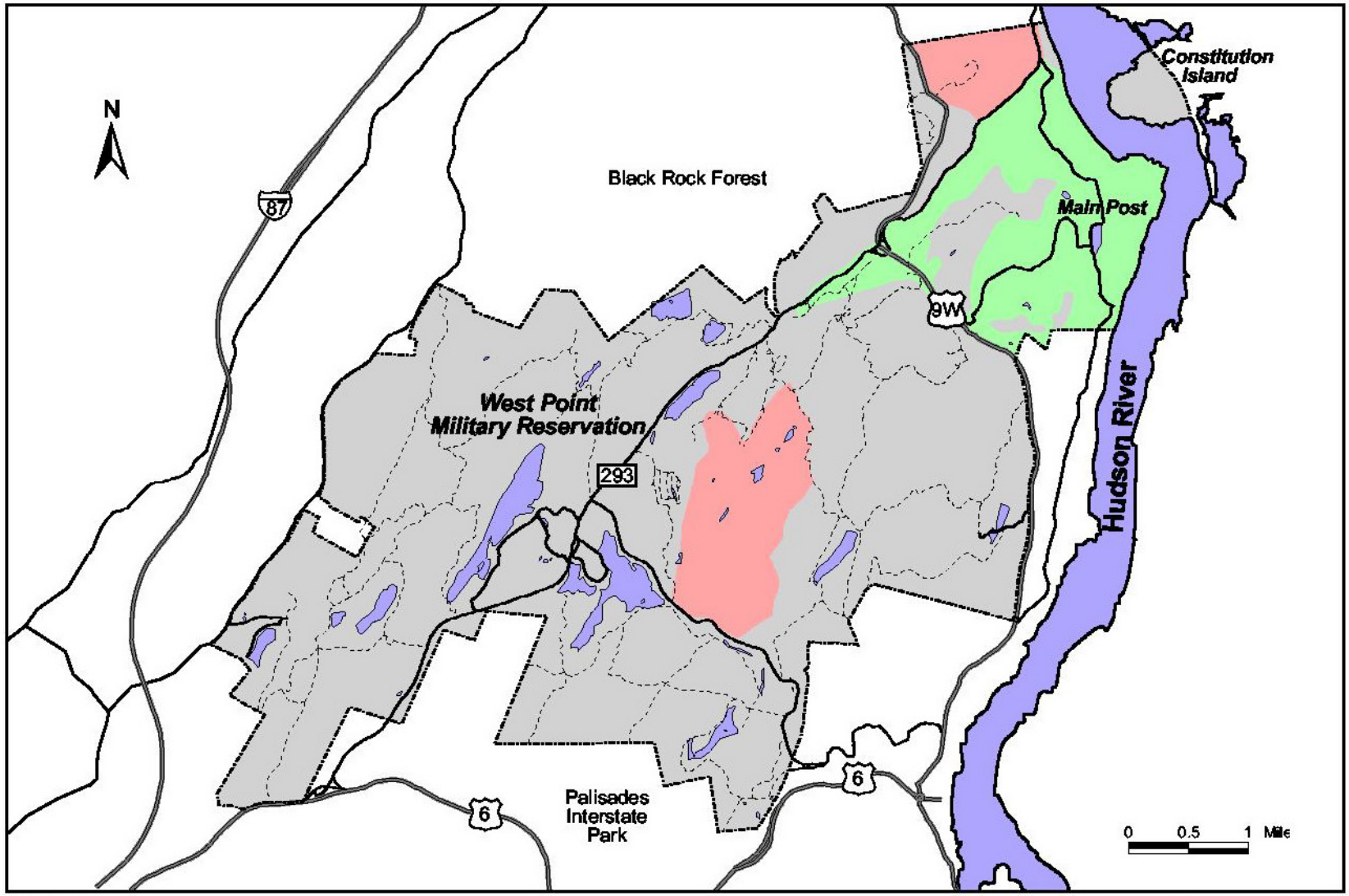


LEGEND

- 87 Interstate
- 6 U.S. Route
- 218 State Route
- # Town
- 25 Meter Contour Line
- Secondary Road
- West Point Military Reservation

Location Map

United States Military Academy
West Point, New York
Figure 1-1



LEGEND

- USMA Reservation Boundary
- Water
- Main Post
- Impact/Danger Area

Roads

- Highway
- Secondary Road
- Range Road

Installation Map

United States Military Academy
West Point, New York
Figure 1-2

Table 1-1
Real Estate Acquisitions to and Transfers from USMA West Point

Date	Description	Acquisition Type	Acreage
1790	Congreve and Moore	Purchase	1,770.00
1824	Gridley Tract	Purchase	310.00
1879	Round Pond	Purchase	47.72
1889	Kinsley Tract	Purchase	231.00
1903	Dassori Tract	Purchase	213.84
1907	Old Popolopen Area	Purchase	721.33
1909	Constitution Island	Donation	280.00
1937	Treasury	Transfer from	-4.05
1941	Palisades Park	Transfer from	-302.00
1942	West Point Land Projects (173 Tracts)	Purchase	10,432.50
1944	Proctor Estate	Purchase	1,270.49
1952	Highland Falls	Transfer from	-0.47
1959	Leone Property	Donation	1,040.00
1960	Highland Falls	Transfer from	-7.96
1969	Highland	Transfer from	-33.43
1970	Thayer Hotel (Ladycliff Property)	Donation	5.00
1974	Town of Woodbury	Transfer from	-0.72
TOTAL			15,973.25

Source: USMA, 1984.

1.2.3 Installation History

West Point is the oldest continuously occupied military post in the United States (USMA, 1984). Founded in 1802 at the urging of Thomas Jefferson, USMA has held the mission of educating and training cadets to provide the

Nation with "leaders of character who serve the common defense" (USMA, 1984). Originally established as a military base, West Point provides medical, administrative, commissary, post exchange, and other logistical support to military personnel, both active and retired (USMA, 1996a). Today, approximately 4,000 cadets and 6,500 military personnel live at West Point and 2,500 civilians are employed there. The installation serves approximately 9,000 retired military personnel and dependents, which reside within a 50-mile radius of the installation (USMA, 1996a).

Constitution Island is the oldest occupied portion of West Point. During the Revolutionary War, Constitution Island, then known as Martelaer's Rock, was fortified by George Washington=s troops to keep out the British (HQDA, 1985). In 1777, the British occupied the island for 3 weeks until it was retaken by colonists, who rebuilt fortifications on the island and started stronger fortification at Fort Putnam on what is now the West Point reservation (HQDA, 1985).

From the early 1800s until 1908, Constitution Island was owned by the Warner Family, who donated the island to the Army (USMA, 1994a). Today, Constitution Island is used primarily by the Constitution Island Association for tours and for cadet outdoor recreation and training (USMA, 1994a).

The first troops were stationed at West Point on January 20, 1778, and a regular garrison remained there after the end of the Revolutionary War (USMA, 1984). It was not until 1801 that Congress created the Military Academy at West Point. It was then occupied by the U.S. Army Corps of Engineers (USACE) and held the mission "to train military technicians for all branches of the military, to encourage the study of military art, and to encourage the practical study of every science" (USMA, 1984). The Academy consisted of 5 officers and 10 cadets and was increased in size to 2,400 acres (USMA, 1984, 1994b).

In April 1812, in the face of war with England, Congress increased the size of the Corps of Cadets to 250 (USMA, 1984). It was after this war that the mission of the Academy was changed to focus on civil engineering to equip the cadets with the ability to serve an expanding nation (USMA, 1984). In addition to military training, course work included architecture and civil engineering. By 1835, land at West Point included what is now the North Athletic Field and the higher ground that surrounds it. By 1850, it included officers' quarters along Wilson Road to the south and Professors Row to the north (USMA, 1989).

The next major action to affect the Academy was the Civil War, during which many West Point graduates served in the armies of the Union and the Confederacy. At the end of the Civil War, technical and engineering schools were being established throughout the country. West Point responded by separating the Academy from USACE and by shifting its curriculum from civil engineering to a more diversified educational program (USMA, 1984). By 1880, West Point included the area of enlisted and civilian quarters and gardens along Washington Road (USMA, 1989).

In 1902, West Point became the New West Point, which provided a liberal education with practical training in minor tactics and field work to 580 cadets. By 1910, land at West Point included most of what exists today (USMA, 1989). Following World War I, the curriculum focused on international tactics and physical education (USMA, 1984). By 1935, the Corps of Cadets had increased to 2,000.

Following World War II and the Korean War, the Academy's curriculum changed to focus on modern technology and national security and international relations (USMA, 1984). The Congress increased the Corps of Cadets to 2,781 (USMA, 1984).

Two recent major changes that have occurred at West Point are the decision to end compulsory chapel in 1973 and the decision to admit women in 1976 (USMA, 1984). In response to the admittance of women, Congress increased the Corps of Cadets to 4,500 (USMA, 1979, 1984).

1.2.3.1 Natural Resources Survey and Management at USMA

The lands at USMA have been subject to natural resources surveys and management actions for over 100 years. Edgar A. Mearns, an Assistant Surgeon for the U.S. Army who was stationed at West Point from 1872 to 1884, was a noted naturalist who made many forays throughout the Hudson Highlands documenting the flora and fauna. A report of his findings in the Bulletin of the American Museum of Natural History provides a historical perspective on the rich biodiversity present on USMA and in the Hudson Highlands in general (Mearns, 1898). The first forest management plan for USMA was written in 1905 upon the recommendation of Gifford Pinchot, head of what was then the federal Bureau of Forestry. The West Point Cadet Fishing Club has been active since at least the 1940s, stocking trout in West Point's lakes and streams. The Club often solicited management

assistance from the US Fish & Wildlife Service through the 1940s and 1950s. USMA hired its first full-time natural resources manager in 1958 and natural resources staff have been present since that time.

1.2.4 Neighbors

The area surrounding West Point is dominated by residential, agricultural, and recreational land uses (USMA, 1984). Although there is some light industry in the surrounding areas, there is no heavy industry (USMA, 1984). Adjacent to the main installation are Black Rock Forest and Storm King State Park (in the Towns of Cornwall and Highlands) to the north; the Hudson River to the east; Highland Falls, Fort Montgomery, and Bear Mountain/Harriman State Park in the Town of Highlands to the south; and Mineral Springs and Smith Clove Roads (in the Town of Woodbury) to the west. Constitution Island is bordered by the Hudson River to the west and a National Audubon Society marshland to the east.

Areas to the north and south are generally undeveloped and are compatible with West Point's Reservation area, which is also undeveloped. Residential development is moderate and increasing along the western edge of USMA. The area bordering the village of Highland Falls shows the contrast between the highly residential and commercial town and the sparsely developed USMA.

1.2.5 Satellite Installations

USMA had custody and accountability for two satellite locations: the Stewart Army Subpost (STAS), located 10 miles north of West Point in Orange County, New York, and the Galeville Army Training Site, located 20 miles north of STAS in Ulster County, New York. The Stewart Army Subpost was divided into three parcels and transferred to the U.S. Army Reserve (September 1999), the Town of Windsor (November 1999), and the U.S. Marine Corps Reserve (February 2000). The Galeville facility was transferred to the U.S. Fish and Wildlife Service during the fall of 2000, and is now the Shawangunk Grasslands National Wildlife Refuge (Anderson, personal communication, 2002; Deschenes, personal communication, 2002).

1.3 RESPONSIBLE AND INTERESTED PARTIES

The success of the management of the natural resources located on the grounds of USMA and the implementation of this INRMP requires a cooperative effort among the parties directly responsible. The level of success can be

enhanced by developing partnerships among other parties that have a vested interest in the responsible management of the natural resources at USMA. A brief description of the parties directly responsible for the implementation of this INRMP, as well as other interested parties is provided below.

1.3.1 U.S. Military Academy

The role of the organizations at USMA that are either directly responsible for, or are providing assistance in, the implementation of this INRMP are provided below.

Garrison Commander. The U.S. Army Garrison, West Point, conducts base operations in support of the United States Military Academy and tenant activities, to include the preparation and implementation of an Integrated Natural Resources Management Plan for the installation.

Directorate of Housing and Public Works (DHPW). The mission for DHPW is to plan, design, construct, repair, and maintain all real property facilities and utility plants, in addition to providing housing and basic services (e.g., utilities, refuse collection, insect and rodent control, fire protection, custodial) for the staff and faculty in support of the USMA community. DHPW also coordinates, develops, and maintains the USMA Master Plan, in which the INRMP is a component and supporting element. The Environmental Management Division of DHPW is responsible for activities related to the conservation and management of the installation's natural resources.

Environmental Management Division (EMD). EMD of DHPW has overall responsibility for the installation's environmental programs. Areas of responsibility include air and water resources, solid waste, natural resources, agronomy, pest management, installation restoration and hazardous materials and waste handling and spill response activities.

Natural Resources Branch (NRB). NRB of EMD plans and conducts programs providing for the conservation and management of the installation's natural resources, and assesses the impacts of other USMA programs on natural resources. NRB programs include resource inventory and protection, timber, fish and wildlife, rare and endangered species, wetlands and vernal pools, habitat improvement and support of recreational hunting and fishing programs.

Engineer Plans and Services Division (EPSD). The ESPD of DHPW has overall responsibility for managing the National Environmental Policy Act process at USMA, as well as the Cultural Resources management program.

Directorate of Plans, Training, and Mobilization (DPTM). DPTM, which includes the Range Control office, supervises and monitors, scheduling, management, and maintenance of the 10 live-fire ranges and 14,000 acres of training areas. DPTM is also responsible for the Integrated Training Area Management (ITAM) Program. Through ITAM, DPTM coordinates with the Natural Resources Branch for the effective integration of training lands management and natural resources management to ensure the training lands continue to supply the conditions necessary to provide realistic military training and meet the needs of the mission.

Directorate of Community and Family Activities (DCFA). The Community Recreation Division (CRD) of the DCFA provides the necessary management, administration, coordination, and efficient operation of the hunting and fishing program, including the issuance of hunting and fishing permits. In addition, CRD administers and establishes the policies and controls for the recreational use of the outlying reservation areas for hiking, camping, hunting, fishing, and archery.

Provost Marshal. The mission of the Provost Marshal's Office is to establish the general security, to maintain discipline, to enforce laws and regulations, and to provide physical security, personnel security, crime prevention support, and traffic control for USMA. These responsibilities include enforcing all hunting, fishing, and trapping laws and regulations applicable to USMA.

1.3.2 Other Defense Organizations

No other defense organizations are involved in the development or implementation of this INRMP.

1.3.3 Other Federal Agencies

There are a number of Federal agencies, in addition to Department of Defense (DoD) and USMA, that have an interest or a role in the management of the natural resources at USMA. The involvement of these agencies is based on signatory responsibilities, cooperative agreements, regulatory authority, and technical assistance as required by Federal laws and regulations. The agencies and their roles and responsibilities are described below.

U.S. Department of the Interior (DOI), U.S. Fish and Wildlife Service (USFWS). USFWS provides signatory approval of the fish and wildlife aspects of the INRMP, and is the primary federal agency for issues regarding fish and wildlife management, as well as the regulatory authority for the Endangered Species Act (ESA) of 1973 and the Migratory Bird Treaty Act (16 U.S.C. §703-711). Currently, USFWS has a cooperative agreement to provide USMA with technical assistance on fisheries- and wetland-related projects. These projects include fish population surveys, habitat assessments, and wetland evaluations, including recommendations for potential improvement and rehabilitation projects.

U.S. Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS). Also referred to as ***NOAA Fisheries***, NMFS is the other federal agency with regulatory authority under the Endangered Species Act (ESA) of 1973 and essential fish habitat under the Magnuson-Stevens Act of 1996 (MSA). USMA is required under Section 7 of ESA to conduct informal and/or formal consultations when proposed projects in the Hudson River may affect the shortnose sturgeon (*Acipenser brevirostrum*). In accordance with the MSA, USMA is required to conduct formal consultation with NMFS if USMA determines that any proposed project in or on the Hudson River may adversely impact "essential fish habitat," as defined under 50 CFR 600.810."

U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). USMA has an interagency agreement with the NRCS to protect and enhance military training areas on the West Point Military Reservation by preventing soil erosion, restoring eroded areas, maintaining vegetative cover, protecting watersheds, and reducing impacts downstream both on and off military lands. This agreement was made under the authority of the Economy Act (31 U.S.C. §1535) and the Memorandum of Understanding between the U.S. Army Environmental Center (USAEC) and NRCS entitled "*Watershed and Environmental Enhancement on U.S. Army Installations*" for the purpose of obtaining NRCS support for ecosystem management at USMA.

USDA, U.S. Forest Service (USFS). USDA has delegated to USFS responsibility for carrying out the provisions of the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. §2101) by providing technical assistance and funding to meet specific pest management objectives. The DoD has a written interagency agreement with the USFS for cooperative assistance for forest insect suppression, including population monitoring, surveys, biological evaluations, trends, and projected damage for the control of gypsy moths. USMA regularly receives USFS technical assistance in areas of forest protection and management.

U.S. Army Corps of Engineers (USACE), Mobile and New York Districts. The Mobile District of USACE is providing contractor support for the preparation of the INRMP and EA for USMA. The New York District assists West Point with Clean Water Act Section 404 issues, including permitting, and with cultural resources management and protection.

U.S. Army Environmental Center (USAEC). USAEC is a field operating agency under the Assistant Chief of Staff (Installation Management), Department of Army. USAEC is responsible for providing support for Conservation Programs to Army installations.

1.3.4 State Agencies

New York State Department of Environmental Conservation (NYSDEC). NYSDEC will provide signatory agreement with the fish and wildlife aspects of the INRMP. NYSDEC is the primary state agency for issues regarding fish and wildlife management, as well as the regulatory authority behind the rules and regulations for hunting, fishing, trapping, surface waters and freshwater wetlands. There is ongoing informal and formal dialog between NYSDEC offices and the NRB.

1.3.5 Universities

Cornell University sponsors two programs that USMA participates in – one pertaining to several bird species and one dealing with invasive species. The Cornell Laboratory of Ornithology activities that USMA had or has participated in include *Project Tanager*, *Birds in the Forested Landscape*, *Cerulean Warbler Atlas Project*, and *Golden-winged Warbler Atlas Project*. Field work for these activities is accomplished by USMA staff and volunteers.

Cornell is also conducting a pilot program/project for the biological control of invasive garlic mustard (*Alliaria petiolata*). USMA is providing a site that is being monitored in preparation of the eventual release of a biological control agent.

In addition, USMA interacts with Cornell's Biological Field Station at Shackelton Point, the Human Dimensions Research Unit, and the Cooperative Fish and Wildlife Research Unit on a variety of natural resource issues, and,

some work is contracted through these units.

Fordham University is conducting a long-term monitoring program of black-legged ticks (*Ixodes scaplaris*), formerly referred to as the deer tick, in the USMA deer population.

In addition, USMA is participating in a project with the **University of Tennessee** that is researching the hemlock woolly adelgid (*Adelges tsuga* Annand). In an effort to isolate adelgid resistant strains of Eastern hemlock, UT started hemlock seeds collected at West Point and other locations in the Northeast, eventually redistributing some of the resulting seedlings back to the donors. These trees are maintained at a protected location on the Reservation.

To assist in forest regeneration, UT sent 2,500 acorns (mostly northern red oak and some white oak) collected by USMA to a Georgia Forestry Commission nursery. The long southern growing season is expected to produce relatively tall seedlings for outplanting on the WPMR in 2003.

1.3.6 Contractors

Contractors provide DHPW with technical support for natural resources and environmental management projects. This technical support includes preparation of the INRMP, National Environmental Policy Act (NEPA) analyses and documentation, cultural and biological resource surveys, and general natural resources support.

1.3.7 Other Interested Parties

Neighboring **Black Rock Forest** is operated by a consortium of educational organizations (e.g., universities, local schools, etc.) that provides staff and students the opportunity to conduct a variety of scientific research on the natural resources located on their property. Although interaction between Black Rock Forest and USMA has been somewhat limited, mostly in the past, and mostly by the nature of the mission of USMA, there is ongoing dialog and information exchange. The potential for developing a stronger partnership based on shared ecosystems between Black Rock Forest and USMA will continued to be explored.

The Palisades Interstate Park Commission is responsible for the operation of **Bear Mountain/Harriman State Park**, which borders the southern edge of USMA and **Storm King State Park**, which borders the northeastern

edge of USMA. The Commission has entered into a cooperative agreement with USMA to jointly fund a recovery and monitoring project for the timber rattlesnake (*Crotalus horridus*), a state-listed species. This project is occurring in habitat that occupies adjacent portions of land managed by Bear Mountain/Harriman State Park and USMA.

USMA is fortunate to have Black Rock Forest and Bear Mountain/Harriman State Park as immediate neighbors and partners in natural resource management. A mutual interest in understanding the shared Hudson Highlands ecosystem is a bond that will benefit all three parties as they seek to maintain and improve the health of our natural environment.

USMA is participating in **The Nature Conservancy's (TNC) (Lower Hudson Chapter)** New York Natural Areas Registry Program, which promotes the preservation of rare species and natural communities through voluntary protection by private landowners and public land managers. In 1989, USMA entered 60 acres of land, primarily wetlands, contiguous to Constitution Marsh, a unique and valuable natural ecosystem in the Hudson River, into the program. USMA's participation in the Registry Program demonstrates its willingness to provide extra safeguards for the rare plants that form a significant component of the Lower Hudson Valley's important natural heritage. In addition, USMA's participation is in the spirit of the cooperation formalized in an agreement between DoD and TNC to identify, document, and protect biological diversity on DoD installations.

1.4 NATIONAL ENVIRONMENTAL POLICY ACT COMPLIANCE AND INTEGRATION

1.4.1 National Environmental Policy Act of 1969

Under NEPA, federal agencies take into consideration the environmental consequences of proposed major actions. The intent of NEPA is to protect, restore, or enhance the environment through well-informed federal decisions. This act is premised on the assumption that providing timely information to the decision-maker and the public concerning the potential environmental consequences of proposed actions will improve the quality of federal decisions. Thus, the NEPA process includes the systematic, interdisciplinary evaluation of potential environmental consequences expected to resulting from implementation of a proposed action.

The Council for Environmental Quality (CEQ) was established under NEPA to implement and oversee federal policy in this decision-making process. To this end, CEQ has issued *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* (40 CFR Parts 1500-1508). The CEQ regulations specify that an EA must be prepared to:

- Briefly provide evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact.
- Aid in an agency's compliance with NEPA when an EIS is unnecessary.
- Facilitate preparation of an EIS when one is necessary.

In addition, according to CEQ regulations (40 CFR Part 1500.2(c)), NEPA's requirements should be integrated "with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively."

1.4.2 32 CFR 651 (Army Regulation 200-2) and AR 200-3

32 CFR 651, *Environmental Analysis of Army Actions (AR 200-2)* (29 March 2002), provides Army guidance and procedures for complying with NEPA and sets forth policy for integrating environmental considerations into Army planning and decision making. Embodying the intent and spirit of NEPA, 32 CFR 651 (AR 200-2) directs installations to integrate environmental reviews concurrently with other Army planning and decisionmaking actions. This regulation specifically identifies the Natural Resource Management Plan as a type of document that should be environmentally reviewed prior to implementation. Therefore, the requirements of 32 CFR 651 (AR 200-2) must be addressed in the context of environmentally assessing the potential effects of a proposed action to *implement* a Natural Resource Management Plan once it has been developed.

Natural Resource Management Plans are developed in accordance with AR 200-3, *Natural Resources—Land, Forest, and Wildlife Management* (28 February 1995), which provides Army guidance and procedures for protection of natural resources, including conservation, management, and restoration. AR 200-3 states that "the appropriate level of environmental documentation will be determined based upon requirements set forth in NEPA

and AR 200-2 on an installation by installation basis." AR 200-3 further states, "It is Army policy to integrate environmental reviews concurrently with other Army planning and decision-making actions to avoid delays in mission accomplishments." The INRMP Policy Memorandum (HQDA, 1997) states that with regard to NEPA requirements, implementation of the INRMP shall serve as the proposed action and NEPA documentation should be scoped to address appropriate alternatives and issues.

1.4.3 INRMP and NEPA Integration

In the past, the Army and other DoD agencies have prepared NEPA analysis and documentation for proposed actions to implement plans, such as INRMPs, *after* these plans have been developed. Although this approach complies generally with NEPA regulations and policies, it is cumbersome and often results in the inefficient repetition and redundancy associated with developing completely separate documents.

Army Regulation 200-2, *Environmental Analysis of Army Actions*, Chapter 2, Section 2-6(e), states that "Environmental analyses and documentation required by this regulation will be integrated as much as practicable with other environmental reviews,… (40 CFR 1502.25)." Section 2-6(e)(5) identifies as falling into this category, "Installation management plans, particularly those that deal directly with the environment. These include the Natural Resources Management Plans (Fish and Wildlife Management Plan, Forest Management Plan, and Range Improvement or Maintenance Plan)."

CEQ regulations encourage NEPA documents to be combined with other agency documents to reduce duplication and paperwork (40 CFR §1506.4) so that agencies can focus on the real purpose of the NEPA analysis—that is making better decisions. Although this recommendation is not routinely or regularly followed for a variety of reasons, it is supported by Army leadership, the U.S. Environmental Protection Agency (USEPA), and CEQ.

Recognizing the efficiencies in cost and time that could be realized from a fully integrated approach to the planning development process, USACE has, for several years, regularly and successfully combined its Civil Works project plans and their required NEPA documents, generally at the project Feasibility Study phase. In addition, the *Habitat Conservation Planning Handbook*, developed in a joint effort between USFWS and the National Marine Fisheries Service, strongly recommends combining Habitat Conservation Plans and their NEPA analyses to streamline the planning process. This handbook states "the process should be streamlined by integrating the

analyses in the same document, to the extent possible, by running the process concurrently, not consecutively, and by conducting joint processes with other agencies as applicable."

Army guidelines recommend that the INRMP and its associated NEPA analysis and documentation be prepared concurrently. In an effort to alleviate the drawbacks of preparing sequential documents and to streamline the overall process, USMA has fully integrated the INRMP and its associated NEPA analysis and documentation into a single report. Combining an INRMP and its associated EA is an alternative approach for integrating environmental analyses and documentation. This document has been prepared utilizing both the concurrent and fully integrated NEPA analysis approach. This approach embraces the intent and spirit of NEPA, as well as the requirements of AR 200-2 and AR 200-3. The resultant "planning assessment" includes a comprehensive description, analysis, and evaluation of all environmental components at a given location. Additionally, it formalizes existing natural resource practices and can be used as an effective tool for future planning and decision-making purposes.

The INRMP portion of the document provides management measures that have been developed by considering various alternatives for meeting resource-specific goals and objectives at USMA. The INRMP also provides the rationale for why certain management measures have been selected for implementation and others have not, based on analysis of resource-specific screening criteria. The EA portion of the document "carries forward" the INRMP's selected management measures as the proposed action. Since other management alternatives are considered and dismissed from further consideration in developing the INRMP, the EA addresses only the proposed action and a no action alternative.

In order to readily identify elements of the NEPA analysis, Table 1-2 presents a "roadmap" indicating corresponding EA sections that are embodied within this document. All remaining sections pertain primarily to the INRMP.

1.4.4 Purpose of and Need for the Proposed Action

USMA is proposing to implement an INRMP, which supports the management of natural resources as prescribed by the plan itself. The purpose of the proposed action is to carry out the set of resource-specific management measures developed in the INRMP, which would enable USMA to manage effectively the use and condition of natural resources located on the installation to protect the natural setting primarily for training

Table 1-2
Roadmap Indicating NEPA Analysis and Corresponding INRMP Sections

Required NEPA Analysis	Corresponding INRMP Section
The **Executive Summary** briefly describes the proposed action, environmental consequences, and mitigation measures.	Provided immediately following the **Preface**.
The **Purpose of and Need for the Proposed Action** summarizes the proposed action's purpose and need and describes the scope of the environmental impact analysis process.	**Section 1.4.4**
Description of the Proposed Action and Alternatives describes the proposed action of implementing the INRMP (i.e., the selected management measures) and an alternative to implement the proposed action (i.e., the no action alternative).	**Section 1.4.5**
Scope of Analysis describes the scope of the environmental impact analysis process.	**Section 1.4.6**
Affected Environment describes the existing environmental setting.	**Section 3.0**
Environmental Consequences identifies potential environmental effects of implementing the proposed action and the no action alternative.	**Section 7.0**
Conclusions identifies potential impacts associated with the alternatives and draws a conclusion as to which alternative should be implemented.	**Section 8.0**
References provides bibliographical information for cited sources.	Provided immediately following **Section 8.0.**
List of Preparers identifies persons who prepared the document and their areas of expertise.	Provided immediately following **References**.
Persons Consulted provides a listing of persons and agencies consulted during preparation of the EA.	Provided immediately following **List of Preparers**.
Distribution List indicates recipients of the EA.	Provided immediately following **Persons Consulted**.
The **Appendices** include agency consultation letters and supplemental information used to develop the NEPA analysis.	Provided immediately following **Distribution List**.

purposes. Implementation of the proposed action would support the Army's continuing need to train cadets and soldiers in a realistic natural setting while meeting other mission and community support requirements and complying with environmental regulations and policies.

1.4.5 Description of the Proposed Action and Alternatives

Proposed Action. The proposed action is to implement the INRMP for USMA, West Point, New York. This proposal would meet the Army's underlying need to train cadets in a realistic setting that is in compliance with

environmental regulations and policies. The proposal includes natural resource management measures involving geographical areas associated with the contiguous properties of the installation. In addition, because the INRMP is a "living" document, it will be modified (adaptively managed) over time. The proposed action focuses on a 5-year planning period, which is consistent with the time frame for the management measures described in the INRMP. Implementation of the INRMP means that the proposed action involves putting in place the management measures presented in Table 5-10 in Section 5.15, *Integration and Summary of Management Measures.* Additional environmental analyses may be required as new management measures are developed over the long-term (i.e., beyond five years). Implementation of some INRMP-related projects also may require evaluation to determine the need for and appropriate level of NEPA documentation.

Alternatives. Alternatives considered for the management of the USMA's natural resources are described and evaluated within those sections of this document that address the ecosystem-based management of each specific resource (see Section 5.0). The development of selected management measures for the INRMP involved a screening analysis of resource-specific management alternatives. The screening analysis involved the use of accepted criteria, standards, and guidelines (i.e., USEPA *Guidance Specifying Management Measures for Sources of Nonpoint Source Pollution in Coastal Waters*; USDA/NRCS *National Soils Handbook*; USEPA *Lake and Reservoir Restoration Guidance*; Commonwealth of Massachusetts' *Guidelines for Certification of Vernal Pool Habitat*; USEPA *Protecting Natural Wetlands: A Guide to Stormwater Best Management Practices*), when available, and best professional judgment to identify management practices for achieving USMA natural resource management objectives. The outcome of the screening analysis led to the development of the proposed action. Obviously, an infinite number of permutations of specific management alternatives are possible. Consistent with the intent of NEPA, this process focused on considering a reasonable range of resource-specific management alternatives and, from those, developing a plan that could be implemented, as a whole, in the foreseeable future. It then dropped from detailed analysis management alternatives deemed to be infeasible. Management alternatives that were considered during the screening process, but not analyzed in detail, are discussed in Section 5.0 as is the rationale for their non-selection. Application of this screening process in developing the proposed action, i.e., adoption of the management measures contained in the INRMP, eliminated the need to define and evaluate hypothetical alternatives to plan implementation. As a result, the EA, made an integral part of this document, formally addresses only two alternatives, the proposed action (i.e., implementation of the INRMP) and the "no action" alternative described below.

No Action. Implementation of the no action alternative means that the management measures set forth in the INRMP would not be implemented. Current management measures for natural resources would remain in effect, and existing conditions would continue as the status quo. This document refers to the continuation of existing (i.e., baseline) conditions of the affected environment, without implementation of the proposed action, as the no action alternative. Inclusion of a no action alternative is prescribed by CEQ regulations and serves as a benchmark against which proposed federal actions can be evaluated.

1.4.6 Scope of Analysis

The potential environmental effects associated with the proposed action are required to be assessed in compliance with NEPA, regulations of the CEQ, and AR 200-2. This EA identifies, documents, and evaluates the effects of implementing the INRMP for USMA. The INRMP addresses the geographical area associated with the contiguous properties of the USMA with particular emphasis on the USMA reservation. As discussed, this EA examines the Army's preferred alternative (i.e., the proposed action as described in Section 1.4.5 and Section 5.0) and a no action alternative (see Section 1.4.5 and Section 7.1). The document analyzes potential environmental effects.

The objective of this analysis is to provide an objective evaluation of the environmental consequences of an implementable INRMP for USMA that can guide the installation in the following activities:

- Meeting training needs and military mission requirements.
- Achieving natural resource management goals.
- Meeting legal and policy requirements, including those associated with the NEPA, that are consistent with current national natural resources management philosophies.

In order to meet this objective, an interdisciplinary team of environmental scientists, biologists, planners, economists, engineers, archeologists, historians, and military technicians developed the EA. The team identified the affected environment, analyzed the proposed action against existing conditions, and determined the potential beneficial and adverse effects associated with the proposal.

1.4.7 Interagency Coordination and Review

Interagency participation is invited throughout the process for developing the INRMP. Once the INRMP has been drafted, the EA may be used as a tool to inform decision makers and the public of the likely environmental and socioeconomic consequences of implementing the proposed action and alternatives. In addition, USMA provides for public participation in the NEPA process to promote open communication and better decisionmaking. Public participation is invited throughout the NEPA process for developing the EA portion of the document. The following discussion describes agency and public involvement for this project.

Interagency Coordination. On July 1, 2002, a formal agency consultation letter was mailed to the USFWS Sikes Act Coordinator located at the USFWS regional office (Region 5). A similar letter was also sent to the New York Department of Environmental Conservation (NYSDEC). These letters served to officially notify USFWS and NYSDEC of USMA's intent to prepare an INRMP. The agency responses are presented in Appendix A. A listing of the individuals that were consulted during the preparation of this INRMP is provided in ***Persons Consulted*** (following Section 8.0). Appropriate notes and written records documenting the consultations have been maintained in the official Administrative Record and incorporated into this document.

Project Review and Comment. The primary responsible agencies (see ***Distribution List*** following Section 8.0) will be provided an opportunity to review and comment on the draft final version of the document. Comments will be incorporated into the document and distributed to these agencies for additional review and comment. These additional comments will be incorporated into the final version of the INRMP/EA, and a Draft Finding of No Significant Impact (FNSI) was prepared.

Public Participation. The public and concerned organizations, including minority and low-income, disadvantaged, and Native American groups, will be notified of the findings and conclusions of the EA by an announcement of the availability of a FNSI (see Appendix B) in the local newspapers and by the availability of the INRMP/EA for public review for 30 days before USMA implements the proposed action. The FNSI will be published in the local newspapers (i.e., *Times-Herald Record*, *News of the Highlands*, and the *Cornwall Local*) and the INRMP/EA will be made available for public review at the West Point Post Library and the Highland Falls Public Library.

SECTION 2.0: MILITARY MISSION

2.1 OVERVIEW

The mission of USMA is "To educate, train, and inspire the Corps of Cadets so that each graduate is a commissioned leader of character committed to the values of Duty, Honor, Country; professional growth throughout a career as an officer in the United States Army; and a lifetime of selfless service to the Nation" (HQDA, 2002). Although USMA's mission is to train the Corps of Cadets, Army reservists, Reserve Officer Training Corps (ROTC) students, active duty units, and other government agencies also conduct field training at West Point. Other users are prohibited from using West Point from May until August, the peak training period for the Corps of Cadets (USMA, 1994a).

There are approximately 14,000 acres of training area, including range impact/danger zones, available for seasonal field training and military field training (USMA, 1996a). Training areas are in use throughout the year, but are most heavily used from May until August to conduct Cadet Basic Training (CBT) and Cadet Field Training (CFT). Training activities, which include light infantry (i.e., foot traffic) and wheeled vehicles (e.g., commercial trucks and HMMV's), train the cadets in basic individual soldier skills and small-unit operations and are generally short-term and scattered throughout the training areas (USMA, 1994a). The 105 mm Howitzer, the largest weapon used at USMA, has a range of two miles and is fired from a fixed position. Tracked vehicles are not permitted in the training areas. Water-borne activities in the CFT include amphibious assault training at White Oak Island, Training Area W and Stilwell Lake, a confidence course and scuba diving at Popolopen Lake, and pontoon bridging techniques at Stilwell Lake. Special Forces have used Lake Georgina to teach rubber boat assault/infiltration techniques (USMA, 1994a).

Additionally, "activities on the West Point reservation primarily exist to serve the needs of USMA. They also provide medical, dental, administrative, commissary, Post Exchange, and other logistics support to active duty personnel of the services stationed in the region, to authorized reserve personnel, and to a substantial retiree population" (USMA, 1989).

2.2 THE RELATIONSHIP BETWEEN THE MILITARY MISSION AND NATURAL RESOURCES

The Army recognizes that a healthy and viable natural resource base is required to support the military mission. To be effective, the natural conditions of the training areas on West Point must be maintained to provide realism. Areas that are obviously degraded by previous training activity detract from the realism of the current training activity. Vegetation is necessary for cover and concealment, therefore, areas that are stripped of their vegetation are no longer representative of the undisturbed lands that might be encountered during real conflicts (USMA, n.d.f.). The relationship between soils and vegetation is very important in supporting the mission. In addition to providing cover and concealment, vegetation protects the soils from erosion. Eroded soils are unable to support the vegetation, which results in a loss of realism and eroded areas also represent a safety hazard to the cadets and soldiers. This INRMP helps to ensure that environmental considerations are an integral part of planning activities at USMA and that natural resources are protected in accordance with Army regulations and policies.

Ongoing military operations performed in support of the USMA mission may alter the environmental setting and condition of the natural resources. For example, standard military practices such as the construction of ditches, foxholes, and roads may result in vegetation loss and soil erosion or compaction. While short-term changes in the environmental setting may still provide for relatively realistic training opportunities, the absence of long-term management measures to properly conserve and restore natural resources may impede the USMA's ability to continue to adequately train cadets and soldiers. In addition to the impacts mentioned above, environmental damage can also place other artificial constraints on training, such as the following:

- Loss of training acreage
- Decreased tactical maneuverability
- Increased land and natural resource maintenance costs
- Increased safety hazards
- Civil and/or criminal liability

The trainers, cadets and soldiers who use USMA are being trained to be aware of the environmental effects of training and recognize that their actions in the field directly affect the long-term sustainability

of the training lands and their ability to continue training. Training the leaders and cadets to understand their environmental stewardship responsibilities can help to prevent environmental degradation during training activities. Implementing appropriate management measures, as well as considering alternatives to these measures as they are developed, limits the potential for serious alterations to the natural resources that are critical to providing a realistic training environment. In addition, such measures likely result in a more effective long-term approach to natural resource protection and conservation.

Because the primary mission of USMA is to train cadets, any environmental initiatives and plans are generally considered secondary and should be managed so as not to inhibit meeting military requirements (USMA, n.d.e.). It is important to consider limitations due to the presence of naturally occurring resources that cannot be altered, as well as those limitations resulting from natural resources that have already been affected.

Existing natural resources on USMA lands may influence the manner in which the USMA mission is executed. While natural resources provide a realistic training environment for meeting mission requirements, their existence also has the potential to limit certain military plans and activities. For example, topographic features of the land or the presence of wetlands or threatened and endangered species may prevent military activities, such as range construction, from occurring due to the potential for adverse impacts to those sensitive resources. In addition, any permanent degradation of natural resources as a result of ongoing military use would, in turn, ultimately lead to further mission impairment should realistic training conditions no longer be available. Therefore, not only is the proper management of natural resources and their use by the military a sound environmental practice, but it also directly supports the USMA mission to provide realistic training. This INRMP considers the effects of such natural resources on the mission. Examples of training activities and their effects on the environment, as well as examples of how degradation to natural resources adversely affects the military mission, are provided in Table 2-1.

Training leaders and soldiers are encouraged to use practices that prevent environmental degradation during training activities. Implementing environmentally sound training practices, and considering alternatives to these practices as they are developed, limits the potential for serious alterations to natural resources that are critical to providing a realistic training environment. In addition, such practices likely

Table 2-1
Mission Activities and Their Potential Effects

Activity/Use	Potential Effects on: Natural Resources	Potential Effects on: Training/Combat Readiness
Vehicles operated off road	Degradation of soil, water, and vegetation Erosion gullies Soil compaction Soil and water contamination from field maintenance	Loss of training realism Loss of camouflaging for vehicles and troop locations Safety hazards in eroded areas Contamination of soils could limit availability of training areas Increased maintenance costs
Foxholes and defilades	Soil displacement Erosion; eroded soils unable to support vegetation	Loss of training realism Safety hazards in eroded areas
Bivouac Areas	Soil compaction and/or erosion Loss of vegetation/forest understory and overstory	Loss of training realism Loss of camouflaging for vehicles and troop locations Limit usable training areas Litter provides Essential Elements of Information (EEI), such as presence and duration at a location, length of supply lines
Cutting of Vegetation for Camouflage/Field Fortifications	Cut vegetation wilts and discolors; contrasts with natural background Eventual loss of vegetation	Loss of training realism Exposed fighting position Dead vegetation is easy target for infrared radar
Field Maneuvers/Range Firing	Soil compaction, erosion, and inversion Loss of vegetation/forest understory and overstory Wildfires from pyrotechnics, tracer ammunition or shell detonation Litter from ammunition brass, plastic paint ball containers, communication wire, concertina wire Artillery training produces a heavy metals residue Metal contamination of commercial timber stands	Accidental fires result in loss of usable training areas Loss of training realism Immobilized vehicles mired in mud. Potential administrative restrictions as a result of disturbance to federally protected species and/or habitat.

Sources: Camp Atterbury, 1995; Fort Campbell, No date b; USMA, 1998, n.d.d., n.d.f., n.d.g.

result in a more effective, long-term approach to natural resource protection and conservation. Presented below are examples of practices used to avoid permanent and serious environmental degradation at USMA. (Some management measures employed to reduce or prevent environmental degradation of resources at USMA are discussed in further sections.)

Water. Soldiers are trained to avoid wet areas, including creek bottoms, streams, and wetlands.

Soil. Ditches, foxholes, bunkers, and fighting positions constructed during training activities must be refilled and leveled at the end of training.

Vegetation. The cutting of live vegetation to support training activities, except for the taking of leaves for personal camouflage, is prohibited without the approval of the USMA forester. Field fortifications should generally be constructed with rocks, although not rocks from stone walls, and fallen dead wood. For construction of field fortifications, soldiers are prohibited from cutting living trees and plants. Temporary field fortifications are permissible but only with prior notification of Range Control.

Cultural Resources. Training activities must avoid affecting cultural resources, such as stone walls, foundations and mine sites.

Weapons firing. Physical damage to natural systems from the ongoing operations of USMA appears to be minimal, with the exception of impacts associated with weapons firing range activities where soil disturbance and physical injury to vegetation occurs. The most extensive disruption of natural systems takes place at the impact area on Cranberry Mountain and can primarily be attributed to artillery fire from Range 2. The range on Cranberry Mountain was originally deforested during its construction in the 1940s, and the ongoing disruption from artillery fire and occasional resulting wildfire prevents the natural ecological succession that would typically occur in a disturbed area. There are also freshwater wetlands at the base of the northwest facing slope of Cranberry Mountain, many of which are located outside of the impact area.

Weapons firing and ordnance usage on USMA's ranges includes MK-19, M16A2, M240B/SAW machine gun, M1, M14, shotgun, M203/M79grenade launcher, pistols, claymore mines, grenades, M72 LAW, M136 (AT4), 4.2 inch, 60 mm and 81 mm mortars, and 105 mm (USMA, 1996c). Blank rifle ammunition and pyrotechnics are used throughout the training areas, though the risk of fire imposes certain restrictions on the use of pyrotechnics. All firing ranges direct weaponry into a 2,000 acre impact/danger area. Range 12 is the demolition range and Sapper Island (in Stilwell Lake) is used for demolition training (USMA, 1996c). Range regulations require the retrieval of all brass. Ammunition that is prohibited includes armor piercing, white phosphorus, tracers (during periods of increased fire hazard), munitions for weapons other than those listed above, demolition charges over 16 pounds per detonation (except Bangalore torpedoes,

which can only be fired in areas specified by Range Control), high explosive M203/M79 rounds, and high explosive anti-tank rounds (USMA, 1996c).

Noise. Trainers and cadets are encouraged to prevent and reduce noise pollution by maintaining vehicles, avoiding revving of engines, and observing quiet hours, which last from 2200 to 0800 hours during the week and include all hours during the weekend.

Fire. Open fires are prohibited on ranges and training areas. In the event of a fire, the training unit involved is trained to try to stop the fire "using any means available" except by entering impact and danger areas to put out fires (USMA, n.d.d.).

Wildlife. Trapping, killing, or harassing wildlife is prohibited in the training areas and emphasis is given to minimize disturbance to wildlife habitats.

Litter. Littering is prohibited at USMA. Trainers and cadets are trained to carry out their trash and debris from training sites. Burial of waste, including kitchen and food waste, is prohibited at West Point. Water used for personal hygiene may not be dumped in or near water bodies or wetlands. Digging of field latrines is prohibited.

Spills. Training units are required to carry drip pans, overpack drums, and dry absorbent pads and booms in case of accidental release and spill of hazardous materials (USMA, n.d.d.). Soldiers are to stop any spills from spreading.

Certain restraints and conditions limit the types and locations of training and range activities. Presented below are examples of environmental conditions that represent constraints to the mission.

- The topography of the installation consists of slopes that are mainly greater than 20 percent. Those areas with slopes greater than 20 percent are considered unbuildable and would be inappropriate for buildings and many training facilities such as firing ranges and bayonet courses (USMA, 1996a). The majority of the land with slopes less than 20 percent are already developed. The topography of USMA lands, therefore, is a major limitation to uses of the property.

- The potential to cause forest fires is a restriction on training activities. Because wildlife and vegetation are affected by forest fires, training activities involving pyrotechnic devices are restricted by type and timing depending upon the forest fire danger determination.

- Environmental degradation affects the military mission by decreasing realistic training opportunities, creating safety risks, and resulting in administrative restrictions on training (USMA, n.d.d.).

- Several areas within USMA's training areas have been designated as Training Exclusion Areas (TEAs). This designation generally prohibits training activities from occurring in these areas and is used to protect environmentally sensitive areas, protected species, administrative and recreational sites.

- In some training areas, there are small, protected growth areas for tree seedling shelters, deer browsing study plots, and areas closed for rehabilitation.

Under West Point's ITAM program and other natural resources protection measures, there are efforts to protect the natural resources needed in military training (see Section 4.2). The sections that follow, together with the description of existing environmental conditions contained in Section 3.0, Affected Environment, reflect the status and condition of the natural resources of USMA lands, the management of which is the subject of this INRMP.

2.3 FUTURE MILITARY MISSION IMPACTS ON NATURAL RESOURCES

The INRMP is considered a "living" document that is based on several short-, medium-, and long-range planning goals. Short-range goals include activities that are planned to occur in 0 to 5 years, while medium-range goals include activities in a 6- to 10-year period. Long-range goals are usually scheduled beyond 10 years. Because an INRMP is a "living" document, goals may be revised over time to reflect evolving environmental conditions. In addition, medium- and long-range planning goals eventually become short-range activities that also require implementation.

An EA, however, is a document that captures the most current baseline environmental conditions as a "snapshot" in time. This EA has been prepared using baseline conditions as of June 2002, for short-range management activities and assesses potential environmental impacts resulting from these proposed activities. Medium- and long-range management activities will be required to be environmentally assessed when they become short-range in nature.

The primary long-range planning goal at USMA is to continue to train cadets while supporting environmental strategies and goals that are consistent with Army regulations and policies. With long-range planning goals in mind, USMA has developed several short-range goals for the installation to support the current mission and meet future needs. To that end, this INRMP includes management measures that meet three short-range planning goals: (1) to implement a comprehensive environmental strategy that represents compliance, restoration, prevention, and conservation; (2) to improve the existing management approach to protecting natural resources on the installation; and (3) to meet legal and policy requirements consistent with national natural resources management philosophies. Details of proposed management measures are discussed in Section 5.0.

At this time, there are no known changes to the USMA military mission or to the intensity and type of training that occurs on the Reservation. Therefore, new sources of impacts are not anticipated. The potential exists for a slight increase in the use of the training facilities by National Guard and Reserve units as support facilities are reduced, however, the impacts associated with this potential increase are expected to be insignificant.

SECTION 3.0: AFFECTED ENVIRONMENT

This section presents a general description of the physical and biological environment of USMA. Discussions include both the reservation and Constitution Island.

3.1 ENVIRONMENTAL SETTING

USMA lies in New York State, bordering the west bank of the Hudson River in the lower Hudson River Valley (USMA, 1994a). Its environmental setting is unique in that five physiographic provinces—the Appalachian Plateaus, Folded Appalachians (Valley and Ridge), New England, Piedmont, and Coastal Plain—converge within a 35-mile radius of the installation. West Point is located in the New England Province in an area known as the Hudson Highlands.

3.2 CLIMATE

The climate of the region including West Point is characterized as a humid, continental climate. Summers are warm and have periods of high humidity. The semipermanent Bermuda High brings south-to-southwest warm and humid air to the area (USMA, 1996a). July is the hottest month, with a mean temperature of 86 degrees Fahrenheit (ºF). Winters are cold with extended periods of snow cover and are influenced by the cold Hudson Bay air masses that are brought into the area (USMA, 1996a). The coldest month of the year is January, which has a mean temperature of 27 ºF. Most winters are characterized by one or more warm periods when soils nearly or completely thaw.

A third weather pattern that influences the climate of West Point is an air mass that flows inland from the North Atlantic Ocean bringing cool, cloudy, and damp weather to the region. Prevailing winds are generally westerly.

Thunderstorms occur approximately 20 times per year; tornadoes have a frequency of occurring 3 to 4 times a year in the region, although no significant tornadoes have occurred at West Point for over twenty

years. Total annual precipitation is above 48 inches, with the least amount of precipitation occurring in February (3.3 inches) and the most occurring in November (4.53 inches) (USMA, 1994a).

3.3 AIR QUALITY

Air quality is regulated at the national level through regulations promulgated under the Clean Air Act of 1970 and its subsequent amendments. The act directed USEPA to establish national ambient air quality standards (NAAQS) for air pollutants that endanger public health. USEPA subsequently adopted air quality standards for six of these criteria pollutants—ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter (total suspended particulates), and lead particles. The Clean Air Act requires state or local governments to monitor ambient levels of these pollutants and to develop air quality management plans to ensure compliance with the standards. The state of New York has developed ambient air quality standards that are more stringent than federal standards (USMA, 1980a).

To evaluate compliance with the NAAQS, USEPA has divided the country into geographical regions known as air quality control regions (AQCRs). Each AQCR has multiple air monitoring stations to sample ambient air quality levels of the criteria pollutants. Attainment and nonattainment indicate the compliance status of AQCRs with respect to the NAAQS.

USMA is located in the southern portion of the Hudson Valley AQCR (USMA, 1980a, 1980b) in the Lower Orange County Metropolitan Area (Ralston, personal communication, 1997). USEPA and NYSDEC have classified the area as attainment for carbon monoxide, nitrogen dioxide, sulfur dioxide, and total suspended particulates.; the area is nonattainment for ozone (Ralston, personal communication, 1997; USMA, 1980a, 1980b).

3.3.1 Air Pollutant Emissions at USMA

Several major stationary sources of on-site air pollutant emissions are present at USMA. These sources include five oil-fired boilers, two incinerators, a restricted burn site, and nuclear, biological, and chemical training activities (USMA, 1980a, 1980b). NYSDEC has issued permits for operation of the boilers and incinerators. Although there is no applicable state permit for the nuclear, biological, and chemical

activities, training is conducted in accordance with Department of the Army Field Manual FM 21-48, *Individual Training Exercises and Tests* (USMA, 1980b). Major stationary sources are in compliance with state and federal standards (USMA, 1980a, 1980b, 1996b).

Several major mobile sources of air pollutant emissions exist at USMA. These sources include vehicular traffic, such as light-duty, gasoline-powered trucks and automobiles, heavy-duty diesel-powered vehicles, and aircraft (USMA, 1980a, 1980b). The major pollutant associated with mobile sources is carbon monoxide. Carbon monoxide levels were monitored during a USMA home football game to determine pollutant concentrations.

Monitoring results indicated that there were no exceedances of NAAQS (USMA, 1980a, 1980b, 1996b). In addition, total mobile source emissions calculated for USMA indicate that pollutant levels are expected to remain below air quality standards (USMA, 1980b).

USMS emissions for 2001 (in tons/acre) are as follows:

- Particulate matter = 13;
- SOx = 53;
- CO = 18;
- Hydrocarbons = 2; and
- NOx = 84.

3.4 NOISE

The Noise Control Act of 1972 (Public Law 92-574) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. In 1974, USEPA provided information on negative effects of noise, identifying indoor and outdoor noise limits that protect public health and welfare (e.g., prevent hearing damage, sleep disturbance, and communication disruption). In addition, sound quality criteria promulgated by USEPA, the U.S. Department of Housing and Urban Development, and DoD have identified noise levels to protect public health and welfare with an adequate margin of

safety. These levels are considered acceptable guidelines for assessing noise conditions in an environmental setting. Noise levels below 65 decibels (dB) are considered to be normally acceptable in suitable living environments (USMA, 1996b). For purposes of this of this INRMP, noise is described in the context of sound levels that result directly from USMA military operations and the compatibility of land use resources with these levels.

3.4.1 Noise Levels at USMA

The primary sources of noise originating from USMA are helicopter missions and firing exercises. Although there are no aviation facilities, such as runways and taxiways, helicopters land on USMA property to transport military personnel. Helicopter noise levels are 67.7 dB at the Lake Frederick Drop Zone, which is slightly above noise guidelines (65 dB). This drop zone is located in an area remote from main post, but close to a golf course and housing on the western side of the reservation. In terms of firing noise, sound exposure contours for artillery training have been developed. These contours lie almost entirely within the boundaries of USMA.

Surrounding areas where sound exposure contours may extend beyond USMA boundaries are characterized as rural with extremely low population density (USMA, 1980b, 1996b). A noise survey was conducted at USMA in 1978 to determine sound quality. Measurements were taken at 15 noise monitoring sites. These sites included academic, residential, support, and special activity areas. In addition, twelve specific noise sources were identified and measured. These sources included vehicular and railroad traffic, trash compactor activities, and power plant operations. Survey results indicate that sound quality associated with USMA may be characterized as good to excellent (USMA, 1980a, 1984).

3.4.2 Noise Levels in the Surrounding Area

Although USMA land uses are generally considered compatible with adjacent land uses, noise complaints related to certain military activities have been received (USMA, 1996b). USMA maintains records of noise complaints received regarding military operations. Historically, noise-related issues have involved helicopter flights from Stewart International Airport (Stewart Army Subpost) to the Main Post and Lake

Frederick Drop Zone. Noise abatement procedures for helicopter operations are developed by USMA, whenever possible, to avoid overflying populated areas or other noise-sensitive locations. In addition, complaints regarding hand grenade noise have been received from residents living in the village of Highland Falls (USMA, 1996b). USMA is in the process of addressing grenade noise issues.

3.5 TOPOGRAPHY

The topography of West Point reflects glacial forces and differential weathering of ancient rock that resulted in formation of the mountains known as the Hudson Highlands, which run in a northeast-southwest direction. This topography is best described as having moderately steep hills and numerous escarpments. Slopes from 10 to 60 percent are common on the installation (Lewis, 1962; Olsson, 1981). Areas in between the hills are interspersed with small plains, basins, and narrow valleys with slopes less than 3 percent (Lewis, 1962).

The topography of the surrounding region is undulating and rugged. These characteristics, along with the alluvium and till deposits in the lowland areas and the relatively flat valley bottoms of the region, are the result of glaciation (USMA, 1984).

The topography of Constitution Island has small variations in elevation and consists of one hill rising to 140 feet above mean sea level (USMA, 1994a). The western third of the island is steeply sloped toward the Hudson River while the eastern portion of the island slopes gradually, generally to the east.

3.6 GEOLOGY

West Point lies in the Hudson Highlands, a low, rugged mountain range. The Hudson Highlands are a hill formation that begins in Reading, Pennsylvania, and run northeasterly through New Jersey and New York to Connecticut and Massachusetts. They form a zone of folded and faulted metamorphic and igneous rocks subjected to extensive weathering and erosion.

The Hudson Highlands belong to the Reading Prong, a 160-mile-long, 25-mile-wide southwest-trending salient of the New England Upland (Curran and Justis, 1974). The New England Upland includes all of

New England and parts of New York, New Jersey, and Pennsylvania. This province is characterized by glacially dissected peneplains and low mountains underlain by a complex sequence of igneous and metamorphic rocks (Curran and Justis, 1970).

The geology of West Point has been influenced by thrust faulting, folding, dike injection, jointing, uplift, and erosion that has occurred throughout geologic time. The installation is located on the crest of an antiform that plunges to the northeast. The wavelength of the antiform is about 10,000 feet and is an "open fold" because the limbs of the antiform dip away from each other (Curran and Justis, 1970).

3.6.1 Bedrock Geology

Precambrian-age granite, diorite, gneiss, and schist compose the majority of the crystalline bedrock underlying West Point (USMA, 1992, 1996a). Granite, the most prevalent rock type in the bedrock, is typically mediumgrained and composed of quartz, feldspar, and mica. Granite and pegmatite are igneous rocks and occur as dikes and sills within the gneiss. Igneous rocks on the installation consist of plagioclase feldspar, hornblende, pyroxene, and biotite mica and quartz (USMA, 1996a).

The metamorphic rocks of West Point exist in sequences. These sequences are composed of a hard, layered, banded rock, gneiss, which is sometimes intruded by igneous rocks (Curran and Justis, 1970; Engineer Intelligence Study, 1958). Marble, quartzite, schist, and amphibolite are other metamorphic rocks present in the Highlands area. The metamorphic rocks were deposited as marine sediments, volcanic ashes, and volcanic rocks (Helenek, 1971, Jaffe and Jaffe, 1973, Offield, 1967). During the Precambrian period, these sediments and rocks were possibly subject to three phases of folding, extensive regional metamorphism, partial melting, and magmatic intrusion.

The western edge of the reservation is underlain partially by limestone and undifferentiated conglomerates (USMA, 1994a). The Stockbridge limestone is a marble unit consisting of rock that varies in composition from almost pure calcium carbonate to almost pure calcium-magnesium carbonate, dolomite. The cantonment area, which is bounded by the Hudson River, is underlain by exposed bedrock and glacial alluvium (USMA, 1996a).

3.6.2 Seismicity

There is a fault underlying USMA approximately along Routes 293 and 218 from the Hudson River to Long Pond. A second fault lies northwest to southeast from Popolopen Lake to east of Fort Montgomery (Frimpter, 1972). There are three fault zones through the Hudson Highlands. These faults were active during the Precambrian period and were reactivated during the period of Taconic mountain buildings. During the latter, some new faults became active (Curran and Justis, 1970). Shear zones are also common at West Point.

According to the New York State Geological Survey, historically, there have not been any major seismic activities in this area (Mitrovonas, personal communication, 1997).

3.6.3 Surficial Geology

Surficial geologic formations on the installation are outcroppings, talus, and glacial deposits (Engineer Intelligence Study, 1958). During glacier retreat, features were formed along the valley walls. The most prominent features were the kame terraces. In all but the flat, marshy areas, bedrock can be observed (Hamilton et al., 1980).

A thin veneer layer of Pleistocene-age glacial deposits, both stratified and unstratified, overlies the igneous and metamorphic bedrock sequence (USMA, 1996a). The stratified drift consists primarily of sand and gravel deposited in glacial lakes and streams. The unstratified drift consists of glacial till material, which consists mainly of large boulders and clay, sand, and gravel that was deposited directly from glacial ice as it progressed or regressed across the area. Other unconsolidated sediments are recent-age alluvial deposits of clay, silt, and sand. These thin deposits are along the Hudson River and in the smaller streams of the installation (USMA, 1996a).

3.6.4 Constitution Island

The geology of Constitution Island is similar to that of the Reservation, consisting of bedrock composed of granite, diorite, gneiss, and schist. The surficial geology is characterized by glacial drift and talus deposits and slopes with outcrops (Engineer Intelligence Study, 1958).

3.7 PETROLEUM AND MINERALS

Local magnetite deposits, in the form of metasomatic deposits found along the borders of some of the granitic intrusions that occur on and around USMA, supported an iron ore mining industry in the 1700s. The Forest of Dean Mine, which was located where Stilwell Lake now stands, was one of the richest and most important iron ore mines in colonial New York (Ransom, 1966). Several smaller iron ore mines were also located on USMA.

Two iron ore furnaces also operated on USMA during the mid to late 1700s. The Forest of Dean Furnace operated from 1770 to 1777, and the Queensboro Furnace operated from 1783 to 1800. Remnants of the Queensboro Furnace are still visible near Camp Shea in the southeastern part of USMA. Furnace operations required large amounts of charcoal to melt iron ore, and large areas of surrounding forests were cut heavily to support furnace operations (USMA, 1994a).

During the Revolutionary War and into the 1800s iron ore mining continued on USMA. By 1800 the furnaces and smaller mines on the installation had shut down. The Forest of Dean Mine continued to operate and was not shut down until 1931 (USMA, 1994a).

Currently, the only active mining on USMA occurs at Sweeney Pit, which is a borrow pit located along Popolopen Brook adjacent to its confluence with Cranberry Brook. Gravel is occasionally taken from the borrow pit for use in road surfacing.

No petroleum resources are known to occur in the vicinity of USMA.

3.8 SOILS

Soils on West Point were formed from glacial till and alluvium derived from glacially transported sediment and locally occurring crystalline bedrock (Olsson, 1981). These soils are characterized as shallow (zero to 24 inches), stony, and boulder-strewn and are less than 6 feet deep (Engineer Intelligence Study, 1958; Olsson, 1981; USMA, 1989, 1994b). Peat deposits on West Point range in thickness from 2 feet to 19 feet. The soils on hilltops and hillsides are well drained and contain only shallow soils with frequent outcrops (Olsson, 1981).

Deeper, poorer draining soils are located in low-lying areas and occupy the level areas and depressions on hill summits and in parts of the small floodplains in the valleys (Olsson, 1981). The fertility of USMA's soils is generally low. Bedrock is exposed on summits and very steep slopes. The Hollis-Rock Outcrop Association is the dominant soil on West Point (Olsson, 1981). Soils in this association are steeply sloping, excessively drained and well-drained, medium-textured soils overlying crystalline bedrock, on mountainous uplands. Sandy loams, gravelly loams, gravelly sandy loams, silt loams, and gravelly silt loams are all known to be on site, with the most prevalent being silt loams (Olsson, 1981). Additionally, there are several stony and extremely stony soil types.

The Soil Survey of Orange County, New York, describes the soils of the Hollis-Rock Outcrop Map Unit as "mostly forested, good habitat for wildlife and unsuited to farming or community development. The soils are shallow and are well drained to excessively drained. The rate of water movement is moderate or moderately rapid." Because of the high amount of vertical relief on much of the reservation, the potential for soil erosion, especially from these rapidly moving waters in some areas, is of a major concern" (Coleman, 1995).

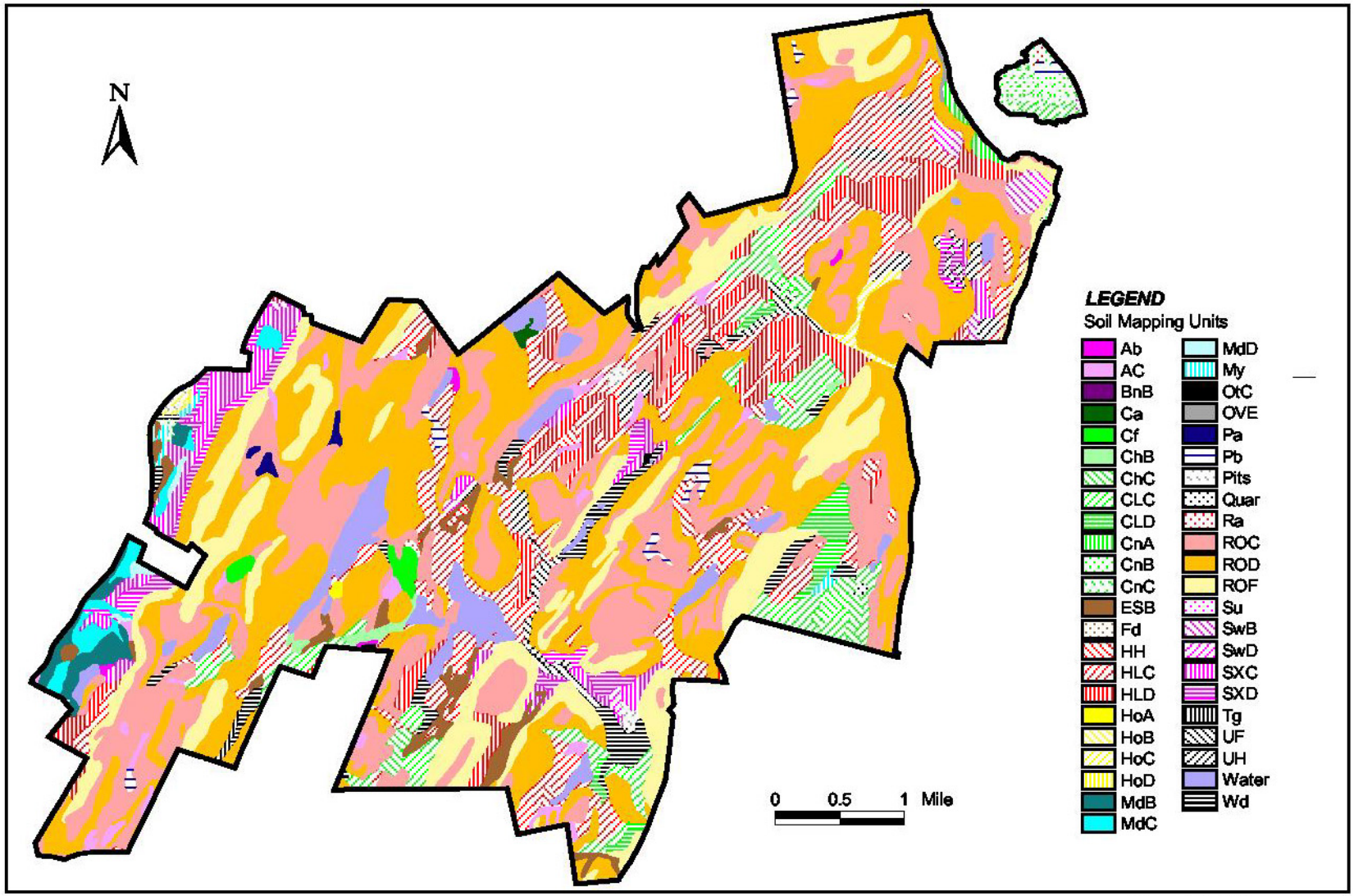
The dominant soils on Constitution Island are part of the Hollis-Rock outcrop, Charlton complex (Olsson, 1981). These are quickly draining soils that include fine sandy loams and gravelly sand loams. A 2-inch layer of humus overlies these soils. The second most prevalent soils on Constitution Island are located in the wetland in the northeast corner of the island. These soils are inundated sulfihemists.

Based on the Orange County Soil Survey (Olsson, 1981), 43 soil mapping units occur on USMA (Figure 3-1). Table 3-1 lists the soil mapping units and provides general characteristics of the soil series or soil complexes.

Drainage characteristics, landscape position and some potential limitations associated with the mapping units are provided. The soils on USMA have also been rated using the USDA Land Use Classification System (see Limitations column in Table 3-1). The classification system assesses the constraints of soils on agricultural development. The capability class rates limitations from slight (I) to those which would nearly preclude their use for commercial agricultural production (VIII). The capability subclasses are soil groups within one class. The subclasses are designated by the letters *e* (erosion), *w* (wet), or *s* (shallow, droughty or stony). For example, a soil that is rated IIe shows that the main limitation is risk of erosion unless close-growing plant cover is maintained. Although West Point is not being used for agriculture, the system provides a general indication of potential soil limitations.

Mapping units that are designated as hydric, or have inclusions that are hydric, are also indicated. Hydric soils are soils that are saturated, flooded, or ponded for long enough during the growing season to develop anaerobic (oxygen deficient) conditions. Anaerobic soil conditions are conducive to the establishment of vegetation that is adapted for growth under oxygen-deficient conditions and is typically found in wetlands (hydrophytic vegetation).

Areas on West Point where hydric soils, or soils with hydric inclusions, have been mapped are typically associated with the general location of wetlands on the installation. Potential loss of soil from erosion on West Point was estimated in the Land Condition Trend Analysis (LCTA) that was conducted from 1991 to 1994. Thirty-four core plots representing all major soil types on the installation were established and inventoried. A modified Universal Soil Loss Equation was used to estimate average annual sheet and rill erosion based on factors representing climate, soil erodibility, topography, cover, and conservation support practices. The LCTA determined that a high number of the plots that were analyzed are susceptible to erosion (i.e., an average of 10 to 20 percent of the core plots). The high percentage of soils determined to be susceptible to erosion is in part due to steep slopes that occur over much of the installation (Coleman, 1995).



Soil Types

United States Military Academy
West Point, New York

Figure 3-1

Table 3-1
Soils Mapped on USMA – General Characteristics

Soil Series	Map Unit	Drainage Class	Hydric	Limitations	Landscape Occurrence
Alden silt loam	Ab	Very poorly drained	Yes	Water table at or near the surface for prolonged period; erodes easily; wetness limits timber production; IVw	Nearly level in low areas and depressions in uplands
Alden extremely stony soils	AC	Very poorly drained	Yes	Water table at or near the surface for prolonged periods; erodes easily; wetness limits timber productions; VIIs	Nearly level in depressions and low areas
Bath-Nassau shaly silt loams, 3%-8% slopes	BnB	Well-drained and excessively drained	No	Moderate erosion potential; IIIe	Hilltops and ridges in uplands
Canadiagua silt loam	Ca	Poorly and very poorly drained	Yes	Water table at or near the surface for prolonged periods; erodes easily; wetness limits timber production; IVw	Small depressions in uplands and broad, flat lowland plains; slope<3%
Carlisle muck, ponded	Cf	Very poorly drained	Yes	Water table at or near the surface most of the year; wetness limits timber production; Vw	Depressional swamps, bogs and marshes in upland till plains and lowland lake plains; slope <2%
Charlton fine sandy loam, 3%-8% slopes	ChB	Well-drained	No	Slight erosion potential; IIe	Ridge crests, hilltops, and mountaintops in uplands
Charlton fine sandy loam, 8%-15% slopes	ChC	Well-drained	No	Slope; potential erosion limitation; IIIe	Ridges, hillsides, and upper mountainsides of uplands
Carlton-Paxton (loam) Complex, extremely stony, sloping	CLC	Well-drained	No	Extremely stony; erodes easily; VIIs	Hilltops, hillcrests, and mountainsides in uplands
Carlton-Paxton Complex, extremely stony, mod. steep	CLD	Well-drained	No	Slope; extremely stony; erodes easily; VIIs	Hillsides and mountainsides of the uplands; slopes 15%-35%
Chenango gravelly silt loam, 0%-3% slopes	CnA	Well-drained	No	IIs	Terraces along valley floors and on broad lowland plains
Chenango gravelly silt loam, 3%-8% slopes	CnB	Well-drained	No	Moderate erosion potential; IIs	Undulating terraces along valley floors and on plains
Chenango gravelly silt loam, 8%-15%	CnC	Well-drained to somewhat excessively drained	No	Slope, serious erosion potential; droughtiness; IIIe	Terraces, along valley floors, and on low rounded hills on plains

Table 3-1
Soils Mapped on USMA – General Characteristics

Soil Series	Map Unit	Drainage Class	Hydric	Limitations	Landscape Occurrence
Erie extremely stony soils, gently sloping	ESB	Somewhat poorly drained	Hydric inclusions	Seasonal wetness; potential erosion limitation; extremely stony; VIIs	Lower hillsides, foot slopes, and hilltops and along shallow drainage ways
Fredon loam	Fd	Somewhat poorly drained	Yes	Seasonal high water table; IIIw	Low terraces and outwash plains along valley floors and lowlands
Histic Humaquepts, ponded	HH	Very poorly drained	Yes	Typically inundated by 1-6 inches of water; VIIIw	Natural depressions, some created by man or by beaver dams; slopes ≤1%
Hollis soils, sloping hills	HLC	Somewhat excessively drained	No	Shallow to rock; moderate erosion potential when exposed; shallowness limits timber production; IVe	Hillcrests, hilltops and valley sides, and ridges of the mountainous uplands; slopes 3%-15%
Hollis soils, mod. steep	HLD	Well- to somewhat excessively drained	No	Shallow to rock; high erosion potential when exposed; shallowness and droughtiness limit timber production; VIe	Hillsides, valley sides, and ridges of mountainous uplands; slopes 15%-25%
Hoosic gravelly sandy loam, 0%-3% slopes	HoA	Somewhat excessively drained	No	IIIs	Terraces and broad flat areas along valley floors and on lowland plains
Hoosic gravelly sandy loam, 3%-8%	HoB	Somewhat excessively drained	No	Slight erosion hazard; IIIs	Terraces and undulating areas along valley floors and on lowland plains
Hoosic gravelly sandy loam, 8%-15% slopes	HoC	Somewhat excessively drained	No	Moderate erosion potential; IVS	Low rounded hills, on ridges, and along the fronts of terraces on valleys and on lowland plains
Hoosic gravelly sandy loam, 15%-25% slopes	HoD	Somewhat excessively drained	No	Slope; high erosion potential; droughtiness; IVe	Sides of terraces and on low rounded hills and on ridges in valleys and on lowland plains
Mardin gravelly silt loam, 3%-8% slopes	MdB	Moderately well drained	No	Seasonal wetness; moderate erosion potential; IIw	Broad divides, hilltops, and ridges in uplands

Table 3-1
Soils Mapped on USMA – General Characteristics

Soil Series	Map Unit	Drainage Class	Hydric	Limitations	Landscape Occurrence
Mardin gravelly silt loam, 8%-15% slopes	MdC	Moderately well drained	No	Seasonal wetness; high erosion potential in exposed areas; slope; IIIe	Valley sides, hillsides, and ridges in uplands
Mardin gravelly silt loam, 15%-25% slopes	MdD	Moderately well drained	No	Seasonal wetness; high erosion potential where soils are exposed; slope; IVe	Hillsides and valley sides in uplands
Middlebury silt loam	My	Moderately well drained to somewhat poorly drained	No	Seasonal high water table; potential flood hazard; IIw	On floodplains adjacent to streams that flood periodically; slopes ≤3%
Otisville gravelly sandy loam; 8%-15% slopes	OtC	Excessively drained	No	Stony; droughtiness limits suitability for timber; IVS	Terraces, ridges, and low rolling hills in valleys and on lowland plains
Otisville and Hoosic soils, steep	OVE	Otisville-excessively drained/Hoosic – somewhat excessively drained	No	Slope; very high erosion potential where soils are exposed; droughtiness; poor suitability for timber; VIIs	Along the front of terraces, on the sides of low hills, on ridges in valleys, and on lowland plains; slopes 25%-45%
Palms muck	Pa	Very poorly drained	Yes	Occasional ponding and flooding in early spring; potential wind erosion hazard; poor suitability for timber; IIIw	In drained depressions and concave basins in lowland lake outwash plains, and flood plains
Palms muck, ponded	Pb	Very poorly drained	Yes	Ponding in spring; water table at or near the surface for most of the year; potential wind erosion hazard; poor suitability for timber; Vw	In depressions and bogs in uplands and in concave basins in lowland plains
Raynham silt loam	Ra	Somewhat poorly drained to poorly drained	Yes	High water table in spring; poor to fair timber suitability; IIIw	Slight depressional areas in uplands and on low benches in valleys
Rock outcrop-Hollis complex, sloping	ROC	Somewhat excessively drained to well-drained	No	Shallow to bedrock; excessive droughtiness; poor suitability for timber; VIIs	Hillcrests, hilltops, and ridges of mountainous uplands; slopes 3%-15%
Rock-outcrop-Hollis complex, mod. steep	ROD	Somewhat excessively drained to well-drained	No	Shallow to bedrock; excessive droughtiness; very high erosion potential where vegetation has been removed; poor suitability for timber; VIIIs	Hillcrests, hilltops, and ridges of the mountainous uplands; slope 15%-35%

Table 3-1
Soils Mapped on USMA – General Characteristics

Soil Series	Map Unit	Drainage Class	Hydric	Limitations	Landscape Occurrence
Rock outcrop-Hollis complex, very steep	ROF	Somewhat excessively drained to well-drained	No	Very steep slopes; shallow to bedrock; very high erosion potential where vegetation has been removed; excessive droughtiness; poor suitability for timber; VIIIs	Hillsides and valley sides of mountainous uplands; slopes 35%-60%
Suncock sandy loam	Su	Excessively drained	No	Flooding for brief periods in early spring; droughtiness in summer; fair to poor timber suitability; IIIs	Floodplains adjacent to streams that periodically overflow; slopes <3%
Swartswood gravelly loam, 3%-8% slopes	SwB	Well-drained and mod. well-drained	No	Wetness due to perched water table in the spring; moderate erosion potential where soils are exposed; IIe	Convex hilltops and ridges in uplands
Swartswood gravelly loam, 15%-25% slopes	SwD	Well-drained and mod. well-drained	No	Very high erosion potential where soils are exposed; IVe	Hillsides and valley sides in uplands
Swartswood and Mardin, very stony soils, sloping	SXC	Swartwood – well-drained and mod. well-drained/Mardin – mod. well-drained	No	Stony; wetness due to perched water table in the spring; VIs	Hill crests, hilltops, and ridges in uplands; slopes 3%-15%
Swartwood and Mardin, very stony soils, mod. steep	SXD	Swartwood – well-drained and mod. well drained/Mardin – mod. well drained	No	Stony; wetness due to perched water table in the spring; high erosion potential where soils are exposed; VIIs	Hillsides and ridges in uplands; slopes 15%-35%
Tioga silt loam	Tg	Well-drained	No	Subject to flooding in early spring; I	Valleys along streams that are subject to periodic overflow; slopes 0%-3%
Udifluvents-Fluvaquents complex, frequently flooded	UF	Well-drained to very poorly drained	Yes	Subject to frequent flooding; soil characteristics are highly variable and onsite investigation is essential for any intended use; Vw	Formed in recent alluvial deposits adjacent to streams; slopes ≤5%
Udorthents, smoothed	UH	Excessively to mod. well-drained	No	Onsite investigation is needed to determine feasibility for any use; no subclass assigned	Man-made cut-and-fill areas
Wayland silt loam	Wd	Poorly to very poorly drained	Yes	Subject to flooding in early spring; water table at or near the surface for prolonged periods; poor suitability for timber production; Vw	Low floodplains adjacent to streams that overflow; slopes ≤3%

The soil survey for Orange County also indicates that there is a moderate to severe potential for erosion for over half of the soil mapping units that occur on USMA (see Table 3-1). Figure 3-2 shows the location of soils on USMA that have potential erosion problems. Because of a high degree of topographic variation within soil mapping units, there is considerable variation in erosion potential among locations within units. Most problems associated with soil erosion on USMA result from the removal of vegetation on moderate to severe slopes or on long gradual slopes.

3.9 WATER RESOURCES

The major uses of USMA's water resources are potable water supply, recreation, training, and aquatic habitat. The water resources of USMA can be divided into four main categories: groundwater, surface water, wetlands, and vernal pools. Each has its own physical and chemical components, which in turn regulate the aquatic flora and fauna that comprise the biological communities. At USMA, the NRB, in coordination with USFWS, monitors aquatic biological communities in Reservation waters. Much of this monitoring had focused on the status and trends of the populations of those species most popular for recreational fishing, but in recent years the scope of this monitoring has broadened considerably. The following discussion describes existing water resources at USMA.

3.9.1 Groundwater

Groundwater on USMA occurs in an unconsolidated aquifer consisting of alluvial deposits and a consolidated bedrock aquifer. Water within the unconsolidated aquifer occurs primarily in the sands and gravels of the stratified drift deposits. These deposits represent the most prolific sources of groundwater on the installation, but the deposits are thin and generally have fairly small well yields which average about 40 gallons per minute (gpm) (USMA, 1984). Water in the unconsolidated aquifer usually occurs under water table conditions.

Recharge to the aquifer is primarily from local precipitation, but hydrologic communication occurs between the alluvial and the bedrock aquifers and some upward seepage from the bedrock aquifer occurs in low-lying areas. The unconsolidated glacial till deposits on the installation exhibit poor sorting and a

LEGEND

- High Potential for Soil Erosion
- Moderate Potential for Soil Erosion
- Slight Potential for Soil Erosion

Soil Erodibility

United States Military Academy
West Point, New York
Figure 3-2

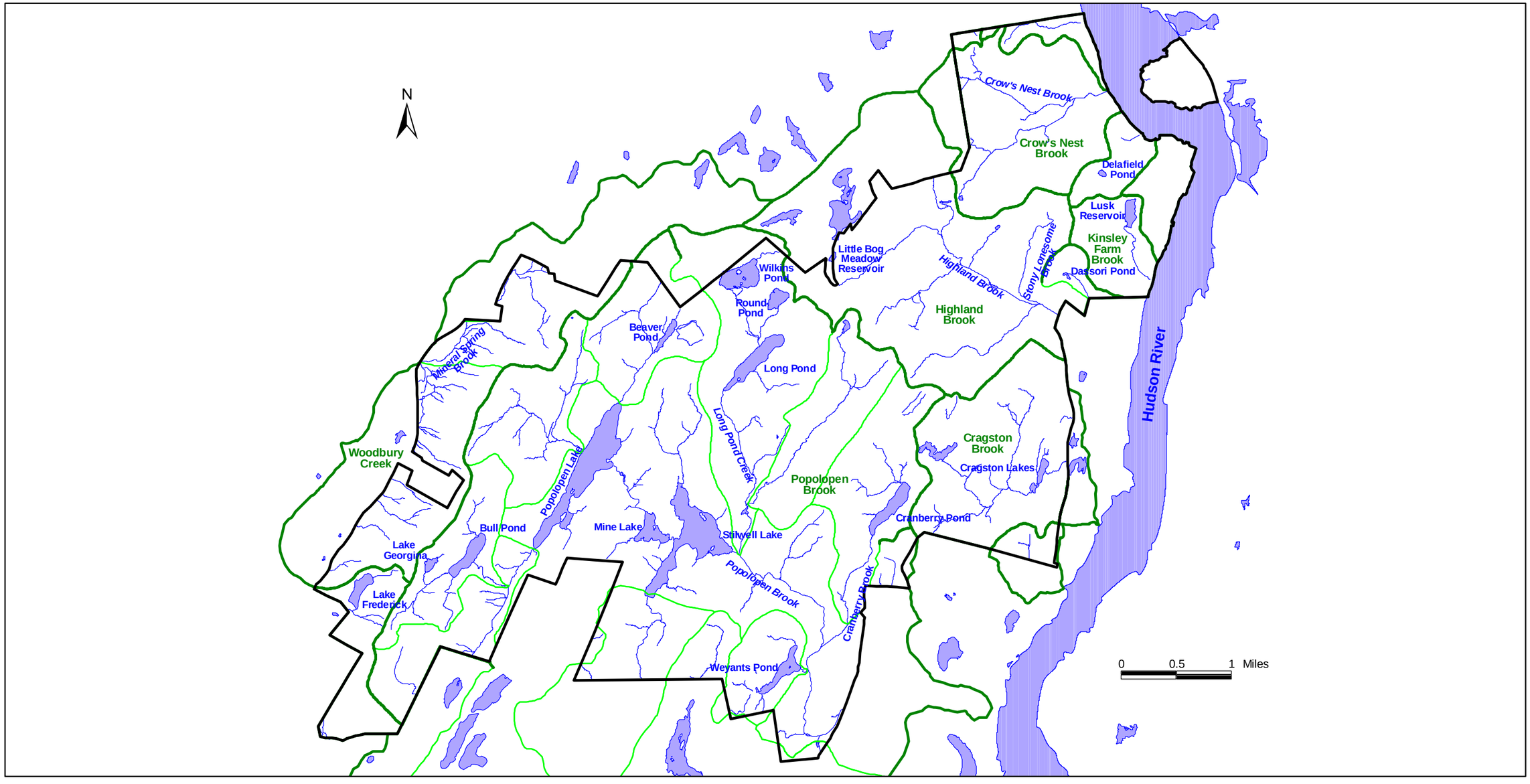
high clay percentage, which results in low porosity and permeability. As a result, the glacial tills typically have low well yields, averaging around 2.0 gpm (McMaster et al., 1984).

Groundwater occurs in the upper weathered, jointed, and fractured sections of the bedrock that underlies the installation. Recharge to the aquifer occurs in upland areas by precipitation, and discharge occurs in lowland areas through springs and upward seepage. Permeability and water movement in the bedrock aquifer is generally extremely slow due to the limited extent of the joint and fracture systems. Well yields in the aquifer are generally sufficient for small demands such as domestic use (McMaster et al., 1984).
Most potable water at USMA is supplied by surface water sources. Seventeen small-diameter, shallow wells supply potable water to outlying range, bivouac, and recreational facilities. The wells most likely draw water from the stratified alluvial sand and gravel deposits, and the upper weathered bedrock aquifers. Well depths are generally from 25 to 40 feet and have fairly low yields of from 3.5 to 6.0 gpm (McMaster et al., 1984).

3.9.2 Surface Water

The surface water systems of USMA are composed of lakes, ponds, and streams scattered throughout the installation. USMA lies in the drainage basin of the Hudson River, which flows along the eastern boundary of the reservation, and is drained by many small tributaries that discharge into the Hudson River. Shallow soil, glacial geology, and abundant rainfall produce a regionally high water table, resulting in numerous wetlands, lakes, and ponds. Most of the lakes and ponds are the result of artificial dams that have raised water levels within former wetland areas.

Twelve surface drainage systems are present on the reservation (see Figure 3-3). The major surface drainage system, as well as the major source of potable water on West Point is the Popolopen Brook system, which discharges into the Hudson River just upstream of the Bear Mountain Bridge. The Highland Brook system flows just west of and drains about one quarter of the cantonment and ultimately discharges into the Hudson River. The rest of the cantonment is drained by the Crow's Nest Brook system, the Kinsley Farm Brook drainage, and an unconsolidated system of storm drains and sewers.



LEGEND

- Stream
- Lake
- USMA Boundary
- Drainage Boundary (Name in Green)
- Sub-Drainage Boundary

Drainage Network

United States Military Academy
West Point, New York
Figure 3-3

Other drainages on the east side of the Reservation include: to the southeast, the Cragston Brook/Cragston Lakes system, and an unnamed brook to the south of Cragston. In the northeast is the Rose Brook drainage, an unnamed, intermittent brook east of Rose, and a small portion of the Upper Reservoir watershed that flows into Black Rock. The western side of USMA is made up of the Lake Frederick, Trout Brook, and Mineral Springs Brook sub-drainages that eventually meet in the Woodbury/Moodna Creek system.

The surface drainage system on Constitution Island generally consists of simple overland flow, with the exception of one small, intermittent stream that drains a centrally-located wetland, and flows into the Hudson. The landforms on the island control drainage; hilly topography is present throughout the dry areas of the island, with valleys forming natural routes of surface runoff. Landforms in most areas exhibit terraced slopes, generally of 10 to 25 percent. Relatively steep slopes and cliffs with average slopes of 25 to 60 percent or greater exist in the west, facing the Hudson River. Dry lands in the north and south are relatively flat, with slopes ranging from 3 to 10 percent. The landscape near the summit levels is generally gently rolling (USMA, 1980b).

The watershed divide line, which joins the high points on the island, runs along an irregular path from the north to the south, broadly separating the island into the east and west subregions. Surface runoff from these subregions enters the Hudson River in the west or the marshland in the east.

Constitution Island Bog, the island's largest wetland (8 ha.), was formed when a lobe of Constitution Island marsh was impounded by the railroad bed (Barbour, 1995c). The wetland does not drain freely into the Hudson River, but is a storage area for surface runoff from adjacent lands. The wetland and the Hudson have limited exchanges of water under two conditions—during periods of high runoff, when overflow from the wetland can reach the river, and during tidal flooding events, when river water can flow into the wetland. In total, the wetland occupies approximately 10 percent of the area west of the Metro-North Railroad tracks, the USMA portion of the island (USMA, 1980b).

Water body-specific descriptions, including physical, chemical, and biological parameters are described in detail below. A listing of the lakes and ponds at USMA and their physical characteristics is provided in

Table 3-2. The list of fish species documents for all USMA water bodies is found in Appendix C, Table C-2.

Beaver Pond. Beaver Pond (not to be confused with Beavers Ponds) is a shallow, warmwater pond located in Training Area B along Firebreak 16. Although historically a wetland, the development of Firebreak 16 during the early 1960s succeeded in partially damming the wetland, despite the installation of a drainage culvert. In 1969, the water level of the pond was raised another 2 feet following the recommendation of a New York State biologist in an effort to reduce the potential for winter fish kills (O'Dell, 1969). Additional road development in the 1970s apparently raised the water level to its current level (USMA, 1994a). The pond is classified by NYSDEC as Class A (USMA, 2002).

Table 3-2
Lakes and Ponds at USMA

Waterbody	Acres	Shoreline (miles)	Depth (feet) Maximum	Depth (feet) Average	Stratification
Beaver Pond	8	0.67	6	3.5	No
Bull Pond	29	1.1	79	25	Yes
Lower Cragston Lake	8	0.7	8	5	No
Cranberry Pond	24	1.0	20	7	Partial
Delafield Pond	2	-	20	11	-
Lake Frederick	19	0.9	25	12	Yes
Lake Georgina	6	0.4	15	8	No
Long Pond	41	1.6	21	8	-
Lusk Reservoir	13	0.75	28	-	Yes
Mine Lake	24	1.1	12	6	No
Owl Swamp	15	1.4	6	3.5	No
Popolopen Lake	149	3.5	31	10	Yes
Round Pond	13	0.6	29	12	Yes
Stilwell Lake	129	3.2	46	20	Yes
Weyants Pond	31	1.4	9	6	No
Wilkins Pond	40	1.1	9	6	No

Sources: Adirondack Lakes Survey, 1987; USMA, 1984; USMA, 1994a; Linck, 1994.

Beaver Pond receives water from the surrounding watershed, and during periods of high flow, runoff from Cat Hollow Brook flowing along Firebreak 16 enters the pond through a drainage culvert. Water from the stream does not enter Beaver Pond during periods of low to normal flow. The only outflow for the pond is through the drainage culvert at the southern end of the pond.

The water quality data that is available for Beaver Pond is limited. Data collected in 1988 indicated water temperature was 67.6 ºF (Fahrenheit), pH was 7.1, dissolved oxygen was 9.5 parts per million (ppm), and hardness was 14 mg/L. In the summer of 1990, conductivity ranged from 47 to 50 micromhos/cm, pH was 6.3 and Secchi depth ranged from 3.1 to 4.1 feet (Green and Mills, 1990). Measurements taken by NRB personnel in May 1992 found a surface temperature of 22 ºC, pH was 6.7, and conductivity was 56 micromhos/cm.

Aquatic plants that have been collected in Beaver Pond include coontail (*Cerratophyllum demersum*), water milfoil, elodea (*Anachris nutelli*), bigleaf pondweed (*Potamogeton amplifolius*), and ribbonleaf pondweed (*Potamogeton ephihydrus*) (Linck, 1993). Zooplankton data for Beaver Pond is provided in Table 3-3.

Table 3-3
1990 Zooplankton Data for Beaver Pond

Parameters	June	August
Mean Length (mm)	0.404	0.47
Density (number/L)	15.4	11.1
% Composition		
Bosmina longirostris	35	12
Tropocyclops prasinus	14	9
Chydorus sphaericus	0	2
Ceriodaphnia quadrilangula	1	22
Cyclops biscupidatus	4	4
Mesocyclops edax	14	4
Diaptomus sp.	4	0
Ophryoxus gracilus	0	4
Diaphanosoma sp.	13	37
Nauplii	12	6

Source: Green and Mills, 1990.

Bull Pond. Bull Pond, a 29-acre, coldwater natural pond located in the southwest portion of USMA in Training Area O, is the deepest and second highest water body on the reservation. It lies at an elevation of 1,021 feet and has a maximum depth of 79 feet. Bull Pond is accessed from Firebreak 23, which borders most of the eastern and northern shoreline of the pond from a distance of approximately 300 feet. Three small, unnamed streams flow into Bull Pond. The outlet is controlled by a small dam and the water eventually flows into Johnson Meadow Brook. The shoreline is composed of boulders, rock, and rubble.

The pond is a NYS Class A waterbody and is surrounded by mature oaks and other hardwoods, although there are stands of hemlock along the east shore. A 10-acre wetland is located on the southwest end of the pond. The wetland consists of 4 acres of shrub swamp and 6 acres of red maple swamp located just west of the shrubs (USMA, 1994a). (See Section 3.16.6 for additional descriptions of the Bull Pond area.) Thermal stratification of the pond occurs at a depth between 10 to 20 feet sometime during mid-summer (Appelget and Otis, 1953). Dissolved oxygen (DO) concentrations are sufficient to support trout species down to a depth of about 20 feet during the summer months; however, below a depth of 20 feet, DO drops below 6 ppm, and below 40 feet DO levels are insufficient to support the majority of fish species (Deschenes, 1977; Mierzykowski, 1982, USMA, 1994a). A number of studies measuring pH indicate a yearly fluctuation within the range of 5.3 to 7.0 (Adirondack Lake Survey Corp, 1987; Green and Mills, 1988). The upper end of the range is characteristic during the summer months (July and August). Recent water quality data for Bull Pond are not available; however, water quality data from 1980 are presented in Appendix D.

A 1988 evaluation of the zooplankton data for Bull Pond stated that the zooplankton population was being impacted by rainbow trout (*Onchorynchus mykiss*) (Green and Mills, 1988). However, it is now thought that the impact was due to alewives (*Alosa pseudoharengus*). A summary of zooplankton data is provided in Table 3-4. Current data suggests that alewives are no longer having a negative impact on zooplankton biomass or diversity.

Cascade Brook. Cascade Brook originates in the Black Rock Forest to the north of West Point. It flows south through Training Area F northeast of the intersection of US Route 9W and NY Route 293. This brook crosses beneath Route 9W and NY Route 218 and crosses the West Point golf course before crossing back underneath Route 9W and joining with Highland Brook just south of the Route 9W/Route

Table 3-4
Zooplankton Data for Bull Pond

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	12	0.655	115.597	365.866	7-Sep	11	0.718	48.656	221.634
2000	22-Jun	12	0.682	34.552	124.119	31-Aug	11	0.693	45.317	196.654
1999	28-May	14	0.768	39.307	211.575	1-Sep	10	0.871	24.413	185.233
1998	21-May	10	0.665	53.931	157.728	12-Aug	10	0.686	37.057	128.642
1997						14-Aug	11	0.927	41.830	397.547

Species collected include*: Bosmina longirostris, Ceriodaphnia sp., Daphnia galatea mendotae, Daphnia pulicaria, Daphnia schodleri, Diacyclops thomasi, Diaphanosoma spp., Diaptomus minutus, Diaptomus oregonensis, Holopedium sp., Leptodora kindtii, Mesocyclops edax, Nauplii sp, Tropocyclops prasinus, Cyclopoid copepodid, Calanoid copepodid*

Source: Beemer, 2002a, Green and Mills, 1988.

293 intersection. This brook is of importance since it feeds Highland Brook, the water supply for the Town of Highlands and Village of Highland Falls (USMA, 1980b). Cascade Brook is a Class A(t) waterbody.

At the West Point golf course clubhouse, a septic tank sand-filter-type unit discharges to Cascade Brook. This is a National Pollutant Discharge Elimination System (NPDES)-approved discharge (Permit obtained through USEPA, Region 2).

Data collected from the 1978 – 1980 surveys did not indicate that any water quality problems existed at that time (see Appendix D).

Cat Hollow Brook. Cat Hollow Brook originates in the Black Rock Forest near Eagle Cliff and flows in a southwest direction through USMA Training Areas B, N, and I before emptying into the northern end of Popolopen Lake. The stream has two small tributaries, which includes the outlet to Beaver Pond. The stream passes through some interesting ecological communities such as the Mount Rascal fen and the Cat Hollow Special Natural Area. Cat Hollow Brook is classified as Class A by New York State.

A thermograph was placed in the brook in 2000 and continuously recorded stream temperature from 5 May through 17 October. Cat Hollow Brook had an average temperature of 63.44ºF with a maximum temperature of 75.25ºF. Other water quality measurements made in July 2000 include a conductivity of 70 µmhos/cm, pH reading of 6.94 and a TDS reading of 50 ppm (Linck 2001).

Results of a Rapid Bioassessment Protocol II (RBP II) sampling in 2001 showed that Cat Hollow Brook is comparable to more pristine streams at West Point, having an EPT Index of 7.

Cragston Creek. Cragston Creek is located along the eastern boundary of USMA in Training Areas D1 and E1 and the Morgan Farm Training Exclusion Area. It is a coldwater stream with two unnamed tributaries? one that originates in Owl Swamp, a circa 15-acre pond/wetland in Training Area D5, and a second that originates in a red maple swamp just west of Range Road 9 in Training Area D3. Cragston Creek flows north, then east, and enters Upper Cragston Lake. Upper Cragston Lake discharges into Lower Cragston Lake and Cragston Creek exits on the east side of Lower Cragston Lake via a concrete spillway. The creek flows in an easterly direction into Crystal Lake in Highland Falls and ultimately enters the Hudson River. The section of Cragston Creek upstream of Upper Cragston Lake is classified as Class C as set forth in Title 6 NYCRR Part 862 and the section downstream of Lower Cragston Lake is classified as Class B.

Water quality data collected in 1980 found DO levels ranging from 12.3 to 13.46 and a pH level of 7.1 (see Appendix D). Additional information collected during the 1980 study did not reveal any water quality problems.

Testing conducted by USFWS personnel in 1997 and 1998 showed conductivity ranging from 50 to 90 µmhos/cm, TDS ranging from 40 to 60 ppm, pH of 7.18 and DO from 5.37 to 7.25. A thermograph was placed in the stream about 1,000 feet upstream of Upper Cragston Lake in 1999. The thermograph continuously recorded stream temperatures from 1 May through 13 October. The average temperature recorded was 62.12º F with a maximum-recorded temperature of 75.56º F.

Results of a RBP II sampling in 1998 showed the upstream stretch to be comparable to more pristine streams at West Point, having an EPT Index of 7. The lower stretch, however, had an EPT Index of 3, which may be impacted by the presence of the two ponds (Linck 1999).

Lower Cragston Lake. Lower Cragston Lake is located on the southeastern edge of the reservation at an elevation of about 300 feet. A small springfed brook drains into the lake.

Lower Cragston Lake is classed B by NYSDEC. Water quality data, last collected in August 1998, included conductivity (80 micro-mhos/cm), pH (6.86), and total dissolved solids (TDS; 50 ppm) (Linck, 1999). Measurements taken in 1988 included DO (6.54 ppm) and hardness (38 mg/L). Previous DO sampling recorded levels of 10 ppm in 1954, between 7 and 8 ppm in 1976, and 11 ppm in 1987. In 1987, the pH value was 8.0. Additional monitoring is being conducted to determine whether the adjacent landfill that has recently been closed is having an effect on water quality. Zooplankton monitoring data are provided in Table 3-5.

Nuisance aquatic vegetation, such as water chestnut, Eurasian milfoil, and other aquatic weeds, has been reported for the lakes (USMA, n.d.a.). Typically dense phytoplankton blooms cover the upper layers.

Cranberry Brook. Cranberry Brook is the outlet stream for Cranberry Pond and is located in Training Area E2. From Cranberry Pond, the stream descends about 320 feet in elevation to its junction with

Table 3-5
Zooplankton Data for Lower Cragston Lake

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	11	0.414	17.737	46.349	7-Sep	10	0.382	25.211	49.733
2000	23-Jun	8	0.450	62.745	222.019	1-Sep	12	0.373	2.294	2.884
1999	27-May	10	0.425	88.401	231.439	1-Sep	9	0.337	430.026	617.818
1998	21-May	8	0.422	16.673	36.846	11-Aug	7	0.296	19.631	32.378
1997						15-Aug	9	0.419	3.798	7.740

Species collected include: *Acanthocyclops sp., Alona sp., Bosmina longirostris, Calanoid copepodid, Ceriodaphnia sp., Chydorus sphaericus, Cyclopoid copepodid, Daphnia galatea mendotae, Daphnia pulicaria, Diacyclops thomasi, Diaphanosoma spp., Diaptomus minutus, Mesocyclops edax, Nauplii sp., Sida crystallina*

Source: Beemer, J. 2002a.

Popolopen Brook just upstream from the Weyants Pond Road bridge. Much of the streambed is rocky and lacks large, well-developed pools. The forest overstory provides shade, and, during dry seasons, some stream sections may not flow.

Water quality information collected in the summer of 2000 showed a temperature of 65 °F, conductivity of 30 micromhos/cm, total dissolved solids of 20 ppm, and a pH of 6.84 (Linck, 2001). Dissolved oxygen has been measured at 10.05 ppm (Linck, 1996b). An RBP II sampling in 2001 resulted in an EPT Index of 8, indicating that the stream is otherwise unimpaired (Linck 2002). One interesting side note about Cranberry Brook is that brook trout were historically present but have not been documented there in recent times. Cranberry Brook has been identified by NYSDEC as a Class A stream.

Cranberry Pond. Cranberry Pond is a 24-acre pond located within Training Area D4, along the southeastern boundary of the dud danger area. Cranberry Pond is near to or within the firing fans of many of the West Point ranges, and access to the pond via Range Road 1 is restricted during artillery and mortar firing from May to August. Range Road 6 passes close to the northeast edge of the pond; however, this road can be impassable at times. A small tributary enters Cranberry Pond at the northwest corner.

The water level varies slightly due to beaver activity. Nuisance beaver were previously removed from one of the ranges and released at Cranberry Pond. Due to beaver activity in the area, the water level is currently at capacity.

Cranberry Pond is a NYSDEC Class A waterbody. Water quality data indicated DO concentrations at the surface of 6.6 ppm and a range of 4 to 0 ppm from a depth of 10 feet to the bottom (Deschenes, 1976; Linck 1993), pH ranging from 6.18 to 6.78, and conductivity in the range of 25.8 to 33.9 micromhos/cm (Green and Mills, 1988). Zooplankton data collected is provided in Table 3-6.

Crown Brook. Crown Brook originates in the wetlands complex known as "Beavers Ponds" located in Training Area D5. The stream passes through some small wetlands before rapidly descending to its junction with Highland Brook, downstream of the Village of Highland Falls Water Treatment Plant. The stream receives a C(t) classification from New York State. In July 2000, Crown Brook had a conductivity

Table 3-6
Zooplankton Data for Cranberry Pond

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	19-Jun	11	0.765	70.688	436.839	7-Sep	6	0.300	207.967	211.448
2000	22-Jun	14	0.641	27.981	81.959	1-Sep	11	0.741	43.483	238.487
1999	28-May	7	0.684	52.124	296.840	1-Sep	9	0.995	33.868	379.763
1998	22-May	11	0.709	15.884	96.268	11-Aug	11	0.491	18.971	51.933
1997						15-Aug	10	0.797	35.660	242.888

Species collected include: *Bosmina longirostris, Calanoid copepodid, Cyclopoid copepodid, Daphnia galatea mendotae, Daphnia pulicaria, Diaphanosoma spp., Diaptomus minutus, Diaptomus oregonensis, Holopedium sp., Mesocyclops edax, Nauplii sp.*

Source: Beemer, J. 2002a; Green and Mills, 1988.

reading of 40 µmhos/cm, a pH reading of 6.0 and a surface temperature reading of 62º F. No other water quality data is available. The remains of several small dams are present in its upper stretches. During dry years, the stream flow can be greatly reduced.

Crows Nest Brook. Crows Nest Brook is located in the northeast corner of USMA property. It has its origin in various small streams flowing down from the Crows Nest peak, which converge and discharge to the Hudson River. It is classified by the NYSDEC as Class C water. In 2001, USFWS personnel discovered evidence of spawning brown trout (*Salmo trutta*) near Target Field. Therefore, USMA as good stewards will treat the stretch of Crows Nest Brook from its junction with Sinclair Pond Brook downstream to the Hudson River as Class C(ts) and the stretch upstream of that junction as Class C.

Water quality data collected in 1980 showed DO levels ranging from 11.82 to 17.1, pH levels ranging from 5.8 to 7.7, and slightly elevated levels of total dissolved solids (see Appendix D). Additional water quality data is provided in Table 3-7. Water quality measurements taken in July 1997 show a pH ranging from 7.48 to 7.73, conductivity ranging from 750 to 940 µmhos/cm and TDS ranging from 510 to 630 ppm (Linck 1997). A thermograph was placed in the brook in 2000. The thermograph continuously recorded stream temperatures from 2 May through 17 October. The average stream temperature was 61.82º F with a maximum-recorded temperature of 73.61º F.

Table 3-7
Water Quality Data for Crow's Nest Brook

Year	Temp (ºF)	Conductivity (micromhos/cm)	Total Dissolved Solids (ppm)	pH	Dissolved Oxygen (ppm)
1996	66.5	690	470	N/A	10.55
2000	66.2	190	120	7.35	7.87
	67.3	420	280	7.43	7.43

Source: Linck, 2001,1996b.

Delafield Pond. Delafield Pond is a small (2 acres) pond located in the northeast corner of USMA property in the main post area. The pond, which is an NYSDEC Class B waterbody, historically served as West Point's reservoir until Lusk Reservoir was built. The pond currently serves as a swimming area for military and civilian personnel. No known studies have been conducted at the pond, and no water quality data are available. Redbreast sunfish have been observed in the pond's outlet stream near the North Athletic field (Beemer, 2002b).

Dassori Pond. The pond is a shallow impoundment fed primarly by storm water runoff from the surrounding steeper terrain and neighboring housing development. It is located near Redoubt 1. During dry periods, the water level in this pond is so low that the pond bottom becomes a juxtaposition of pools and exposed muck and organic debris. As such, the pond provides rich habitat for frogs, turtles, and other amphibians, and eastern blacknose dace. It is surrounded by a fringe wetland area, limited in size due to the abrupt rise in terrain surrounding the pond area (USMA, 1994a). Dassori Pond is classified by the NYSDEC as a Class B waterbody.

Deep Hollow Brook. Deep Hollow Brook originates in Harriman State Park near the Long Mountain Parkway and flows north through USMA Training Area X before emptying into the southwest arm of Stilwell Lake. New York State classifies Deep Hollow Brook as Class A. Water quality measurements were taken in June 1995 (Linck 1995), August 1997 (Linck 1997) and July 2000 (Linck 2001). Conductivity ranged from 130 to 210 µmhos/cm, TDS ranged from 90 to 110, DO was 11.47 and the pH ranged from 6.94 to 7.48. A RBP II sample was attempted in 2000 but low water conditions prevented obtaining an adequate sample but taxa richness was comparable to other unimpaired West Point waters. A thermograph was placed in the brook in 1999. The thermograph continuously recorded stream temperatures from 1 May through 13 October. The average stream temperature was 61.78º F with a maximum-recorded temperature of 75.8º F.

Lake Frederick. Lake Frederick, a NYSDEC Class B waterbody, is located in the southwest corner of the reservation near Woodbury at an elevation of 712 feet. The lake covers 19 acres with a maximum water depth of 25 feet and an average water depth of 12 feet. The shoreline is wooded over the eastern side of the lake whereas the rest of the lake is bordered by hayfields. The lake has 2 small inlets, one draining from a 0.5-acre pond 200 feet from the northeast corner along the eastern shore, and water discharges over a spillway during high water levels (USMA, 1980b).

Temperature profiles from the 1970s indicated a partial stratification, with bottom temperatures ranging from 50 to 60 ºF in the summer (Deschenes, 1976, 1977). DO concentrations have been reported to be sufficient for most fish (USMA, 1994a). DO values in 1987 were 9 ppm at a depth of 5 feet and 7 ppm at a depth of 20 feet (Adirondack Lakes Survey, 1987); DO levels taken in 1954 during the summer were 9.2 ppm at the surface, 9 ppm at 10 feet, and 4 ppm near the bottom; and DO levels taken in September 1976 were between 5 and 6 ppm.

DO concentrations of the bottom waters (below 16 feet) during the summer months have ranged from less than 4 ppm (Deschenes, 1976, 1977) to 7 ppm (Adirondack Lakes Survey Corp., 1987). DO and temperature data collected during the summer of 1994 clearly indicate a more dramatic stratification than the earlier data (Linck, 1994). As indicated below (Table 3-8), both DO and temperature show a stratification occurring between depths of 10 and 15 feet, and nearly hypoxic conditions at a depth of 20 feet.

Other water quality data for Lake Frederick include measurements of pH ranging from 7.0 to 8.42 (Adirondack Lakes Survey Corp., 1987; Linck 1994), conductivity ranging from 90 to 94 micromhos/cm (Green and Mills, 1989; Linck, 1999; USMA, 1994a) and Secchi depth ranging from 7.67 to 10.83 feet

Table 3-8
Temperature and Dissolved Oxygen Data for Lake Frederick

Depth (ft)	DO (ppm)	Temp (°F)
Surface	6.32	81.1
5	6.34	79.5
10	5.96	78.5
15	0.84	67.5
20	0.32	58.5

Source: Linck, 1994.

with a mean of 9.67 feet (Green and Mills, 1989). Total dissolved solids have been measured at 60 ppm (Linck, 1999).

Zooplankton data collected for Lake Frederick is provided in Table 3-9. Minimal information is available on the biological parameters of Lake Frederick. The principle emergent and submergent gathered and tentatively identified are *Najas* sp., possibly *Ceratophyllum* sp., *Potamogeton* sp., *Myriophylum* sp., and *Trapa* sp. Aquatic plants are found at the lake (Adirondack Lakes Survey Corp., 1987; Linck 1994).

Lake Georgina. Lake Georgina, a NYSDEC Class A waterbody, is situated in Training Area O, 1/4 mile west of Bull Pond. The approximate elevation of Lake Georgina is 1,100 feet. It covers 6 acres and its maximum depth is 15 feet. The size of the littoral zone is limited because of steep, rocky ledges and boulders along the shores.

There is limited drainage into Lake Georgina; it receives inflow from an intermittent stream and a small red maple swamp that drains into the lake from the northeast (Breden et al., 1981). There also appears to be continuous leakage through the spillway, although the exact location of the leak has not yet been determined. As a result of the leakage, and the limited drainage into the lake, the current water level is below the top of the spillway.

Table 3-9
Zooplankton Data for Lake Frederick

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	10	0.741	92.804	494.802	7-Sep	8	0.453	31.360	92.500
2000	22-Jun	11	0.978	81.120	891.656	31-Aug	6	1.192	33.091	497.752
1999	28-May	8	0.983	28.282	330.240	1-Sep	6	0.915	19.964	198.259
1998	21-May	7	0.680	71.277	487.119	12-Aug	11	0.889	21.289	225.557
1997						15-Aug	7	1.136	28.957	456.009

Species collected include: *Bosmina longirostris, Calanoid copepodid, Chydorus sphaericus, Cyclopoid copepodid, Daphnia galatea mendotae, Daphnia pulicaria, Diacyclops thomasi, Diaptomus minutus, Diaptomus oregonensis, Mesocyclops edax, Nauplii sp., Tropocyclops prasinus*

Source: Beemer, J. 2002a; Green and Mills, 1989.

The lake does not appear to stratify, with temperatures ranging between 82 °F and 83.2 °F at the surface and 77.9 ºF to 80 ºF at depths between 5 and 10 feet (Adirondack Lakes Survey Corp., 1987; Linck, 1994). DO concentrations recorded at a depth of 5 feet have ranged from 5.66 ppm to 8.0 ppm (Appelget and Otis, 1953; Adirondack Lakes Survey Corp., 1987; Linck, 1994). In 1953, dissolved oxygen levels were reported at 7.7 and 6.1 ppm at the surface and at 10 feet, respectively. Conductivity has ranged from 42 to 45 micro-mhos/cm and pH has ranged from 6.5 to 7.1 (Adirondack Lakes Survey Corp., 1987; Green and Mills, 1989).

Zooplankton data for Lake Georgina is provided in Table 3-10. The limited area of shallow water limits the occurrence of aquatic macrophytes to small numbers of pondweeds (USMA, 1980b). The lake is dominated by Eurasian water milfoil (USMA, 1994a).

Hemlock Brook. Hemlock Brook originates in a large wetland located in Training Area Q and flows eastward before entering Popolopen Lake on its western shore. A thermograph was placed in the brook in 2001 and continuously recorded stream temperatures from 2 May through 29 October. The readings reveal an average temperature of 61.48º F with a maximum temperature of 78.05º F. On June 20, 1995, a pH of 7.28 was recorded while electrofishing the stream for a fish survey. No other water quality data is available. New York State classifies Hemlock Brook as Class A.

Table 3-10
Zooplankton Data for Lake Georgina

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	9	0.743	122.007	308.249	7-Sep	11	0.541	444.564	1309.698
2000	22-Jun	11	0.551	66.061	100.596	31-Aug	12	0.486	216.599	450.204
1999	28-May	9	0.677	82.098	359.760	1-Sep	10	0.694	201.818	635.806
1998	21-May	11	0.563	297.377	574.768	11-Aug	8	0.480	505.390	943.575
1997						15-Aug	7	0.613	151.272	536.569

Species collected include: *Ceriodaphnia sp., Cyclopoid copepodid, Daphnia galatea mendotae, Diaphanosoma spp., Diaptomus minutus, Diaptomus oregonensis, Mesocyclops edax Nauplii sp., Tropocyclops prasinus.*

Source: Beemer, J. 2002a; Green and Mills, 1989.

Highland Brook. Highland Brook is an extensive stream and wetland system that is critically important because it constitutes the potable water supply for Highland Falls. Its headwaters are located in Jim's Pond and Bog Meadow Reservoir, both of which are located adjacent to the northern border of USMA. The brook traverses the USMA golf course, flows into a reservoir at Route 9W near Stony Lonesome Road in Highland Falls, and ultimately discharges into the Hudson River. Highland Brook is classified by NYSDEC as Class A and has been assigned a standard of A(t) (USMA, 1993)[1].

Because of its use as a drinking water supply, Highland Brook is tested regularly by Highland Falls for various water quality parameters. To date, the test results indicate that Highland Brook has extremely good quality water, consistent with the A(t) classification and standard (USMA, 1993). Water quality data collected in 1980 found dissolved oxygen levels ranging from 11.82 to 13.7 and pH levels ranging from 5.8 to 7.9 (see Appendix D). Data collected during the summer of 1996 showed temperatures ranging between 62 °F to 65 °F, conductivity from 70 to 200 micromhos/cm, DO from 10.17 to 10.21 ppm, total dissolved solids from 100 to 160 ppm, and pH from 6.6 to 9.65 (Linck, 1996). A thermograph was placed in the brook in 2001 and continuously recorded stream temperatures from 27 April through 24 October. The average stream temperature was 60.86º F and rarely climbed above 73º F for more than two hours at any time.

Johnson Meadow Brook. Johnson Meadow Brook is a small stream located in Training Area A1 and A2 in the southwest corner of the reservation. The stream drains Barnes Lake and flows northward, entering Popolopen Lake at Natural Bridge. Unidentified species of salamanders, crayfish and frogs have been collected in this stream (Linck, 1996a). Johnson Meadow Brook is a NYSDEC Class A waterbody. Available water quality data is provided in Table 3-11. A thermograph was placed in the brook in 1997 and continuously recorded stream temperatures from 1 May through 13 October. The average stream temperature was 61.66º F with a maximum-recorded temperature of 73.01º F. A RBP II survey in 1998 by USFWS personnel suggests that Johnson Meadow Brook is somewhat impaired, with an EPT Index of

[1] Class A waters are best used as a source of water supply for drinking, culinary, or food processing purposes and any other usages. The waters, if subjected to approved treatment equal to coagulation, sedimentation, filtration, and disinfection, with additional treatment if necessary to reduce naturally present impurities, will meet New York State Department of Health drinking water standards and will be considered safe and satisfactory for drinking water standards. The "(t)" designation indicates that the waters are suitable for trout, and meet a standard for dissolved oxygen of a minimum daily average of not less than 6.0 mg/L (USMA, 1993).

Table 3-11
Water Quality Data for Johnson Meadow Brook

Year	Temp (ºF)	Conductivity (micromhos/cm)	Total Dissolved Solids (ppm)	pH	Dissolved Oxygen (ppm)
1996	70	110	N/A	N/A	N/A
1998	70.7	200	140	N/A	6.42

Source Linck, 1996a, 1999.

2 (Linck 1999). Sediment from surrounding roadways may be a contributing factor. This bears closer scrutiny.

Long Pond. Long Pond is leased by USMA to the Town of Highlands for exclusive use by residents for swimming, fishing and other water-based recreation. Long Pond is located between Training Areas M and Z4 in a "training exclusion" area. It has an area of 41 acres and a maximum depth of 21 feet. One tributary, Wilkins Hollow Brook, flows south from Wilkins Pond and enters the northwest corner of Long Pond. Another tributary is an intermittent stream entering the east side from the vicinity of Ranges 7 – 10. Long Pond is drained in the southwest corner of the pond by Long Pond Creek. A small wetland area borders the southwest corner of the pond. Long Pond is classified as a Class A water body.

The most comprehensive water quality data for Long Pond was collected in 1980 (see Appendix D). Additional data collected in 1987 is provided in Table 3-12 (Adirondack Lakes Survey Corp., 1987). Zooplankton data for Long Pond is provided in Table 3-13 (Adirondack Lakes Survey Corp., 1987, Beemer 2002a).

Table 3-12
Water Quality Data for Long Pond

Year	Temp (ºF)	Conductivity (micromhos/cm)	Total Dissolved Solids (ppm)	pH	Dissolved Oxygen (ppm)
1980	N/A	108.4	N/A	6.4 – 7.0	11.5 – 12.3
1987	N/A	108.4		6.72 – 6.8	9.0 (at depth of 5 ft.) 2.0 (at depth of 16.4 ft.)

Source: Adirondack Lakes Survey Corp., 1987; Linck, 1999.

Table 3-13
Zooplankton Data for Long Pond

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	7	0.260	122.181	95.694	7-Sep	8	0.289	93.165	90.975
2000	22-Jun	9	0.357	82.634	97.092	31-Aug	6	0.273	9.538	7.376
1999	27-May	10	0.471	100.56	279.032	1-Sep	9	0.327	151.146	182.486
1998	22-May	10	0.421	19.98	42.2697	12-Aug	9	0.425	128.178	194.038
1997						28-Aug	4	0.362	5.628	12.415

Species collected include: *Bosmina longirostris, Calanoid copepodid, Chydorus sphaericus, Cyclopoid Copepodid, Daphnia galatea mendotae, Diacyclops thomasi, Diaphanosoma spp., Mesocyclops edax, Nauplii sp., Tropo-cyclops prasinus*.

Source: Beemer, J. 2002a

Long Pond Creek. Long Pond Creek is the outlet for Long Pond. It flows southeast through Training Areas Z5 and Z6 and across Ranges 11 and 12. It merges with Zints Brook approximately 500 meters upstream of the Zints Brook junction with Popolopen Brook.

Water quality measurements taken in 1997 and 1998 showed conductivity ranging from 140 to 150 µmhos/cm, pH ranged from 7.05 to 8.02, TDS varied from 90 to 100 ppm, and DO values were between 2.6 and 5.2 (Linck 1998; Linck 1999). A thermograph was placed in the brook in 2001 and continuously recorded stream temperatures from 1 May through 13 October. The average stream temperature was 65.97º F with a maximum-recorded temperature of 82.77º F. A RBP II sampling was conducted in 1998 but low water levels prevented getting a second sample from a site upstream of the first. However, the data collected suggests that the brook is relatively unimpaired (Linck 1999).

Lusk Reservoir. Lusk Reservoir is located on the Main Post and serves as one of the primary sources of potable water for USMA. The reservoir is fed by a direct pipeline from an intake structure on Popolopen Brook in the southeast section of the reservation. The reservoir covers an area of 13 acres and has a maximum depth of 28 feet. The reservoir has a capacity of approximately 63 million gallons, although its usable capacity is only about 33 million gallons (USMA, 1980b). To comply with drinking water standards, no more than two non-motorized boats (oars and paddles only) may be afloat for angling (USMA, 1995). Lusk Reservoir is classified by NYSDEC as Class A and has been assigned a standard of A(t). Discharge from Lusk Reservoir flows into Kinsley Farm Brook (USMA, n.d.a.).

Water temperature profiles indicate the presence of a thermocline and temperature differential between the surface and bottom of 30 ºF (USMA, 1994a). DO levels at depth have been know to vary significantly. In 1987, a DO concentration of 9 ppm was recorded at a depth of 26 feet (Adirondack Lakes Survey Corp., 1987), whereas, in 1976, DO at 20 feet was reportedly only 4 ppm (USMA, 1994a). Conductivity has been measured between a range of 98.5 and 179.8 micromhos/cm, and pH has ranged from 6.6 to 8.4 (Adirondack Lakes Survey Corp., 1989).

Zooplankton data for Lusk Reservoir is provided in Table 3-14. Eurasian milfoil (*Myriophyllum spicatum*) has been a problem in the past and mechanical methods of removal were initiated in 1989.

Currently, there is a program in place to remove nuisance vegetation at the reservoir, specifically water chestnut plants, as it is found (USMA, n.d.a.).

Mine Lake. Mine Lake, located between Training Areas W and T1 along Route 293, is a man-made lake that formed as a result of the construction of a dam on Popolopen Brook. Both the Popolopen Lake outlet and Brooks Hollow Creek flow into Mine Lake. The Mine Lake outlet flows only a short distance to Stilwell Lake. Mine Lake covers approximately 24 acres and has a maximum depth of 12 feet. The surrounding watershed includes both cleared and forested land. The lake bottom is gravel covered by mud, and the shores are protected by brush and forest (USMA, 1980b). Mine Lake is a NYSDEC Class A waterbody.

Table 3-14
Zooplankton Data for Lusk Reservoir

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	7	0.336	180.015	222.561	7-Sep	9	0.321	83.104	83.118
2000	22-Jun	11	0.514	70.267	237.777	1-Sep	8	0.390	42.451	59.204
1999	27-May	6	0.349	38.182	62.156	1-Sep	5	0.470	35.518	85.521
1998	21-May	5	0.290	9.389	15.911	11-Aug	6	0.342	138.528	155.843
1997						15-Aug	7	0.424	42.529	88.244

Species collected include: *Bosmina longirostris, Calanoid copepodid, Ceriodaphnia sp., Cyclopoid copepodid, Daphnia galatea mendotae, Diacyclops Thomasi, Diaphanosoma spp., Mesocyclops edax, Nauplii sp., Tropocyclops prasinus*

Source: Beemer, J. 2002a.

Limited chemical and biological parameter information exists. A 1987 survey reports a DO value of 12 ppm at a depth of 5 feet and a pH of 7.8 (Adirondack Lakes Survey Corp., 1987). Data collected during the summer of 1998 indicated a temperature of 78 °F, conductivity of 80 micromhos/cm, total dissolved solids of 50 ppm, and a pH of 7.21 (Linck, 1999). Aquatic plants are common at Mine Lake and offer shelter and food for the fish species.

The small mean size of the zooplankton population determined from data collected in 1988 (see Table 3-15) suggest an excessive number of panfish or forage species (Green and Mills, 1988; USMA, 1994a).

Mineral Springs Brook. Mineral Springs Brook, located on the northwestern section of the West Point Military Reservation, originates from Sutherland Pond in the Black Rock Forest. It travels in a west-southwesterly direction for 5.5 kilometers where it joins with Woodbury Creek. Approximately 2.5 kilometers (1.55 miles) of the brook is located on USMA property in Training Areas L and N. A private land-holding containing 1,500 feet of stream divides the USMA part of the brook into two sections. Mineral Springs Brook is a NYSDEC Class C(ts) waterbody.

Mineral Springs Brook can be characterized as a small, freestone stream of moderate gradient, averaging eight feet in width in the USMA sections. The substrate is predominantly cobble and boulder with many small pools interspersed with short riffles. Available water quality data is provided in Table 3-16. A

Table 3-15
Zooplankton Data for Mine Lake

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	10	0.340	42.239	74.056	7-Sep	10	0.416	257.716	473.431
2000	22-Jun	9	0.312	11.927	15.725	31-Aug	10	0.450	43.147	75.317
1999	28-May	10	0.651	26.714	121.215	1-Sep	13	0.473	122.116	246.154
1998	22-May	6	0.339	13.438	22.528	12-Aug	11	0.407	176.583	397.528
1997						14-Aug	6	0.348	13.469	39.290

Species collected include: *Alona sp., Bosmina longirostris, Calanoid copepodid, Ceriodaphnia sp., Chydorus sphaericus, Cyclopoid copepodid, Daphnia galatea mendotae, Diaphanosoma sp., Diaptomus minutus, Diaptomus oregonensis, Harpacticoid copepod, Mesocyclops edax, Nauplii sp.*

Source: Beemer, J. 2002a; Green and Mills, 1988.

Table 3-16
Water Quality Data for Mineral Springs Brook

Year	Temp (ºF)	Conductivity (micromhos/cm)	Total Dissolved Solids (ppm)	PH	Dissolved Oxygen (ppm)
1996	60	30 (Firebreak 21 crossing) 66 (Mineral Springs Brook Natural Area)	N/A	6.4 – 7.0	11.5 – 12.3
1998	62.6	270	140	N/A	N/A

Source: Linck, 1996a, 1999.

thermograph was placed in the brook in 1998 and continuously recorded stream temperatures from 1 May through 13 October. The average stream temperature was 60.62º F with a maximum-recorded temperature of 70.6º F.

A RBP II sampling was conducted by USFWS personnel in 1997. The lower stretch of Mineral Springs Brook scored the best on most of the metrics used, compared to all other West Point waters (Linck 1997). In fact, it has been recommended that Mineral Springs Brook be considered as the possible reference stream used to rate all other West Point streams with the RBP II metrics (Linck 1997).

A wild, reproducing population of brown trout (*Salmo trutta*) was discovered in the brook in 1996 (Linck, 1996a). Non-fingerling trout sampled ranged from 101 to 310 mm in size.

In FY 97, a permanent stream crossing structure was installed in Training Area N to protect stream bank stabilization and water quality. The project involved the removal of a temporary gabion/culvert structure and installation of a concrete arch crossing structure.

Popolopen Brook. Popolopen Brook is the outlet stream of Stilwell Lake, traverses the south-central portion of USMA, and empties into the Hudson River. It is about 3.8 miles in length from its source to where it meets the Hudson River. The stream is about 30 feet wide with little gradient through its first mile. It borders a wetland system. There is a moderate gradient with areas of rocky pools interspersed with riffles where Cranberry Brook and Weyant's Pond outlet meet Popolopen Brook. Outside of the reservation, the stream is quite steep. Popolopen Brook is classified is a Class A(t) stream between Stilwell Lake and the USMA intake, and a Class C(t) stream downstream from the USMA water intake.

Raw water is drawn from Popolopen Brook 2.25 miles downstream of Stilwell Lake and conveyed through a cast iron pipe 10.1 km (6.3 miles) into Lusk Reservoir for potable water supply for the cantonment area of USMA (McMaster et al., 1984). One-quarter mile further downstream, treated effluent from the Camp Buckner secondary wastewater treatment plant is discharged into Popolopen Brook, approximately 1.5 miles upstream from its confluence with the Hudson River (in accordance with NPDES permit NY0023213) (USMA, 1980b).

Water quality data collected in 1980 show dissolved oxygen levels ranging from 11.42 to 13.62 and pH levels ranging from 6.3 to 7.2 (see Appendix D). Additional information collected during the study does not indicate that any water quality problems existed in 1980. Temperature data has been collected in recent years to evaluate whether environmental conditions would support a year-round population of trout. Data collected by Linck (1993, 1996a, 1996b) indicated that temperatures in June range from the low to mid 70s (ºF), but in July through August temperatures rarely drop below 77 ºF, and maximum temperatures in August can reach 83 ºF (Table 3-17). It was concluded that while physical habitat conditions were adequate, trout would be unable to survive the maximum temperatures recorded in late summer. Thermographs were placed in 1997 and 2000 in the vicinity of the great falls located in the Popolopen Gorge Special Natural Area. The thermographs were programmed to record the stream temperature every 30 minutes over a 165-day span, starting on or about 1 May. The average stream temperature during both years was 66.5º F. These readings confirm that Popolopen Brook is best described as a cool-water system with limited survival possibilities for coldwater species such as trout (except near thermal refugia near springs and cold seeps).

A 1988 survey of macroinvertebrates yielded decapods (i.e., crayfish), amphipods (scuds), corydalids (alderflies), hydropsychids (net spinner caddisflies), limnephilids (vegetable case caddisflies),

Table 3-17
Water Quality Data for Popolopen Brook

Year	Temp (°F)	Conductivity (micromhos/cm)	Total Dissolved Solids (ppm)	pH	Dissolved Oxygen (ppm)
1996	Low 70s to 83	90	60	6.4 – 7.0	9.23
1998	69.8 - 71	90	60	N/A	N/A
2000	70.3	90	60	7.37	N/A

Source: Linck, 1996a, 1999, 2001.

chironomids (midges), simulids (blackflies), tipulids (craneflies), odonates (dragonflies), and two unidentified pupae (Linck, 1988). Of the 72 individuals collected, 46 were hydropsychids, which are indicative of moderately enriched environments. A RBP II sampling was conducted in 1997 by USFWS personnel (Linck 1997). Popolopen Brook scored well on all metrics and, along with Mineral Springs Brook, could be used as the reference stream with which to compare all other West Point streams for impairment declines.

A stream bank stabilization project is planned for Popolopen Brook. The proposed project will restore the stream bank to its natural state following years of use as a vehicle-crossing ford. The project involves building up stream banks, as well as grading, reseeding, and mulching them. Trees and shrubs will be planted to stabilize the soil. The ford site is now closed to all vehicle traffic.

Popolopen Lake. Popolopen Lake is the largest and one of the most popular recreational lakes on the West Point reservation. Camps Natural Bridge and Buckner, located upon the lakeshore and used to support cadet field training, derive potable water directly from Popolopen Lake (McMaster et al., 1984). This 149-acre lake lies at an elevation of about 678 feet. Popolopen Lake is a Class A waterbody.

The shores of the lake are composed of rock and gravel, and the maximum depth is 31 feet. Three streams drain into Popolopen Lake—Johnson Meadow Brook, Cat Hollow Brook, and Hemlock Brook. Popolopen Brook forms the lake's outlet and is controlled by drains in a concrete dam.

In 1987, the Adirondack Lakes Survey Corp. study observed a DO level of 10 ppm at 5 feet and a DO level of 1 ppm at 28 feet, with pH values of 7.3 and 7.1, respectively.

Studies indicate that the mean zooplankton length is low and has been on the decline in recent years (Table 3-18) (Green and Mills, 1993, 1994, 1995, 2002a). The 1994 report noted that the impacts from a recent unintended introduction of alewives into Popolopen Lake might be evident by the size and structure of the zooplankton population. In 1995, at least two year classes were collected while electrofishing and it appears that alewives have become firmly established in the lake (Green and Mills, 1995). The mean zooplankton size has declined to a value representative of Stilwell Lake, which has the most popular bass fishing on the reservation.

Table 3-18
Zooplankton Data for Popolopen Lake

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	10	0.318	12.737	13.847	7-Sep	8	0.331	138.902	123.675
2000	22-Jun	10	0.494	139.714	254.913	31-Aug	9	0.321	16.743	15.867
1999	28-May	10	0.592	42.373	176.977	1-Sep	9	0.723	74.587	399.729
1998	22-May	9	0.302	11.715	25.896	12-Aug	9	0.456	44.635	95.575
1997						14-Aug	9	0.370	10.562	17.410
1996	30-May	7	0.489	22.342	31.296	7-Aug	7	0.379	122.328	149.486
1995	6-Jun	5	0.276	36.837	31.258	11-Aug	6	0.335	87.405	105.391
1994	27-May	8	0.685	82.756	320.200	23-Aug	7	0.448	89.939	149.916
1993	27-May	10	0.697	7.464	33.119	11-Aug	8	0.558	12.801	168.197
1992	28-May	6	0.696	34.236	94.413	6-Aug	8	0.548	32.381	88.708
1991	12-Jun	11	0.492	38.860	72.811	6-Aug	10	0.504	85.053	203.130
1990	5-Jun	7	0.694	29.440	237.924	20-Aug	7	0.532	4.684	19.269
1989	1-Jun	9	0.805	32.813	150.472	24-Aug	11	0.566	27.646	69.264
1988	20-Jun	8	0.500	144.495	214.771	26-Aug	7	0.438	162.016	238.031
1987	20-May	5	0.641	13.768	46.924	12-Aug	4	0.639	150.926	547.079

Species collected include: *Bosmina longirostris, Calanoid copepodid, Ceriodaphnia sp., Chydorus sphaericus, Cyclopoid copepodid, Diacyclops thomasi, Diaphanosoma sp., Mesocyclops edax, Nauplii sp., Sida crystalline, Tropocyclops prasinus*.

Sources: Beemer, J. 2002a; Green and Mills, 1993, 1994, 1995.

Conductivity values indicate that some enrichment has occurred in the lake (Green and Mills, 1995). Previously, a single application of copper sulfate was added in June as an annual management technique to reduce algal blooms (USMA, n.d.a.).

Queensboro Brook. Queensboro Brook is located in Training Area CS in the southeast corner of the WPMR. This coldwater brook originates within Harriman State Park and only 0.25 miles is on USMA property. This coldwater stream was used as part of USMA's water supply for a time, and USMA has an agreement with PIPC to withdraw additional water from the Queensboro watershed in the event of drought conditions, if need be. An old concrete dam impounds a 0.5-acre pond just upstream from the junction with Popolopen Brook. New York State classifies Queensboro Brook as A(t).

A thermograph was placed in 1997 to record stream temperature every 8 minutes from 27 April to 24 October. The average temperature recorded during this time was 64.17º F. Temperatures rarely climbed

above 75º F. Water quality measurements taken in 1996 and 1998 showed a conductivity value of 210 µmhos/cm, a TDS value of 140 ppm, pH of 7.7 and DO of 10.07 (Linck 1996; Linck 1999).

A RBP II sampling conducted in 1998 failed to obtain the requisite 100 specimens needed to make an accurate analysis (Linck 1999). The metrics that were obtained, though, suggest that the stream is not impaired.

Round Pond. Round Pond, located near Wilkins Pond along the northern boundary of USMA, has an area of about 13 acres and a maximum depth of 29 feet. It is located at an elevation of approximately 1,020 feet. There are no inlets and a small structure serves to control the outlet. A bank of gravel and rock ledges form a steep shoreline with a small littoral zone (McMaster et al., 1984). The surrounding watershed is forested and used for recreation. Round Pond is classified as an NYSDEC Class B(t) waterbody.

Data regarding the chemical parameters of the pond are limited. During the summer, a thermocline develops. DO levels ranged from 6.8 to 4.3 for surface and 20-foot stations, respectively. Data for September 1976 show DO levels to be between 8 and 9 ppm (no depth given). A 1987 study observed DO values of 10 ppm and 3 ppm at depths of 5 feet and 23 feet; pH values were 7.0 and 7.1 at respective depths. Zooplankton data are available (Table 3-19).

Table 3-19
Zooplankton Data for Round Pond

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	11	0.477	52.604	125.460	7-Sep	12	0.458	20.647	54.256
2000	22-Jun	8	0.745	36.147	99.080	1-Sep	11	0.606	21.507	76.440
1999	27-May	10	0.709	27.182	97.284	1-Sep	9	0.617	58.362	205.627
1998	21-May	10	0.570	28.022	140.961	12-Aug	11	0.659	38.544	162.974
1997						14-Aug	10	1.023	51.726	543.331

Species collected include: *Bosmina longirostris, Calanoid copepodid, Chydorus sphaericus, Cyclopoid copepodid, Daphnia galatea mendotae, Daphnia pulicaria, Diacyclops thomasi, Diaphanosoma spp., Diaptomus minutus, Diaptomus oregonensis, Mesocyclops edax, Nauplii sp., Tropocyclops prasinus*.

Sources: Beemer, J. 2002a.

The lake itself is also used for recreation and is immediately surrounded by the Round Pond Recreation Area, which consists of a beach, playgrounds, picnic areas, and campsites. Lifeguards are on duty at Round Pond during the summer months. (DCFA, n.d.).

Guano from a large population of Canada geese in the Round Pond Recreation Area has caused water quality problems in the past. A goose roundup is conducted each June (corresponding to the goose molt) to reduce the goose population size during the summer swimming season. Eventually, many geese move back to the area. Round Pond is one of the most heavily used recreational areas and is the most heavily fished water body on the reservation.

Stilwell Lake. Stilwell Lake is located near Training Areas V and W in the south-central portion of USMA. The 129-acre lake was formed in 1949 by construction of a concrete dam across Popolopen Brook. Maximum depth is 46 feet with much of the lake over 10 feet. The southern and western shore of the lake is mostly forested to the water's edge, while the northeastern shore is generally open and brushy without forest cover. A military engineer training site is located in a large open area along the western edge of the lake. The shorelines of Stilwell Lake are mostly gravel, although rock ledges and boulders are present at some locations. Stilwell Lake is classified as a NYSDEC Class A waterbody.

Mine Lake outlet forms the major inlet to the lake. Deep Hollow Creek enters in a shallow section along the southern end, and an unnamed creek enters from the north. Water is drawn from intakes in the northeast corner of the Stilwell Lake and pumped through a concrete pipe to the Stony Lonesome Water Treatment Plant and is supplied as potable water to the cantonment area of USMA (McMaster et al., 1984).

A thermocline develops in the summer at an upper limit depth of about 10 feet and a lower-limit depth of about 18 feet. Above this level, DO appears adequate; however, below 18 feet summer DO becomes low with traces of hydrogen sulfide (Darrow, 1980, cited in USMA, 1980b). In 1987, DO values of 10 ppm and 1 ppm were observed at depths of 5 feet and 30 feet; pH values were 7.1 and 6.3, respectively. According to a 1995 study by Cornell University's Bass and Panfish Management Program, conductivity levels appear to be increasing over time, with the 1995 values the highest observed to date. Water quality

data collected in 1998 indicated a conductivity of 80 micromhos/cm, total dissolved solids of 50 ppm, and a pH of 7.48 (Linck, 1999).

Compared to other USMA lakes, zooplankton average density and mean length are small (Table 3-20). Nuisance vegetation, such as water chestnut, has been identified in Stilwell Lake (USMA, n.d.a.). Stilwell Lake also experiences infrequent algal blooms (approximately every 3 years). The previous management strategy was to add a copper sulfate treatment when necessary.

Stilwell Lake is a popular recreation area at USMA. Powerboats (internal combustion engines) are allowed, as well as waterskiing (Directorate of Community & Family Activities, n.d.). Stilwell Lake is an outstanding fishery and is the most popular largemouth bass fishery at the Academy (see Appendix E for

Table 3-20
Zooplankton Data for Stilwell Lake

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	9	0.316	39.604	44.405	7-Sep	7	0.328	13.333	13.188
2000	22-Jun	6	0.285	68.209	60.122	31-Aug	6	0.292	72.174	57.740
1999	28-May	8	0.360	75.295	127.320	1-Sep	12	0.530	5.402	20.358
1998	22-May	6	0.298	64.561	72.355	11-Aug	10	0.340	45.017	59.750
1997						15-Aug	6	0.340	11.047	18.292
1996	31-May	6	0.683	48.985	142.009	7-Aug	9	0.442	26.038	40.198
1995	6-Jun	5	0.301	5.556	5.816	11-Aug	6	0.352	48.486	62.233
1994	27-May	6	0.385	11.736	17.751	24-Aug	6	0.439	7.769	16.383
1993	27-May	6	0.396	25.285	49.211	16-Aug	7	0.398	9.266	15.686
1992	28-May	7	0.280	17.394	17.482	6-Aug	6	0.400	23.131	32.197
1991	12-Jun	7	0.251	68.471	47.232	6-Aug	5	0.350	12.794	13.319
1990	5-Jun	8	0.372	10.351	15.624	20-Aug	7	0.354	10.384	11.861
1989	1-Jun	8	0.430	19.904	33.021	24-Aug	7	0.394	31.113	45.161
1988	20-Jun	6	0.334	10.330	9.541	26-Aug	7	0.324	13.661	11.965
1987	20-May	4	0.286	5.300	3.167	12-Aug	5	0.233	3.300	1.771

Species collected include: *Bosmina longirostris, Ceriodaphnia sp., Chydorus sphaericus, Cyclopoid copepodid, Diacyclops thomasi, Diaphanosoma spp., Diaptomus minutus, Mesocyclops edax, Nauplii sp., Tropocyclops Prasinus.*

Source: Beemer, J. 2002a; Green and Mills, 1988.

harvest counts) (Green and Mills, 1995). In addition, a portion of this lake is used for military engineer training involving use of small watercraft and emplacement of pontoon bridges.

Two Land Rehabilitation and Maintenance (LRAM) projects were completed at Stilwell Lake in 1998. The first project involved installation of a wood beam and gravel erosion control stairway at the pontoon bridge access point. (It is designed to blend in with the natural landscape.) The second project involved the installation of a gabion bulkhead in front of the old deteriorating bulkhead and backfilling the area between the two with excavated material and rock. In addition, erosion control structures were completed around three trees at the lake edge near the bulkhead.

Stony Lonesome Brook. Stony Lonesome Brook is located along the eastern edge of Training Area J3. It drains an area of approximately 315 acres. Stony Lonesome Brook originates at an unnamed wetland area and runs about three-quarters of a mile to the south to join Highland Brook. It is a permanent stream, but does not have its own classification in terms of water quality by NYSDEC. It therefore takes on the classification of Highland Brook, to which it is a tributary. Highland Brook is a Class A(t) stream according to NYSDEC's classification system.[2]

Water quality data was collected during the summer of 1998 and resulted in a temperature of 70 °F, conductivity of 330 micromhos/cm, total dissolved solids of 220 ppm, pH of 7.55, and DO of 7.5 ppm (Linck, 1999). Limited information exists regarding the biological parameters of Stony Lonesome Brook. A thermograph was placed in 1999 to record stream temperature every 30 minutes from 1 May to 10 September. The average temperature recorded during this time was 63.48º F with a maximum-recorded temperature of 74.54º F.

The riparian area surrounding Stony Lonesome Brook is vegetated with shrubs along the stream channel. Species predominant in the shrub strata include willows (*Salix* sp.), dogwoods (*Cornus* sp.), and brambles (*Rubus* sp.). Along the upland edge, sumac (*Rhus* sp.) is common. Several small stands of common reed

[2] Class A waters are defined as the highest usage waters suitable as a source for drinking water supply when appropriate treatment is provided. Requirements applicable to these waters also are that such waters will meet New York State Department of Health Drinking Water Standards, which are equivalent to National Interim Primary Drinking Water Regulations and National Secondary Drinking Water Regulations maximum contaminant levels (MCLs) after approved treatment equal to coagulation, sedimentation, filtration, and disinfection. An A(t) classification is a very high classification in terms of water quality.

(*Phragmites australis*) are also present. The dense groundcover throughout the wetland area consists of grasses, rushes, sedges, and hydrophytic forb species (USMA, 1996a).

Trout Brook. Trout Brook is located on the western edge of the WPMR in Training Area L. The brook originates off USMA property west of Smith Clove Road in the vicinity of Lake Frederick and flows northeast for approximately 3 km before joining Mineral Springs Brook. New York State classifies Trout Brook as Class C. However, USMA has documented wild trout in Trout Brook and will treat it as if it were classified as Class C(t), in maintaining its good stewardship role.

A thermograph was placed in 2001 to record the stream temperature every 30 minutes from 1 May to 13 October. The average temperature recorded during this time was 61.86º F with a maximum-recorded temperature of 76.8º F. Water quality measurements taken in 1998 showed a conductivity value of 470 µmhos/cm and TDS value of 310 ppm. Run-off from Smith Clove Road is likely impacting this stream, as sedimentation is evident in the upper USMA stretches. An RBP II sampling was conducted in 1998 (Linck 1999). Its metrics were similar to Mineral Springs Brook, to which it is a tributary.

Weyants Pond. Weyants Pond is a Class A waterbody and is located in the southeast section of USMA, crossing Training Areas Y, and CS. The 31-acre pond occurs at an elevation of 520 feet and has a maximum depth of about 9 feet. Its shores are brushy and marshy, and the entire watershed is forested. Tributaries to the pond are limited to two small, unnamed streams entering on the southwest corner and one in the northeast corner.

Water quality studies are limited for Weyants Pond. A 1987 study measured a DO value of 8.0 and a pH value of 6.6 at a depth of 5 feet (Adirondack Lakes Survey Corp., 1989). Cornell University's Bass and Panfish Management Program annual studies have reported pH values ranging from 6.4 to 7.6 and noted that conductivity values were slightly higher in 1995 than in previous years (Green and Mills, 1995). Zooplankton surveys were also completed during the annual studies (Table 3-21). The zooplankton sample analyses after 1996 were not part of the Cornell Bass and Panfish Program, but were instead conducted under contract through Cornell University's Biological Research Station at Shackelton Point, Bridgeport, NY.

Table 3-21
Zooplankton Data for Weyants Pond

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	11	0.665	75.434	413.905	7-Sep	7	0.465	119.985	201.086
2000	22-Jun	13	0.667	14.997	43.076	1-Sep	10	0.499	7.413	12.419
1999	28-May	13	0.571	19.099	66.510	1-Sep	10	0.470	55.614	175.593
1998	22-May	6	0.360	9.500	17.456	11-Aug	6	0.347	153.680	204.948
1997						15-Aug	9	0.572	404.198	1151.965
1996	31-May	7	0.807	187.678	524.687	7-Aug	6	0.744	39.494	125.872
1995	6-Jun	8	0.806	68.304	326.046	11-Aug	6	0.410	15.812	33.796
1994	27-May	9	0.575	39.478	146.647	23-Aug	7	0.352	7.174	15.234
1993	27-May	8	0.548	15.503	65.158	11-Aug	3	0.337	95.116	136.531
1992	28-May	7	0.565	63.782	112.032	6-Aug	6	0.567	37.937	85.388
1991	12-Jun	6	0.231	12.600	7.000	6-Aug	8	0.482	23.059	50.606
1990	5-Jun	5	0.718	119.438	930.278	20-Aug	9	0.431	10.538	19.640
1989	31-May	9	0.655	33.402	102.550	16-Aug	10	0.487	41.705	130.300
1988	20-Jun	9	0.810	32.918	115.996	26-Aug	9	0.628	275.788	1030.032

Species collected include: *Bosmina longirostris, Calanoid copepodid, Ceriodaphnia sp., Cyclopoid copepodid, Daphnia galatea mendotae, Diacyclops thomasi, Diaphanosoma sp., Diaptomus minutus, Diaptomus oregonensis, Mesocyclops edax, Nauplii sp., Tropocyclops prasinus*

Sources: Beemer, J. 2002a; Green and Mills, 1993, 1994, 1995.

Nuisance aquatic vegetation, such as Eurasian water milfoil, has been observed at Weyants Pond. At times, aquatic macrophytes cover the entire lake and interfere with angling (USMA, 1980b). Previously, herbicides were applied to control aquatic plants. In 1998, Weyants Pond was stocked with 400 12-inch triploid grass carp (*Ctenopharyngodon idella*) that were purchased with proceeds from sale of USMA Fishing Permits. Since that time, there has been a noticeable reduction of aquatic macrophytes in the lake. The characteristics of the lake make it well suited for largemouth bass (USMA, 1980b).

Wilkins Pond. Wilkins Pond, adjacent to Round Pond and Training Area M along the northern border of USMA, is located within one of the "training exclusion" areas on the military reservation. Wilkins Hollow Brook drains from the southwest corner of the Pond and flows in a southerly direction into Long Pond. Wilkins Pond has an area of 40 acres and a maximum depth of 9 feet. Small feeder streams enter in the northwest and northeast corners.

Although its waters are classified as Class A, limited studies have been conducted at Wilkins Pond; available zooplankton data are presented in Table 3-22 and water quality is provided in Table 3-23. Cornell University's Bass and Panfish Management Program annual studies have reported that the pond is relatively clear.

Table 3-22
Zooplankton Data for Wilkins Pond

Year	Spring Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)	Late Summer Sample Date	# of species	Avg. length (mm)	Density (#/L)	Biomass (ug/L)
2001	12-Jun	11	0.678	102.945	565.516	7-Sep	11	0.569	243.107	800.698
2000	22-Jun	11	0.719	59.719	144.696	1-Sep	11	0.706	96.634	507.304
1999	27-May	10	0.812	93.170	466.581	1-Sep	14	0.643	141.318	687.530
1998	22-May	11	0.724	100.784	314.116	12-Aug	12	0.642	150.886	553.900
1997						14-Aug	7	0.853	115.926	774.359
1996	30-May	7	0.918	154.687	1175.202	7-Aug	7	0.724	96.229	363.064
1995	6-Jun	10	0.838	56.159	318.640	11-Aug	8	0.636	146.688	607.412
1994	27-May	9	0.903	195.278	1324.555					
1993	27-May	9	0.810	61.146	211.275	11-Aug	9	0.538	238.632	625.355
1992	28-May	8	0.709	101.333	322.421	6-Aug	6	0.666	26.983	70.761
1991	12-Jun	7	0.885	38.124	149.115	6-Aug	8	0.470	49.064	90.916
1990	5-Jun	7	0.745	166.304	1060.425	20-Aug	7	0.772	141.146	1099.876
1989	1-Jun	9	0.759	53.568	270.904	24-Aug	11	0.801	170.577	1061.356
1988	20-Jun	8	0.709	126.400	332.700	23-Aug	9	0.577	109.223	390.100
1987	1-May	5	0.605	53.160	159.546	12-Aug	8	0.691	256.128	1330.796

Species collected include: *Bosmina longirostris, Calanoid copepodid, Ceriodaphnia sp., Chydorus sphaericus, Cyclopoid copepodid, Daphnia galatea mendotae, Daphnia pulicaria, Diaphanosoma sp., Diaptomus minutus, Diaptomus oregonensis, Mesocyclops edax, Nauplii sp.*

Sources: Beemer, J. 2002a; Green and Mills, 1993, 1994, 1995.

Table 3-23
Water Quality Data for Wilkins Pond

Year	Temp (ºF)	Conductivity (micromhos/cm)	Total Dissolved Solids (ppm)	pH	Dissolved Oxygen (ppm)
1987	N/A	N/A	N/A	6.2 to 7.5	9.0
1998	68	90	60	7.26	N/A
2000	64.2	70	50	6.58	N/A

Source: Linck 1999, 2001.

Nuisance aquatic vegetation has been reported as a problem in Wilkins Pond, and an herbicide treatment occurred here in 1990. Since that time, a state-threatened bladderwort species (*Utricularia radiata*) has been documented in Wilkins Pond.

Others. There are several other water bodies located within the reservation that have not been studied. Water bodies for which studies have not been done include Owl Swamp and numerous small unnamed streams and brooks throughout USMA. Most, however, are small streams that are not managed for their recreational fishing resources and therefore have not been studied. Some of the named streams include Brooks Hollow Brook, Kinsley Farm Brook, Wilkins Hollow Brook, and Zints Brook.

Hudson River. The Hudson River is an important ecological and commercial river system flowing approximately 304 miles from its source at Lake Tear of the Clouds in the Adirondack Mountains to its mouth in Upper New York Bay. The entire river system drains a watershed of approximately 13,514 square miles. As the Hudson passes through the Highlands region of New York, it flows along a relatively narrow and deep path with depths ranging from 49 to 197 feet. This area is characterized by turbulent mixing that creates long, undulating swells and swirling eddies. Water currents for the entire Hudson River vary throughout the year in flow rates, salinity gradients, and temperature gradients (BTI, 1977). The section of the Hudson River adjacent to West Point is classified Class B, as reflected in 6 NYCRR Part 858.3.

The Hudson River is tidally influenced to Troy, New York, some 150 miles upstream of the Battery in New York Harbor. Tidal amplitudes were measured at the Federal Dam in Troy, New York and found to be 4.6 feet; similar tidal amplitudes can be found near the mouth of the Hudson at New York City. Near West Point/Constitution Island (53 miles upstream), the river flow characteristics are predominantly tidal, although the Hudson tides are least here with an average of 2.6 feet (BTI, 1977). The downstream moving freshwater component is nearly masked by the oscillating tidal flows, which typically move several times the volume of water of the freshwater flow. The peak magnitudes of the average flood and ebb currents are 1.0 knots and 1.1 knots, respectively (USMA, 1980b).

The Hudson River, flowing between the reservation and Constitution Island, is an oligohaline estuarine reach. It is characterized by rapidly changing salinities in the range of 1 to 5 parts per thousand (ppt). The

river is moderately enriched by nitrogen and phosphorus and would be expected to support blooms of phytoplankton.

The Hudson River reach adjacent to USMA and downstream to the Bear Mountain Bridge has been extensively sampled, primarily in conjunction with past industrial waste discharges from the former Cold Spring Battery Plant (CSBP), located on the east bank of the Hudson River at Foundry Cove across from the cantonment area of USMA. Studies conducted in Foundry Cove revealed that cadmium levels in the cove and vicinity were several times the federal criterion of 3.98 µg/L calculated for aquatic health and 10 µg/L for human health (USEPA, 1980, cited in USMA, 1984). Aquatic sediments in the cove were also contaminated. No evidence of toxic effects to biota were observed; however, elevated levels of cadmium were observed in invertebrates, fish, and aquatic plants. Environmental remediation and clean-up efforts at the CSBP site were completed in July, 1995 (Knizek. personal communication, 1997) and the site was delisted from the National Priorities List pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) on October 18, 1996 (Tams, personal communication, 1997).

The Hudson River estuary is a very important habitat for many fish species. It is used not only by resident brackish water species but also as a migratory pathway for anadromous or catadromous species, and as a nursery ground for juvenile marine and estuarine spawners. The abundance of nutrients and shelter provided within an estuary collectively attract many species. The eggs and larvae deposited in the estuary are a food source for many other fish. Bluefish (*Pomatomus saltatrix*), a species of management concern under the Magnuson-Stevens Fishery Resource Conservation Act of 1996 and which USMA has statutory compliance requirements, are found in the USMA stretch of the Hudson in late summer, especially during low flow years.

3.10 WETLANDS

There are approximately 1,010 acres of wetlands located throughout West Point in association with streams, ponds, depressions, and seeps. In 1993, the USACE, New York District (Environmental Analysis Branch) conducted an inventory of wetlands on West Point. The inventory, which consisted of

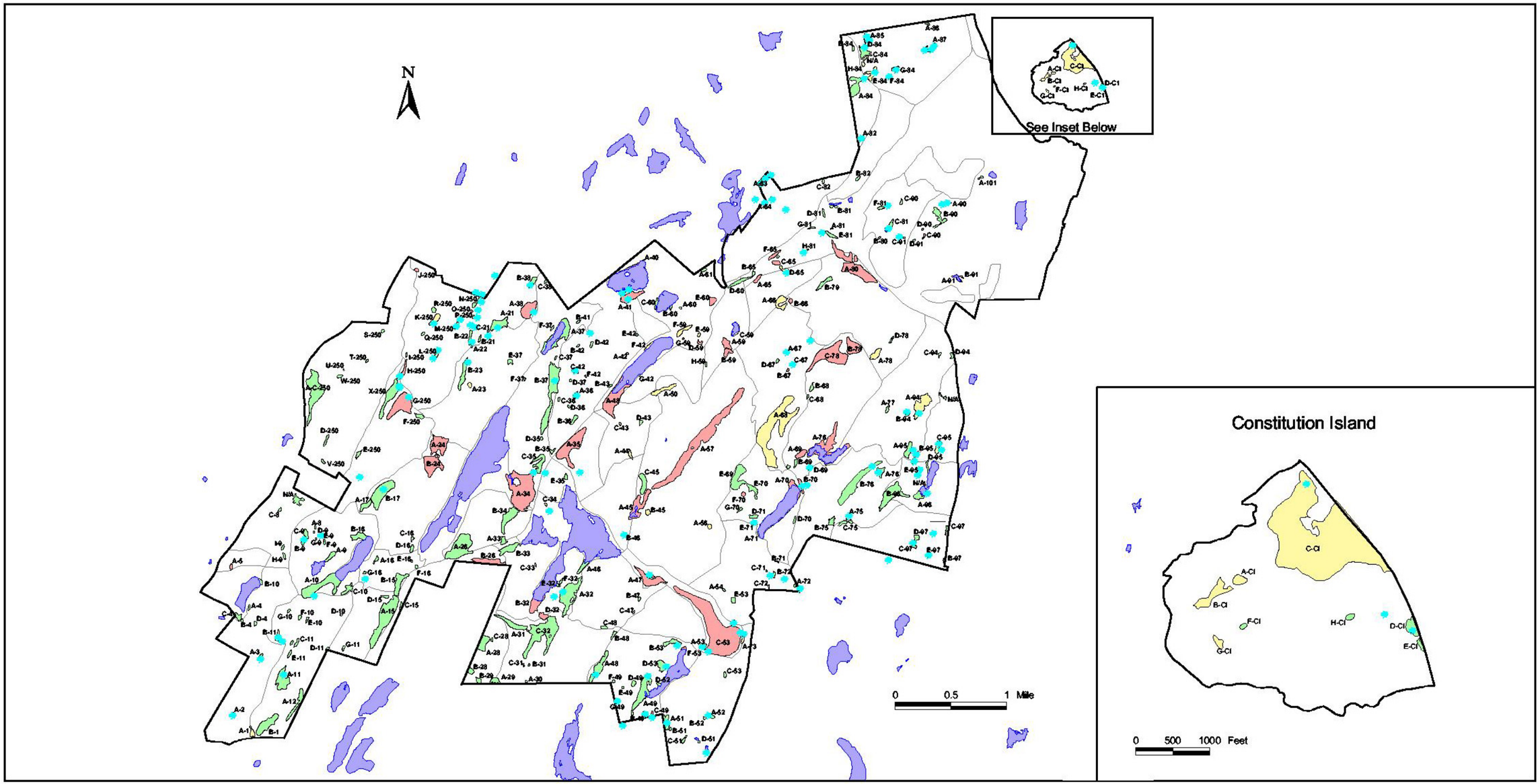
determinations conducted in accordance with the 1987 *Corps of Engineers Wetland Delineation Manual* and the approximation of wetland boundaries and USFWS classification based on field observations, mapped and characterized 146 distinct wetlands on USMA. Nine wetlands were delineated based on the 1987 Wetland Manual. The remaining wetland boundaries were approximated in the field by observing indicators of hydrology, noting breaks in vegetation from upland to transitional species, and performing spot soil examinations (Figure 3-4).

Predominant USFWS (Cowardin et al., 1992) class information, along with acreage was determined for each of the wetlands identified in the inventory (see Appendix F). For the study, the predominant wetland class was defined as the class, of all classes of more than 0.5 acres within a given wetland, that contained the greatest acreage. Based on the characterization, over two-thirds (108) of the wetlands identified on USMA are predominantly palustrine forested (PFO). Twenty-three of the wetlands identified on USMA are predominantly palustrine emergent (PEM), and 14 are palustrine scrub shrub (PSS). Five wetlands identified during the inventory were determined to consist of a mosaic of PEM and PSS (USACE, 1993).

Most of the wetlands on USMA are small with areas of less than 5 acres, and only a few of the wetlands on the installation exceed 15 acres. The largest wetland (WP-C53), located adjacent to Popolopen Brook, is 71.6 acres in size and consists of palustrine forested, scrub shrub, and emergent habitats (Appendix F) (USACE, 1993).

Overall, wetlands that occur on USMA consist of acreage of more than one USFWS class or cover type (see Appendix F). About one-fourth of the PFO wetlands characterized in the 1993 survey have areas that are PEM, PSS, or a combination of the cover types. Approximately one-half of the PEM wetlands contain PSS, PFO, or a combination of the habitat types. Four of the PSS wetlands contain emergent habitats, and one has a PFO area. The PSS habitat is the least represented wetland class on USMA (USACE, 1993).

Wetlands identified and characterized in the USACE inventory include those that are shown on the USFWS National Wetland Inventory Maps and the New York State Wetland Maps. There are 154 wetlands on USMA in addition to those which were contracted to be characterized in the USACE inventory. These wetlands have been identified and field-verified since the 1993 USACE inventory and are shown on Figure 3-4. For the most part, these areas include the smaller wetlands on USMA. There



LEGEND

- Palustrine Emergent Wetland
- Palustrine Forested Wetland
- Palustrine Shrub/Scrub Wetland
- Vernal Pool
- Training Area Boundary
- Lake

Note: Codes refer to wetland IDs; refer to text for description.

Wetlands and Vernal Pools

United States Military Academy
West Point, New York
Figure 3-4

are, however, several larger wetlands included in this group. The larger wetlands (WP-A57, WP-A68, WP-B78, WP-C78) are located primarily in and around the impact zone. These wetlands, in addition to those identified in the 1993 inventory, represent all of the wetlands currently known to occur on the reservation and Constitution Island. The wetland designator for the additional 154 wetlands, dominant USFWS wetland class, and a rough estimate of acreage, based on available map data, are provided in Appendix F.

Wetlands on West Point are often similar, both in vegetative makeup and habitat potential. The most common overstory species throughout the forested wetlands are red maple (*Acer rubrum*) and yellow birch (*Betula lutea*). Highbush blueberry (*Vaccinium corybosum*), lowbush blueberry (*Vaccinium angustifolium*), sweet pepperbush (*Clethra alnifolia*), steeplebush (*Spirea tomentosa*), and meadowsweet (*Spirea alba*) are common understory species throughout the wetlands. Dominant species occurring in the wettest scrub shrub areas include meadowsweet. Occurring in the herbaceous layer are species of sedge (*Carex* sp.), rushes (*Juncus* sp.) and smartweed (*Polygonum* sp.). Several species of ferns including New York fern (*Thelypteris noveboracensis*), marsh fern (*Thelypteris palustris*), lady's fern (*Athyrium filix-femina*), and cinnamon fern (*Osmunda cinnamomea*) also occur in association with West Point's wetlands. A significant acreage of the emergent wetlands is also dominated by common reed (*Phragmites australis*) and narrow leaved cattail (*Typha angustifolia*) (USACE, 1993).

3.11 VERNAL POOLS

Vernal pools are temporary bodies of freshwater that provide vital habitat for many vertebrate and invertebrate wildlife species. Most vernal pools are filled by spring rains and snowmelt, and then dry up during the summer months. Many vernal pools, however, are filled by rainwater in the fall and may persist throughout the winter. Vernal pools may also exist as a result of seasonally high groundwater tables.

Because vernal pools are temporary bodies of water they do not support fish populations. Several species of wildlife, including some that have evolved breeding strategies that are intolerant of fish predation on their eggs and larvae, are totally dependent on vernal pools for their survival. In particular, certain species of mole salamanders (*Ambystoma* sp.) and the wood frog (*Rana sylvatica*) rely on vernal pools for

breeding. Many other species of amphibians use vernal pools for breeding and nonbreeding functions, although they are not restricted to the habitat. The many diverse types of invertebrates that inhabit vernal pools provide important food for various species of birds, mammals, reptiles, and amphibians. Areas in the immediate vicinity of vernal pools are also used by vernal pool species for important nonbreeding habitat functions such as feeding, shelter, and overwintering.

Vernal pools on USMA are identified based on criteria established in the Commonwealth of Massachusetts' *Guidelines for Certification of Vernal Pool Habitat* (Colburn, 1993). New York State does not currently have an established procedure for identifying vernal pools. As of November of 1996, 41 vernal pools had been identified and approximately located on West Point. Thirty-eight of the vernal pools were located on the reservation and occur within most of the training areas, and three of the vernal pools are located on Constitution Island just to the west of the Metro North railroad tracks.

In 1997 and 1998, Barbour (1998) conducted a comprehensive survey of vernal pools on the reservation using the criteria established by Massachusetts (Colburn, 1993) to classify the pools. The physiographic criteria for vernal pools are as follows:

- confinement of water basin from permanent waters, and
- at least two continuous months of water in basin, but with complete drying, typically from mid-summer to late fall.

Biological criteria that were applied include:

- lack of fish fauna (a result of the above physical characteristics),
- use of the basin by one or more species of obligate vernal pool fauna or at least two species of facultative vernal pool fauna, and
- at least six species from a list of vernal pool indicator plants.

Barbour assessed the vernal pools and put them into groups by applying a combination of the above criteria. These groups, A (strongest indicator) through E (weakest indicator), and the criteria of which they consist are as follows:

A. Isolated basin with two months of water, drying, no fish, and proof of breeding by any obligate amphibian species.
B. Isolated basin with fairy shrimp.
C. Two or more facultative faunal species.
D. Facultative invertebrates or six indicator plant species.
E. Meets the physical criteria plus the presence in the pool of any amphibian or reptile on the list.

The results of the 1997-1998 vernal pool survey are presented in Table 3-24 and Figure 3-4.

3.12 AQUATIC HABITAT

Aquatic habitats on USMA include 17 ponds and small lakes covering 565.7 acres, as well as 11 stream reaches (many of which are tributaries to the Hudson River) extending approximately 35 miles. Stilwell and Popolopen Lakes are the major lentic (standing water) habitats on USMA. Significant lotic (moving water) habitats onsite are Popolopen and Highland Brooks and, bordering USMA to the east, is the Hudson River.

Table 3-24
USMA Vernal Pools by Group

Group	Number of Vernal Pools
A	14
SA	5
B	15
SB	6
C	22
SC	4
D	33
SD	3
E	0
TOTAL	**99**

S = denotes swamp

Source: Barbour, 1998.

The differences between lakes and ponds are not always apparent. For simplification, lakes will be considered bodies of standing water that are too deep for rooted plants to grow, except around the shore. Although the temperature is relatively stable from day to day, lakes of this region exhibit vertical layering of temperature during the summer. DO levels are also relatively stable during a 24-hour period in a lake. Ponds, on the other hand, are generally smaller and shallower than lakes. Rooted plants often can grow completely across ponds. The temperature is fairly uniform with depth, while DO levels over a daily cycle can be quite variable (USMA, 1980b). Zooplankton and phytoplankton species are common in lakes and ponds and are important as a source of food for higher organisms.

Streams are composed of pools, riffles, and glides. Pools are deeper areas where the current is slow and sand, silt, and organic debris are deposited. Both emergent and submergent vegetation may grow in this zone. Submergents are rooted to the streambed and tend to bend and flow with the downstream current. The DO level may be lower in pools. The benthic invertebrates of pools can easily move about by swimming, crawling, or burrowing (USMA, 1980b).

In the riffles, organisms must adapt to relatively swift current. The benthic invertebrate species found in riffles attach or cling to rocks on the stream bottom to avoid being swept away. Filtering organisms predominate in riffles, where the current transports oxygenated water and food. Periphyton are the dominant floral species and consist primarily of diatoms, blue-green algae, green algae, and water moss. High faunal density and variety may be found in riffles as a function of increased DO levels and greater amounts of food. Streams in this region are probably rich in amphipods, decapods, gastropods, and mayfly, caddisfly, and stonefly nymphs. These species, along with oligochaetes and other molluscs, serve as a major food source for larger fish species such as trout, crappie, pickerel, sunfish, and catfish (USMA, 1980b).

Rapid bioassessment protocols (RBPs) for assessing the ecological integrity of macroinvertebrate communities were conducted on a number of streams on the USMA reservation during the summers of 1997, 1998 and 2000. The results of the RBPs are provided in Tables 3-25 through 3-27. It should be noted that there are no reference streams to which these data can be compared. Linck (1997) recommended that either Popolopen Brook or Mineral Springs Brook would likely serve as a suitable reference stream for evaluating other West Point streams.

Table 3-25
Rapid Bioassessment Protocol Data for Selected USMA Waterbodies – 1997

Station	Popolopen Brook		Highland Brook		Mineral Springs Brook	
	Upper	lower	upper	lower	upper	lower
Taxa Richness	6	10	12	16	15	11
FBI (modified)	2.70	2.39	2.47	3.26	2.28	2.48
Functional Feeding Groups						
Riffle Community: Scrapers/Filterers – Collectors	36/105 (0.34)	25/72 (0.35)	27/26 (1.04)	13/44 (0.30)	8/23 (0.35)	35/30 (1.17)
CPOM Community: Shredders/Total	Not done – insufficient CPOM present					
EPT/Chironomidae	71	51	29.3	18.3	4.3	0
% Contribution (dom. family)	43	43	25	17	39	25
EPT Index	4	4	5	7	6	6
Community Similarity Index	Not done					

Linck, 1998.

Table 3-26
Rapid Bioassessment Protocol Data for Selected USMA Waterbodies - 1998

Station	Cragston Creek		Johnson Meadow Brook	Stony Lonesome Brook	Trout Brook	Queensboro Brook	Long Pond Creek
	upper	lower					
Taxa Richness	12	9	8	10	16	11	15
FBI (modified)	2.73	3.27	4.61	2.78	2.61	2.56	3.70
Functional Feeding Groups							
Riffle Community: Scrapers/Filterers – Collectors	19/2 (9.5)	2/31 (0.06)	17/73 (0.23)	1/25 (0.04)	29/32 (0.90)	10/5 (2.0)	23/31 (0.74)
CPOM Community: Shredders/Total	Not done – insufficient CPOM present						
EPT/Chironomidae	32/0	23/0	87/9	75/6	51/1	14/1	68/0
% Contribution (dom. family)	0.35	0.42	0.60	0.29	0.20	0.14	0.28
EPT Index	7	3	2	4	8	4	7
Community Similarity Index	Not done						

Linck, 1999.

Table 3-27
Rapid Bioassessment Protocol Data for Selected USMA Waterbodies – 2001

Station	Cat Hollow Brook	Cranberry Brook	Deep Hollow Brook	Wilkins Hollow Brook
Taxa Richness	13	12	9	6
FBI (modified)	2.46	3.12	2.31	3.82
Functional Feeding Groups				
Riffle Community:	7/13	10/14	16/11	8/7
Scrapers/Filterers – Collectors	(0.54)	(0.71)	(1.45)	(1.14)
CPOM Community: Shredders/Total	Not done – insufficient CPOM present			
EPT/Chironomidae	0	0	12	0
% Contribution (dom. family)	29	28	42	28
EPT Index	7	8	4	4
Community Similarity Index	Not done			

Linck, 2001.

The fish species documented from USMA waters are presented in Appendix C. Fish are characterized by their aquatic thermal preferences (coldwater, coolwater or warmwater). Most streams at USMA are best characterized as either coolwater or coldwater. Most of the USMA lakes and ponds are warmwater while Bull Pond, Round Pond and Lusk Reservoir stratify and are characterized as two-story fisheries, having both sustained coldwater and warmwater fisheries. Popolopen Lake, Stilwell Lake, and Lake Frederick are stratified warmwater/coolwater fisheries.

NYSDEC has listed several areas on or adjacent to USMA as significant habitats. Three aquatic habitats of significance, described below, are Popolopen Brook and Constitution Marsh, the latter of which provides a number of wetland habitats that are considered significant and are listed as Hudson River significant tidal habitats (NYSDS and The Nature Conservancy, 1990).

- Popolopen Brook is the only tributary of the Hudson River listed by NYSDEC as significant habitat in the vicinity of USMA. The Popolopen Brook marsh is a boggy wet area that serves as a nesting area for snipe, woodcock, spotted sandpipers, the blue gray knatcatcher, some warblers, and bluebirds. Other warblers that nest in the area include yellow-rumped warblers, American redstarts, blue-winged warblers, golden-winged warblers, Brewsters warblers, chestnut-sided warblers, and black and white warblers. This area is also one of the better areas for birds in migration, as well as for nesting geese, black ducks, mallards, and wood ducks (NYSDEC, 1975). Although its confluence with the Hudson is not on military land, its source is on the Reservation.

The tributary is of minor importance to herrings (*Alosa spp*.), white perch (*Morone americana*), and various freshwater species.

- Constitution Marsh, located east of Constitution Island, has been designated by NYSDEC as a Significant Coastal Fish and Wildlife Habitat and is described as a moderately diverse habitat of good quality that has experienced extensive disturbance (NYSDS and The Nature Conservancy, 1990). The large marsh area, which is cut by a grid of water channels is owned primarily by New York State and managed by the National Audubon Society as a wildlife sanctuary. Constitution Marsh serves as a nesting area for the least bittern (NYS Species of Special Concern) as well as a variety of other birds including the green-backed heron, various waterfowl, and passerine birds; a stopover point for migratory ospreys; and an important feeding grounds for herons, and other wetland and shore birds (NYSDS and The Nature Conservancy, 1990). The marsh also is a significant spawning and feeding grounds for anadromous and resident fishes including alewife (*Alosa pseudoharengus*), white perch, and striped bass (*Morone saxatilis*).

- The area between miles 44 to 56 on the Hudson River is the major spawning area for striped bass and white perch (an estimated 50 percent of Northeast Atlantic striped bass stocks come from the Hudson) (NYSDEC, 1990). The area has been designated by the NYSDEC as a Significant Coastal Fish and Wildlife Habitat, and is also specially recognized by the New York Natural Heritage Program for its importance. Characterized by higher water flows than occur upriver (based on local tributary freshwater inflow), strong currents and a rocky bottom, this area serves as a narrow migration corridor for all anadromous fish spawning upriver, including Atlantic sturgeon (*Acipenser oxyrhynchus*), American shad (*Alosa sapidissima*), and alewife (NYSDS and The Nature Conservancy, 1990). During periods of low flow and saltwater intrusion, bluefish (*Pomatomus saltatrix*), bay anchovy (*Anchoa mitchilli*), silversides (*Menidia spp*.), hogchoker (*Trinectes maculatus*) and blue crabs (*Callinectes sapidus*) are abundant in the deep-water zones. This stretch of the Hudson River is also considered "essential fish habitat" for bluefish under the Magnuson-Stevens Act of 1996.

3.13 RIPARIAN HABITAT

Riparian areas are critical at USMA due to the large number of surface water bodies on the installation. Most of the water bodies at USMA are surrounded by forested areas and are generally well buffered. These riparian areas are considered to be in good condition due to the generally low impact activities associated with them.

Riparian areas are equally beneficial to lentic and lotic water bodies. The essential component of these riparian areas is vegetation. Riparian areas typically have high levels of species productivity and greater species diversity than upland sites. Broader riparian zones have greater species diversity than narrow, steep-sided riparian areas.

The diversity of species is critical in providing protection from extreme changes in environmental conditions such as those created by floods or forest fires. Rich riparian diversity is partially due to the presence of many species adapted to two adjacent habitat types; this is known as the "edge effect." (See Section 5.5.4.1 for a more detailed description of the "edge effect.")

Riparian habitats provide water and food requirements for many wildlife species. Riparian areas provide habitat for many wildlife species (e.g., amphibians, beaver, muskrat, waterfowl) for breeding and rearing young, as well as providing areas for escape, hiding, and resting cover. Riparian areas also form natural travel corridors for wildlife species.

Vegetation in the riparian area also protects the water quality by reducing sediment, nutrient, and contaminant loading from activities occurring in the surrounding watershed. Overland water flow approaching surface water bodies from the surrounding watershed is intercepted and filtered by riparian vegetation before it enters the water body. Pollutant and sediment transported may be partially removed as a result of a combination of processes including reduction in flow pattern and transport capacity, settling and deposition of particulates, and eventually nutrient uptake by plants. In addition, the vegetation provides stream bank/shoreline stabilization to the water body. The roots of the riparian vegetation anchor shoreline sediments and protect the shoreline from the erosive forces of water movement (USEPA, 1993).

For lotic stream systems, riparian areas serve several additional functions. The riparian areas act as a temperature regulator by shading the water surface and maintaining necessary temperatures for cold-water aquatic species.

The riparian areas also supply large organic debris (LOD) to the stream system, which influence the instream channel structure, such as the occurrence of pools and riffles. As a result of this pattern of pools and falls, streams with LOD typically have less erosion, slower routing of organic detritus (the main food source for aquatic invertebrates), and greater habitat diversity than straight, even-gradient streams. LOD also provides habitat cover for aquatic species and characteristics ideally suited for fish spawning.

Riparian areas provide valuable flood control during storms. The vegetated riparian area attenuates flood waters and reduces the erosive nature of the water before reaching upland areas. Most riparian areas provide flood conveyance, conveying floodwaters from upstream to downstream areas. Some riparian areas may store water during floods and slowly release it to downstream areas, lowering flood peaks (USEPA, 1993).

3.14 TERRESTRIAL ECOSYSTEMS

The terrestrial ecosystems of USMA lie within a variety of ecological classifications. Based on a classification system developed for the state of New York, USMA is located within an area of the Hudson Valley known as the Hudson Highlands, an ecozone consisting of Appalachian ridges and valleys that is in the New England Upland physiographic province (Reschke, 1990). The Hudson Highlands ecozone is bordered to the northeast by the Taconic Highlands ecozone, to the southwest by the Triassic Lowlands ecozone, and to the southeast by the Manhattan Hills ecozone.

Based on Bailey's (1994) ecoregional classification, USMA lies within the Hudson Valley section of the Eastern Broadleaf Forest (Oceanic) ecoregional province. According to a description of this ecoregional province by McNab and Avers (1994), the largely undeveloped and forested Hudson Highlands are characterized by Küchler vegetation types of northern hardwood and Appalachian oak forests, and regionally by central hardwoods, transition hardwoods, and northern hardwoods.

Braun (1950) classified the deciduous forest formations of the eastern US by region and section. Using Braun's classification, the Hudson Highlands fall within the glaciated section of the Oak-Chestnut Forest region known as the sprout hardwoods (Braun, 1950). The sprout hardwood forests are prevailingly secondary communities comprised of even-aged stands of oak-hickory, mixed mesophytic, and hemlock-hardwood forest associations that are able to survive the edaphic extremes that make this area unsuitable for farming (Braun, 1950; McNab and Avers, 1994). The white oak-hickory association is "characteristically restricted to the northeast sides of the crowns of the hills, and to fine soils which are relatively stable" (Raup, 1938 - as cited in Braun, 1950). A number of variants are seen in the mixed mesophytic forest communities, with beech being one of the more abundant species, and hemlock present in some, and absent in others. The mesophytic communities of mixed hardwood, hemlock-mixed hardwood, and beech-maple that occur in the ravines and lower north slopes have been described as "cove forests" (Raup, 1938 - as cited in Braun, 1950). The beech-sugar maple community is a beechsugar maple-yellow birch community allied to northern forests, whereas the mixed hardwood and hemlockhardwood are comparable to Bromley's mixed mesophytic type (Braun, 1950).

Eyre (1980) developed a descriptive classification of forestland based on present occupancy of an area by tree species. The criteria for recognizing a cover type included that the dominant cover must be of trees (i.e., tree crowns should cover at least 25 percent of the area), the type must occupy a fairly large area in the aggregate, but not necessarily in continuous stands, and recognition of a forest cover type must be based entirely on biological considerations. According to Eyre's classification, USMA lies within the major forest type known as oak-hickory (Eyre, 1980).

Regionally, the Highlands have been recognized as important terrestrial wildlife habitat. Hundreds of species of flora and 32 vertebrate species listed by New York as endangered, threatened or special concern are found in the Highlands. Ten of the plant species also have some kind of federal status. Over 140 species of birds are known to nest in the region and approximately 95 neotropical migrants pass through each year. For the almost 75 species of neotropical migrants that nest in the Highlands, such as the red-eyed vireo (*Vireo olivaceus*), American redstart (*Setophaga ruticilla*), Canada warbler (*Wilsonia canadensis*), and eastern wood-peewee (*Contopus virens*), the large tracts of forest provide interior habitat necessary for reproductive success and long-term survival of the species. Open space in the Highlands provides feeding and migratory corridors to large mammals with extensive range requirements.

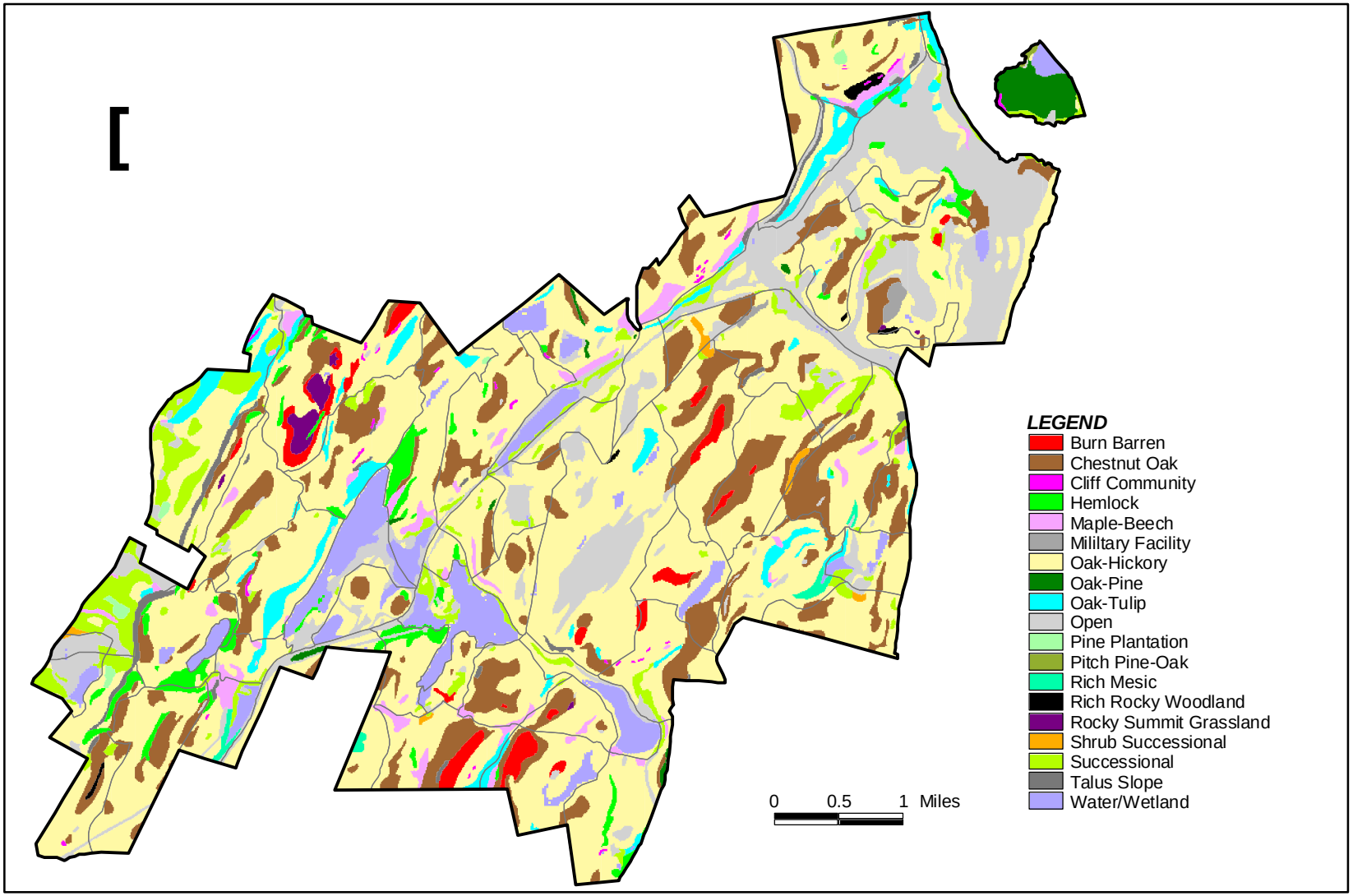
In 1993-1994, the USMA NRB conducted a communities inventory of the USMA main reservation using methods and community categories from the New York Natural Heritage Program's (NYNHP) *Ecological Communities of New York State* (Reschke, 1990). Wetlands were not described in this particular inventory, though USMA wetlands have been mapped (see Section 3.10). The inventory was updated in 1995 by field-checking terrestrial communities previously described (Barbour, 1995a; Kakerbeck, 1995).

The West Point landscape has been described as elevated, rugged terrain with deep ravines and predominately glacial, acidic soils (till). Most of this landscape is forested, but many crests have few trees and support only woodlands, savannas, or grasslands. A few broad crests have extensive unvegetated granitic bedrock exposure with vascular plants growing only in cracks or pockets of shallow soil. Oaks are the most common trees throughout the reservation reflecting the rocky and well-drained qualities of the soil. There are a few areas of sugar maple-dominated forests. Crests and ridges are very dry and burn frequently from human-caused fires, generally associated with military training activities.

The reservation is classified into 28 terrestrial community types. Because the terrestrial system encompasses all upland habitats, these communities have been subdivided into open uplands, barrens and woodlands, forested uplands, and cultural categories. Ecological descriptions of each community, provided below, were taken from Kakerbeck's 1995 *Ecological Communities of the West Point Military Reservation* and NYNHP's *Ecological Communities of New York State* (Reschke, 1990). A map of these terrestrial communities are provided as Figure 3-5, though some of the classifications (e.g., successional and cultural communities) have been grouped together for improved visual display.

3.14.1 Open Uplands

This subsystem includes upland communities with less than 25 percent canopy cover of trees; dominant species include shrubs, herbs, or cryptogammic plants (e.g., mosses, lichens). Three distinct physiognomic types are included in this category—grasslands, meadows, and shrublands. Grasslands include communities dominated by grasses and sedges; they may include scattered shrubs (never more than 50 percent cover) and scattered trees (usually fewer than one tree per acre). Meadows include communities with codominant forbs, grasses, sedges (*Carex* spp.), and shrubs and may include scattered



LEGEND

- Installation Boundary
- Training Area Boundary

Natural Heritage Communities

United States Military Academy
West Point, New York

Figure 3-5

trees. Shrublands include communities dominated by shrubs (more than 50 percent cover) and may contain scattered trees.

Rocky Summit Grassland. This grassland community occurs on the many ridges and rocky summits that characterize much of the USMA reservation. Though craggy, the hilltops are generally forested, but periodic brush fires have opened up a few of the drier summits. Grassland species predominate, with characteristic species including little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), broomsedge (*A. virginicus*), poverty-grass (*Danthonia spicata*), and Indian grass (*Sorghastrum nutans*). Scattered patches of lowbush blueberry (*Vaccinium angustifolium*), scrub oak (*Quercus ilicifolia*), and shadbush (*Amelanchier stolonifera*) are also present here.

The redoubts on West Point are artificially maintained in this community type with periodic brush clearing. The recurrence of brush fires, often caused by training activities, also seems to slow the natural succession toward a forested state in some areas of the reservation. Following a fire event, vegetation usually recovers rapidly, with pink corydalis (*Corydalis sempervirens*) and fireweed (*Epilobium agustifolium*). These areas may revert to the original graminoids and black huckleberry (*Gaylussacia baccata*) or thick stands of aspen (*Populus tremuloides or P. grandidentata*) saplings.

Cliff Community. The cliff community occurs on vertical exposures of resistant, noncalcareous bedrock or consolidated material. Ledges and rounded cliffs are common in the Highlands, but occur mostly as small outcroppings under one acre in size. There is minimal soil development, and vascular plants are usually limited to cracks and small soil pockets. Characteristic species include rock polypody (*Polypodium virginianum*), common hairgrass (*Deschampsia flexuosa*), black chokeberry (*Aronia melanocarpa*), mountain laurel (*Kalmia latifolia*), and sometimes hemlock (*Tsuga canadensis*).

Successional Fern Meadow. This type of meadow is dominated by ferns and occurs on sites that have been cleared or otherwise disturbed. Small patches of fern meadow are common where a logged or windthrown tree creates a forest opening. Characteristic ferns that may be dominant include New York fern (*Thelypteris noveboracensis*) and hay-scented fern (*Dennstaedtia punctilobula*); blueberries (*Vaccinium* sp.) are common associates. This community is relatively short-lived, as it gradually succeeds to a blueberry heath or forest community.

Successional Blueberry Heath. This shrubland is dominated by ericaceous shrubs that occur on sites with acidic (or circumneutral) soils that have been cleared or otherwise disturbed. These dense thickets are found on old burns and logging glades. Once widespread over the reservation, this short-lived community has been largely replaced by secondary growth forest. The heath cover is now more sparse, but remnants survive in the shade of oaks and hickory and have become part of the forest community. Characteristic species include lowbush blueberry, sourtop blueberry (*Vaccinium myrtilloides*), deerberry (*V. stamineum*), black huckleberry, wintergreen (*Gaultheria procumbens*), poverty-grass, and oak seedlings (*Quercus* sp.).

Successional Old Field. This community is described by NYNHP as a meadow dominated by forbs and grasses that occurs on sites that have been cleared or plowed and then abandoned. While many of the old field communities have succeeded to secondary forest, several small fields still exist on the reservation. Some of this area is maintained for military training. Characteristic herbs include goldenrods (*Solidago* sp.), bluegrasses (*Poa* sp.), smooth brome (*Bromus inermis*), common chickweed (*Cerastium arvense*), New England aster (*Aster novae-angliae*), and hawkweeds (*Hieracium* sp.). Shrubs may be present, but collectively they have less than 50 percent cover in this community.

Successional Shrubland. This community is described as a shrubland that occurs on cleared or otherwise disturbed sites and has since developed at least a 50 percent cover of shrubs. Species found here include gray dogwood (*Cornus foemina* ssp. *racemosa*), multiflora rose (*Rosa multiflora*), raspberry (*Rubus* sp.), hawthorn (*Crateagus* sp.), sumac (*Rhus* sp.), and Japanese barberry (*Berberis thunbergii*).

3.14.2 Barrens and Woodlands

This subsystem contains communities that are structurally intermediate between forests and open canopy uplands. Physiognomic types included in this division are savannas and woodlands. Savannas are communities with a sparse canopy of trees (25 to 60 percent cover) and a ground layer that is predominantly grassy or shrubby (referred to respectively as grass savanna and shrub savanna). Woodlands include communities with a canopy of stunted or dwarf trees (less than 16 feet) and wooded communities occurring on shallow soils over bedrock with numerous rock outcrops. The term “barrens” is commonly applied to both savannas and woodlands.

Burn Barrens (Oak-Hickory Ridgetop Savanna). This community can occur as a grass and/or shrub savanna with variably scattered oaks and hickory. Small areas of these burn barrens have developed on West Point along some dry ridgetops and have likely been maintained by decades of periodic brush fires. The soil layer is typically thin and dry, with leaf litter often burned off. The vegetation is variable. Grasses can be interspersed with lichen and moss-encrusted rock outcroppings; the shrub layer, if present, is usually sparse with patches of raspberry, huckleberry, and/or blueberry. Sapling black birch (*Betula lenta*), black cherry (*Prunus serotina*), aspen, or the occasional shadbush may also be found.

Talus Slope Woodland. This community varies from an open to closed canopy woodland that occurs on talus slopes composed of noncalcareous bedrock. At West Point, talus can vary in size from cobbles to boulders and is derived from generally acidic parent materials—granite, quartzite, or schist. Small patches of this community are scattered down the many escarpments of the reservation. Characteristic trees include sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), basswood (*Tilia americana*), hop hornbeam (*Ostrya virginiana*), chestnut oak (*Quercus muehlenbergii*), red oak (*Q. rubra*), and white oak (*Q. alba*). Striped maple (*Acer pensylvanicum*) is a common subcanopy tree. Characteristic ground layer species include Christmas fern (*Polystichum acrostichoides*), rock polypody, Virginia creeper (*Parthenocissus vitacea*), bloodroot (*Sanguinaria canadensis*), and baneberry (*Actaea* sp.).

Pitch Pine-Oak-Heath Rocky Summit. This community occurs on warm, dry, rocky ridgetops and summits where the bedrock is noncalcareous and the soils are more or less acidic. The vegetation may be sparse or patchy, with numerous rock outcrops. On West Point, one such sizable tract exists atop Crow's Nest Mountain.

Characteristic species include pitch pine (*Pinus rigida*), chestnut oak, scrub oak, blueberry, black huckleberry, sweet-fern (*Comptonia peregrina*), Pennsylvania sedge (*Carex pensylvanica*), poverty grass, and hair grass. Characteristic lichens include *Cetraria arenaria* and *Cladonia* sp.

Rich Rocky Woodland. This woodland occurs on shallow soils on hard rocks and usually includes numerous rock outcrops. A sparse (25% to 60%) stunted cover of white ash, pignut hickory (*Carya glabra*), black cherry, and hop hornbeam occurring with a well-developed understory is characteristic. Typical herbaceous species include cress (*Barbarea* sp.) and dwarf dandelion (*Krigia virginica*), but at

West Point the ground cover is mostly common wood sedge (*Carex albicans var. albicans*). Rare plants found here include yellow harlequin (*Corydalis flavula*), dittany (*Cunila origanoides*), violet bush-clover (*Lespedeza violacea*), and slender knotweed (*Polygonum tenue*).

3.14.3 Forested Uplands

Forested uplands include communities containing more than 60 percent canopy cover. These communities occur on substrates with less than 50 percent rock outcrop or shallow soil over bedrock.

Appalachian Oak-Hickory Forest. This hardwood forest occurs in various forms on a wide range of sites and conditions, three of which exist on West Point. First, it is found on well-drained bottomlands, benches, or coves and often gives rise to high quality stands of northern red oak (*Quercus rubra* var. *borealis*) and black oak (*Q. veluntia*). There is typically a subcanopy stratum of small trees and tall shrubs, including flowering dogwood (*Cornus florida*), witch hazel (*Hamamelis virginiana*), shadbush, and choke cherry (*Prunus virginiana*). Hickory (*Carya* sp.), the other signature species of this community, is rarely abundant, and sometimes absent, but contributes to the mast crop.

Another form of this forest common to the reservation is even-aged stands that have developed on cleared, burned, or otherwise disturbed land. Cleared within the last 60 years, young stands of regenerational oak are now widespread. Scarlet (*Quercus coccinea*) and/or black oak are usually dominant with little or no hickory. Red oak, white oak (*Q. alba*), chestnut oak, and red maple (*Acer rubrum*) are common associates; the ground cover typically consists of black huckleberry, sweetfern (*Comptonia peregrina*), wintergreen, and the sedge *Carex albicans var. albicans*.

A stunted, sparse version of the oak-hickory forest is typical of dry, upper slopes and rocky ridgetops. The relatively open character of the forest is probably maintained by its location in nutrient-depleted sites and the occasional brush fire. Pignut hickory is common here, and a mix of black oak, white oak, chestnut oak, and northern red oak compete for dominance. Huckleberry and *Carex albicans var. albicans* compose the usual ground cover, though ebony spleenwort (*Asplenium platyneuron*), prickly pear cactus (*Opuntia humifusa*), and polypody ferns (*Polypodium* sp.) also occur.

Chestnut Oak Forest. This locally common hardwood forest occurs on dry ridgetops and slopes in glaciated portions of the Appalachians. It thrives on the well-drained, thin soil of the poorest quality sites and is characterized by a few canopy dominants and minimal diversity in the understory. Dominant trees are typically chestnut oak (*Quercus montana*) and red oak (*Q. rubra*). Common associates are white oak (*Q. alba*), black oak (*Q. velutina*), and red maple (*Acer rubrum*). American chestnut (*Castanea dentata*) was a common associate in these forests prior to the chestnut blight, though chestnut sprouts are still found in some stands. Common sub and ground layer plants are huckleberry, mountain laurel, blueberry, *Carex albicans var. albicans*, wintergreen (*Gaultheria procumbens*), and cushions of the moss *Leucobryum glaucum.*

Oak-Tuliptree Forest. This mesophytic hardwood forest occurs on moist, well-drained sites in southeastern New York. The dominant trees include a mixture of five or more of the following: red oak, tulip tree (*Liriodendron tulipifera*), beech (*Fagus grandifolia*), black birch (*Betula lenta*), red maple, scarlet oak, black oak, and white oak. There is typically a subcanopy stratum of small trees and tall shrubs, and the shrub layer and ground layer flora may be diverse. Characteristic ground layer herbs are white wood aster (*Aster divaricatus*), New York fern (*Thelypteris noveboracensis*), wild geranium (*Geranium maculatum*), Solomon's-seal (*Polygonatum biflorum*), and Jack-in-the-pulpit (*Arisema triphyllum*). This community commonly intergrades with beech-maple mesic and oak-hickory forests.

Appalachian Oak-Pine Forest. Uncommon on the reservation and found somewhat on Constitution Island, this mixed forest occurs on sandy soils, in sandy ravines in pine barrens, or on slopes with rocky soils that are well drained. The canopy is dominated by a mixture of oaks (black, chestnut, red, white, and scarlet) and pines (white (*Pinus strobus*) or pitch (*P. rigida*)). Red maple, hemlock, and beech are common associates occurring at low densities. The shrub layer is predominately ericaceous, usually with blueberries and black huckleberry. The ground layer is relatively sparse, and species diversity is low.

Beech-Maple Mesic Forest. This community type is described by NYNHP as a hardwood forest with sugar maple (*Acer saccharum*) and beech codominant. In the Hudson Highlands, local variants, described below, occur with little beech.

- Small stands composed almost entirely of maple can be found on lower, well-drained, often rocky slopes such as the Route 293 escarpment north of Long Pond. Trees are tall and cast a dense shade. A sparse understory of witch hazel, Christmas fern, and spring ephemerals may be found.

- Sugar maple can occur in association with white ash and red maple in rich bottomland or on steeper talus slopes with chestnut oak.

- Various admixtures occur where this forest type intergrades with the oak-tuliptree or rich mesophytic forest, such as is found at the north end of Bull Pond. This community type usually supports a high diversity of species.

- Areas where oak was harvested and residual sugar maple, beech, and ash was left to become dominant are now also considered maple mesic forest.

Hemlock-Northern Hardwood Forest. This mixed forest typically occurs on middle to lower slopes of ravines; on cool, mid-elevation slopes; and on moist, well-drained sites at the margins of swamps. On West Point, it occurs on some of the northerly slopes and ravines of the reservation. In any one stand, hemlock is codominant with any one to three of the following: beech, sugar maple, red maple, chestnut oak, white pine, yellow birch (*Betula lutea*), black birch, red oak, and basswood. Striped maple is often predominant as a mid-story tree. Characteristic ground layer plants include partridgeberry (*Mitchella repens*), Leucobryum moss, and Christmas fern.

Maple-Basswood Rich Mesic Forest. This hardwood forest type typically is found on middle to lower elevation, concave slopes with north or east aspects (but not in ravines). On West Point, a narrow band of this community occurs along the base of an escarpment near Proctoria. Rich, moist soils support a mix of basswood, ash, hickory, black birch, and sugar maple. Witch hazel shades a rich herbaceous layer of Virginia creeper, bloodroot, white baneberry (*Actaea pachypoda*), troutlily (*Erythronium* sp.), Christmas fern, and mosses.

Successional Hardwoods. This community is a loosely defined hardwood type that can be a composite of both northern and southern successional species and can vary in growth stages from saplings to mature

trees. On West Point it is found on some reservation old fields and disturbed lands such as construction sites and burns.

Drainage, soil, slope, and aspect determine the dominant tree species, which can be any of the following: aspen, black birch, gray birch (*Betula populifolia*), cottonwood (*Populus deltoides*), sassafras (*Sassafras*), red maple, hawthorn (*Crataegus* sp.), and black cherry. Multiflora rose (*Rosa multiflora*), Japanese barberry, grape (*Vitis* sp.), greenbriar (*Smilax* sp.), and poison ivy (*Rhus radicans*) are sometimes present in the understory, especially in young stands.

Pitch Pine-Oak Forest. The pitch pine-oak forest typically occurs on well-drained, sandy soils of glacial outwash plains or moraines; it also occurs on thin, rocky soils of ridgetops. On West Point, it is found on a remote 4-acre tract atop the Crow's Nest Mountain dud danger zone. The ridgetop soil supports a sparse, stunted canopy of scarlet oak and white oak and a sublayer of huckleberry and blueberry. With heavy leaf litter, the forest floor is bare but for the occasional moss, poverty grass, and wintergreen. This community type also occurs along the north and west shores of Constitution Island. Chestnut oak largely replaces the scarlet and white oaks.

Rich Mesophytic Forest. This highly diverse hardwood or mixed forest occurs on rich, moist, well-drained soils. On West Point, it occurs in a few of the rich bottomland sites. The forest canopy is characterized by the codominance of five or more of the following trees: red oak, beech, sugar maple, yellow poplar and white oak. This community has a well-developed shrub layer with a variety of characteristic species including striped maple, witch hazel, shadbush, and blueberry. Characteristic herbs in the ground layer include interrupted fern (*Osmunda claytoniana*), partridgeberry, violets (*Viola* sp.), snakeroot (*Polygala senega*), wild leek (*Allium tricoccum*), asters (*Aster* sp.), and goldenrods (*Solidago* sp.).

3.14.4 Cultural

This classification includes ecological communities that have been created by anthropogenic forces.

Mowed Lawn. This community type consists of land that is actively maintained in short grass by periodic mowing. The ground may be have been excavated and filled during the creation of golf courses or athletic fields.

Paved Roads and Highways. Sixteen miles of main road traverse the reservation. Pavement is typically composed of asphalt or concrete, with small cracks yielding to some vegetation. Roadways can be ecological barriers that separate adjacent community types, possibly resulting in fragmentation effects.

Mowed Roadside. This community, dominated by grasses, is maintained by periodic mowing.

Military Facility. The built-up areas of Camp Buckner, Camp Natural Bridge, and the main post constitute this community type. Vegetation is both natural and planted, but the main features, such as buildings, roads, sidewalks, and parking lots, have been constructed.

Pine Plantation. These plantations are monocultures with more than 90 percent of the canopy consisting of white pine and interspersed with an occasional deciduous species. There are a few stands of planted white or red pine on West Point, two of these located near the old Proctoria estate. Ground layer vegetation is usually sparse, apparently due to the lack of sunlight reaching the pine stand floor and the dense accumulation of leaf litter. Speedwell (*Veronica officinalis*) is a characteristic ground layer plant.

Brushy Cleared Land. Woodland glades are a sporadic feature of the reservation landscape. These openings result from small clearcuts within selectively logged areas and are typically about one acre in size. Recently cleared areas contain patchy vegetation, along with slash and other woody debris. Grasses, forbs, ferns, and tree suckers flourish after a year, with shrubs, brambles, and saplings appearing after about a decade of the clearing.

Another form of brushy cleared land occurs along powerline rights-of-way, which are periodically cut and cleared. They can consist of miles-long tracts, with only a narrow width (30 to 100 feet), that serve to fragment previously contiguous forest.

Training Range. The community type found on Training Ranges 3, 4, and 5 has developed from periodic munitions target practice and occasional brushfires. These disturbances have limited vegetation to a weedy mix of legumes, forbs, and grasses, with sporatic low shrubs. Impacts from munitions have also caused the exposure of bare, stony soil patches.

Sand or Gravel Mine. Old excavations exist on the Leone Tract and at the Sweeney Borrow Pit on Mine Torne Road. The poor sandy or gravelly substrate is slow to develop vegetation, though a weedy mix of legumes, grasses, and early successional shrubs and trees is found in these areas.

Ordnance-Impacted Land. This land type is caused by unique circumstances on military installations (decades of periodic artillery bombardment and associated fires from the munitions) and is not found in the NYNHP classification. The ordnance-impacted tract at West Point, known as the Impact Area, encompasses approximately 190 acres along the west flank of Cranberry Mountain. The ground is largely bare with bedrock outcroppings, and the dry soil is subject to continuing wind and water erosion. This "community" type harbors scant vegetation including upland grasses, forbs, and shrubs, with an occasional tree persisting along the Impact Area perimeter.

3.15 FLORA

In 1992-1993, the State Botanist's Office of the New York State Museum conducted a floristic inventory of USMA (Mitchell and Tucker, 1993). The survey recorded 520 vascular plant species new to the installation (representing 94 families and 277 genera of ferns, horsetails, trees, shrubs, and flowering herbs), nearly doubling the previously recorded flora of the area (570 species). While most of the plants found were those expected in the Hudson Highlands, there were a few exceptions of species outside their recorded ranges (e.g., *Woodwardia areolata*, *Betula cordifolia*). Results of the survey indicate that the botanical diversity at West Point is well within the range or higher than that of nearby areas such as Bear Mountain/Harriman State Park.

Mr. Gordon Tucker also compiled a list of 114 bryophyte species and 5 species of lichen collected by himself and associates incidental to the 1992-1993 survey of vascular plants on the Reservation. In addition, Mr. Joseph T. Bridges of Matthew D. Rudikoff Associates (Poughkeepsie, New York) looked

specifically for liverworts in a brief 1993 search of likely habitats and found 15 species, 10 of which had not been reported by Mr. Tucker.

An additional 29 plant species, 11 of which have special status of concern, have been discovered since 1993 through formal rare plant investigations or through ongoing activities of Natural Resources personnel. A complete listing of the vascular plants on West Point is provided in Appendix G. The list of vascular plants is followed by the list of bryophytes and lichens compiled by Gordon Tucker and Joseph Bridges. More detailed information from these surveys is on file in the USMA NRB office.

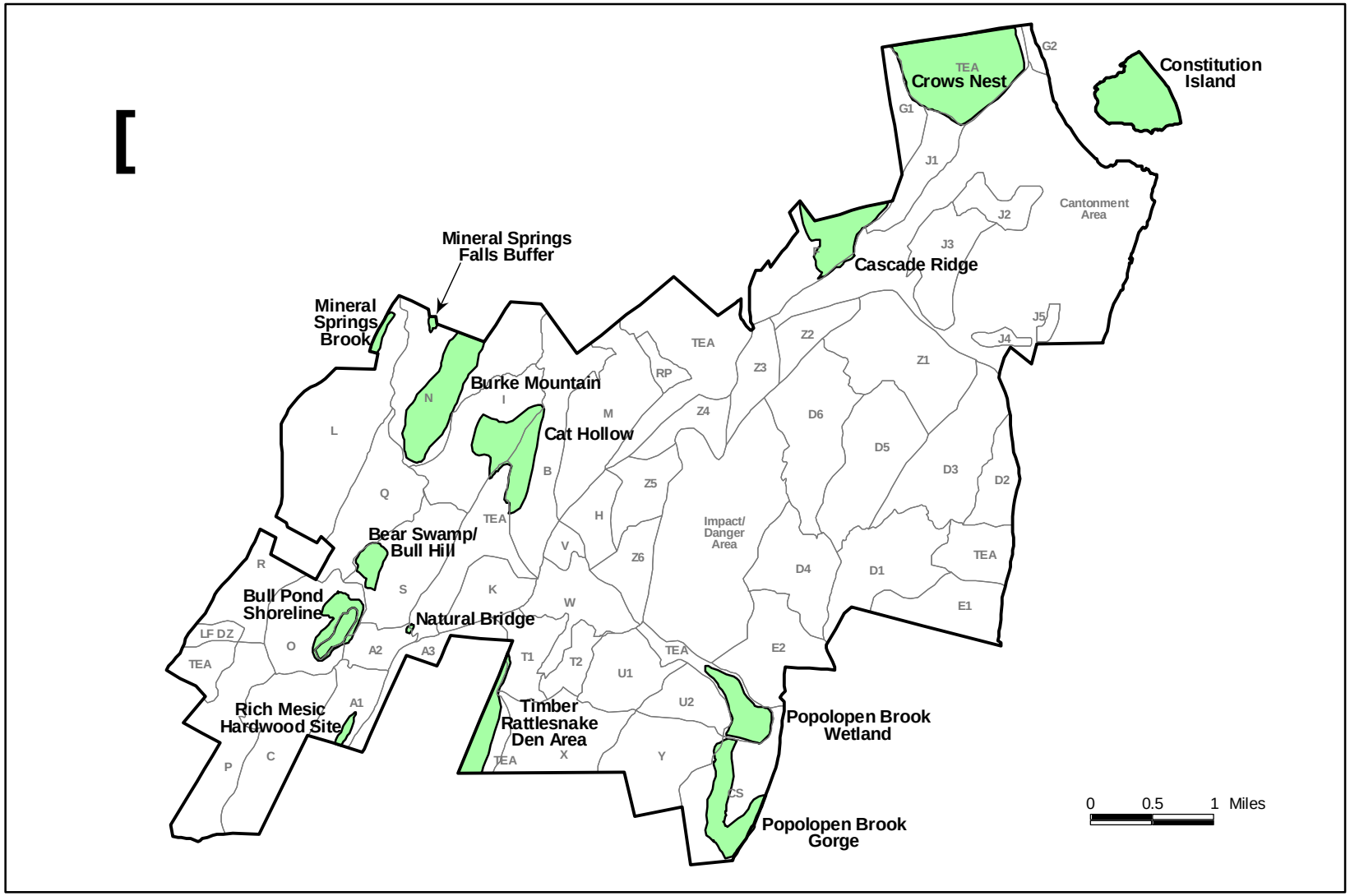
3.16 SPECIAL NATURAL AREAS

USMA has identified 12 sites that are to be specially managed because of their ecological or geological significance, unique geological structure, and/or aesthetic and educational value to the installation (Figure 3-6). With the designation of special natural area, USMA intends for the areas to remain as parts of training areas, if currently designated as such, but to make additional efforts to minimize impacts occurring as a result of training and other activities. Areas are listed below in approximate order of priority, and an ecological characterization is provided for those sites that have been inventoried.

3.16.1 Constitution Island

Constitution Island is the highest (maximum elevation 140 feet) and largest (177 acres) of the Hudson River's rocky islands. It is located on the east side of the Hudson River directly opposite West Point and is separated from the east shore by a large tidal marsh area. During the Revolutionary War, the island was occupied by American colonists who were fighting for emancipation from British rule. To establish defense against the British, fortifications were constructed on the island in 1775, and then again in 1778. Remains of these fortifications are still present.

Constitution Island supports a largely undisturbed matrix of forest, grassland, and wetlands (Barbour, 1995c). Forests cover most of the island. Crests support chestnut-oak forest, oak-pine woodland, or oak-heath rocky summit savanna; hollows support hemlock-hardwoods (mostly oaks); and lowlands support



LEGEND

- Special Natural Area
- Training Area

Special Natural Areas

United States Military Academy
West Point, New York
Figure 3-6

red maple swamp. Nonforest communities include patches of rocky summit grassland, steep riverfront cliffs, rocky intertidal shores, and areas frequently mowed or cleared of tall woody plants (Barbour, 1995c). A 1993 wetland inventory conducted on all USMA properties identified eight wetland habitats on the island. The breakdown of wetland acreage by USFWS classification is provided in Appendix F. Figure 3-4 shows wetland locations. Contributing to its regional value, Constitution Island provides habitat for a number of sensitive fauna and flora species. The federally-threatened bald eagle is a frequent winter visitor, and sightings have been made of least bitterns (state threatened), small-footed bat (state special concern), ospreys (state special concern), and spotted turtles (state special concern). Rare and unusual plants found on the island include prickly pear cactus (*Opuntia sp.*), cluster sedge (*Carex cumulata*), weak stellate sedge (*Carex seorsa*), pigmyweed (*Crassula (Tillaea) aquatica*), slender crabgrass (*Digitaria filiformis*), yellow harlequin (*Corydalis flavula*), small-flowered crowfoot (*Ranunculus micranthus*), violet wood-sorrel (*Oxalis violacea*), gypsywort (*Lycopus rubellus*), two-flowered bladderwort (*Uticularia biflora*), green-fruited clearweed (*Pilea fontana*), red-root cyperus (*Cyperus erythrorhizos*), sedge (*Carex seorsa*), and Long's bittercress (*Cardimine longii*).

3.16.2 Bear Swamp/Bull Hill

Bear Swamp (WP-B17) is a 13.1-acre wetland located at the base of Bull Hill and valued for its ecological diversity and scenic qualities. It is primarily a PFO wetland, but also contains 4.9 acres of PSS habitat. Receiving drainage from the hills to the east and west, Bear Swamp has a total drainage basin of approximately 120 acres. A dense overstory of tall eastern hemlock and white pine, the presence of great laurel, abundant sphagnum at the surface interspersed with deep water pools, and a rich variety of species made Bear Swamp unique at West Point.

The overstory in the wetland is dominated by red maple (*Acer rubrum*), with hemlock (*Tsuga canadensis*) being the second most abundant species. Lesser numbers of yellow birch (*Betula lutea*), grey birch (*Betula populifolia*), and black tupelo (*Nissa sylvatica*) are also found in the overstory. The shrub layer is moderately dense and dominated by highbush blueberry (*Vaccinium corymbosum*), speckled alder (*Alnus rugosa*), sweet pepperbush (*Clethra alnifolia*), clammy azalea (*Rhododendron viscosum*), huckleberry (*Gaylussacia frondosa*) and sheep laurel (*Kalmia latifolia*). Great laurel (*Rhododendron maximum*) commonly grows around the edges of the wetland and in dryer areas within the wetland. Cinnamon fern

(*Osmunda cinnamomea*) and sensitive fern (*O. sensibilis*) are found in the herbaceous layer (USACE, 1993). Poison sumac, uncommon at West Point, and the regionally rare netted chain fern are also present.

Wildlife present in the area, as documented by the NRB, include the four-toed salamander (*Hemidactylum scutatum*), eastern spadefoot toad (*Scaphiopus holbrookii*), spotted salamander (*Ambystoma maculatum*), wood frog (*Rana sylvatica*), cerulean warbler (*Dendroica cerulea*), chestnut-sided warbler (*D. pensylvanica*), yellow warbler (*D. petechia*), prairie warbler (*D. discolor*), black-and-white warbler (*Mniotilta varia*), Canada warbler (*Wilsonia canadensis*), ovenbird (*Seiurus aurocapillus*), common yellowthroat (*Geothlypis trichas*), American redstart (*Setophaga ruticilla*), ruffed grouse (*Bonasa umbellus*), barred owl (*Strix varia*), scarlet tanager (*Piranga olivacea*), American robin (*Turdus migratorious*), wood thrush (*Hylocichla mustelina*), veery (*Catharus fuscescens*), hermit thrush (*C. guttatus*), red-eyed vireo (*Vireo olivacea*), solitary vireo (*V. solitarius*), yellow-throated vireo (*V. flavifrons*), blue jay (*Cyanocitta cristatta*), great-crested flycatcher (*Myiarchus tyrannulus*), eastern wood-pewee (*Contopus virens*), hairy woodpecker (*Picoides villosus*), northern flicker (*Colaptes auratus*), red-bellied woodpecker (*Melanerpes carolinus*), gray catbird (*Dumetella carolinensis*), rufous-sided towhee (*Pipilo erythrophthalmus*), brown-headed cowbird (*Molothrus ater*), mourning dove (*Zenaida macroura*), black-capped chickadee (*Parus atricapillus*), blue-gray gnatcatcher (*Polioptila caerulea*), chipping sparrow (*Spizella passerina*), and wild turkey (*Meleagris gallopavo*), white-tailed deer (*Odocoileus virginiana*) and American toad (*Bufo americanus*).

One feature contributing to the uniqueness of this site is Bull Hill Grotto, located approximately 220 meters (720 feet) southeast of Bear Swamp at the base of the steep southwest slope of Bull Hill (Barbour, 1995b). The west side of Bull Hill is a rounded granite escarpment with deep vertical cracks, a broken horizontal shelf about halfway up slope, and immense boulders at the base. The basal talus consists mostly of huge rock chunks 2-5 meters (6.5 - 16.5 feet) wide, with deep soil rather than empty spaces between rocks. The talus supports an unusually rich forest community of red oak, chestnut oak, red maple, black birch, yellow birch, paper birch, mountain paper birch, American mountain ash, witch hazel, rosebay, mountain laurel, and black huckleberry. The only herbs growing in the heavy shade of these trees and shrubs are hayscented fern (*Dennstaidtia punctilobula*), Massachusetts fern (*Theyopteris simulata*), netted chainfern (*Woodwardia areolata*), whorled wood aster (*Aster acuminatus*), and common hairgrass (*Deschampsia flexuosa*).

Bull Hill's west upper slope has oak-birch communities ranging from forest through woodland to savanna, with tree density varying with soil depth. Dwarfed black, paper, and gray birches, making up 80 percent of the trees, are spindly where dense and gnarled or shrubby where sparse. The remaining 20 percent are single, widely spaced red and chestnut oaks, much larger (15-25 cm diameter at breast height (dbh)) than the birches. Tall shrubs consist of shrub-like birches and a few scrub oaks. Scrub oak increases to 15 percent cover on the summit and 25 percent cover on the south cliff top, which has a few pitch pines as well. The summit has 50-60 percent bare rock and supports only a sparse shrub savanna with patches of dry herbaceous meadow. Savanna shrubs are scrub oak, black cherry, and choke cherry (*Prunus virginiana*). The associated herb flora is too diverse and fragmented to categorize. Mouse-ear chickweed (*Cerastium fontanum*), mouse-ear hawkweed (*Hieracium pilosella*), small-flowered bittercress (*Cardamine parviflora*), pink corydalis (*Corydalis sempervirens*), and sheep sorrel (*Rumex acetosella*) grow in the ashes of old campfires. Downy goldenrod and bristly sarsaparilla (*Aralia hispida*) grow in vertical cracks. Little bluestem and hairgrass are also present.

The east upper slope has a rich rocky woodland community with scattered small red oak, white oak, white ash, pignut hickory, black birch, paper birch, bigtooth aspen, and black cherry. Dominant shrubs are deerberry, pale blueberry, black huckleberry, and bush honeysuckle; common herbs include deer-tongue grass (*Panicum clandestinum*), hairgrass, povertygrass, common wood sedge (*Carex artitecta*), sweet goldenrod (*Solidago odora*), cow-wheat (*Melampyrum lineare*), and wavy-leaf aster (*Aster undulatus*).

3.16.3 Popolopen Brook Wetland

The Popolopen Brook wetland (WP-C53), the largest wetland on West Point at 71.6 acres, is designated by NYSDEC as significant habitat in recognition of its support of wintering populations of waterfowl. This relatively undisturbed site has high aesthetic value since it has never been designated as a formal military training area. The wetland, located adjacent to Mine Torne Road above the confluence of Popolopen Brook and Cranberry Brook, is a mixed palustrine system consisting of interconnected emergent (30.7 acres), scrub shrub (21.4 acres) and forested (19.5 acres) wetland habitats. It is supported by Popolopen Brook and a series or braided streams that flow through the area (USACE, 1993). As a result of these mixed wetland habitats, Popolopen wetland contains a large diversity of vegetation. The wettest section, at the edge of the wetland, is an emergent/scrub shrub system with a mix of scrub shrub

islands and sedge tussocks. The shrub islands are dominated by meadowsweet (*Spirea latifolia*) with some highbush blueberry (*Vaccinium corymbosum*) and speckled alder (*Alnus rugosa*) also present. The herbaceous layer is dominated by tussock sedge (*Carex stricta*) with jewelweed (*Impatiens capensis*) and cinnamon fern (*Osmunda cinnamomea*). Royal fern (*Osmunda regalis*) and marsh fern (*Thelypteris thelypteroides*) are also present in the herbaceous layer. In the northwestern section of the wetland, the emergent system is surrounded primarily by forested acreage. In the southwestern section of the wetland, the habitat changes from emergent/scrub shrub habitat to a substantial PSS system before changing to PFO habitat (USACE, 1993).

The northern PFO area consists primarily of red maple (*Acer rubrum*) in the overstory, with invasive Japanese barberry (*Berberis thunbergii*) and tussock sedge dominating the understory. The southeastern PSS habitat consists of an assemblage of meadowsweet, highbush blueberry and arrowwood (*Viburnum dentatum*) over a diverse herbaceous layer. The PFO fringe wetlands are dominated by red maple and have a very sparse shrub layer. The sparse herbaceous understory consists primarily of jewelweed, sensitive fern (*Onoclea sensibilis*), cinnamon fern, and jack in the pulpit (*Arisaema triphyllum*) (USACE, 1993).

Three state-endangered plant species are found in this wetland, the smooth bur-marigold (*Bidens laevis*), glomerate sedge (*Carex aggregata*) and a pondweed (*Potamogeton pulcher*). The mix of community types in the wetland supports a variety of fauna, making it a desirable watchable wildlife area. Waterfowl, woodcock, and songbirds are found there, which attract local bird clubs and other recreationists.

3.16.4 Popolopen Brook Gorge

Popolopen Brook is the largest of West Point's streams. The approximately 1.5 mile length from Weyants Pond Road Bridge to the USMA boundary with Bear Mountain State Park has rocky rapids, small waterfalls, deep ravines, and an occurrence of riverweed (*Podostemum ceratophyllum*), a rare plant. It is an exceptionally beautiful area and popular trout fishing stream. A complete ecological characterization of this site has not yet been conducted.

3.16.5 Timber Rattlesnake Den Area

This portion of the reservation contains the two habitat components required by timber rattlesnake populations in the northeastern United States—den areas and summer habitat for gravid females (Brown, 1993). Den areas are characterized as rocky areas with underground crevices necessary for overwintering, and summer habitat for gravid females consists of open, sparsely forested areas with fallen logs and flat slab rocks. In southeastern New York, den areas are found on granitic escarpments and ledges with talus accumulations and a generally southern exposure at between 500 and 2,000 feet in elevation. Accessible summer habitat is critical for gravid female timber rattlesnakes, since they do not travel far during gestation (Stechert, 1997). The exposed areas are important for thermoregulation, with the fallen logs and slab rocks necessary for shelter and escape habitat.

3.16.6 Bull Pond Shoreline and Adjacent Hardwood Cove

Bull Pond is a 29-acre, spring-fed lake located in Training Area O. It is valued at West Point both for its beautiful setting and ecological diversity. Bull Pond itself is a cold-water oligotrophic lake, found at a 1000- foot elevation at the base of 1,420-foot Bull Hill. The western shore hardwood community is dominated by large oaks sloping up from the pond, while a hemlock stand (one of the largest of the few on West Point) dominates the eastern shore. It is estimated that the tallest trees on West Point are found within the hardwood cove dominated by oaks (*Quercus* sp.), yellow poplar (*Liriodendron tulipifera*), and sugar maple (*Acer saccharum*) at the northern end of the pond. The southern end of the lake is composed of swampy thickets with an adjacent 20-acre swamp bordering the southwest edge of the lake.

There is an exceptionally rich diversity of shrubs and herbaceous species along the shoreline. Species identified during a 1994 survey include water purslane (*Ludwigia palustris*), marsh St. Johnswort (*Hypericum virginicum*), royal fern (*Osmunda regalis*), marsh fern (*Thelypteris thelypteroides*), purple loosestrife (*Lythrum salicaria*), leatherleaf (*Chamaedaphne* sp.), stick-tights (*Bidens cernua*), sensitive fern (*Onoclea sensibilis*), tearthumb (*Polygonum sagittatum*), and swamp rose (*Rosa palustris*) (USMA, n.d.c.). Shrub zone species include sweet pepperbush (*Clethra alnifolia*), speckled alder (*Alnus rugosa*), arrowwood (*Viburnum recognitum*), highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), mountain laurel (*Kalmia latifolia*), witch hazel (*Hamamelis virginiana*),

buttonbush (*Cephalanthus occidentalis*), gray birch (*Betula populifolia*), musclewood (*Carpinus caroliniana*), meadowsweet (*Spirea latifolia*), silky dogwood (*Cornus amomum*), fox grape (*Vitis* sp.), climbing boneset (*Eupatorium* sp.), winterberry (*Ilex virticillata*), and maleberry (*Lyonia* sp.) (USMA, n.d.c.).

The pristine nature of Bull Pond and the mature stands of oak and hemlock make this area ecologically valuable on West Point. Few exotic plants have been identified in the area; no phragmites or water chestnut have invaded Bull Pond, and only a few scattered purple loosestrife individuals are present. Contributing to its value is the presence of two rare species of pondweed— *Potamogeton pulcher* and *P. diversifolius* and small-floating bladderwort (*Utricularia radiata)* (ref rare plant species map).

3.16.7 Natural Bridge

This area is considered a valuable resource for three primary reasons—(1) the unique geologic formation; (2) the steep stream channel, which makes the area canyon-like; and (3) the rich diversity of flora, including large concentrations of early spring flowers. The neutral marble on the bridge is an unusual occurrence on West Point among the acidic granite and gneiss typically found. The marble comes into contact with biotite gneiss on the northern stream bank, which, on the downstream side of the bridge, is marked by large masses of brown biotite or phlopopite mica. A garnet-rich pegmatite occurs in the gneiss near the contact (Curran and Justus, 1970).

The upstream side of Natural Bridge forms a grotto, 30 feet wide and 10 feet high, carved out of billion-year-old marble. On the downstream side there is a much smaller cavity in the marble, and the stream exits the bridge from a deep pool extending under it. A 14-inch-wide, steeply dipping, metamorphosed basaltic dike is exposed at this entrance (Curran and Justus, 1970).

Wildflowers are growing in most of the canyon-like area upstream of the bridge formation. Some species include red trillium, wild ginger, and hepatica.

3.16.8 Mineral Springs Talus Buffer and Gorge

The steep talus slope found at this site is an extension of the escarpment that forms Mineral Springs Falls, a local natural landmark formerly owned by TNC and now a part of neighboring Black Rock Forest. This area includes approximately 750 feet of Mineral Springs Brook west of the West Point/Black Rock Forest boundary, southeast to the steep cliff-and-talus formation. The elevated range is about 710 feet from the stream to 1,000 feet at the top of the slope. The steep rugged talus slope and stream valley are the outstanding topographic features, with intervening moderate slopes widening to the arbitrary south boundary of the special natural area. The slope is composed of many large boulders and is dominated by hemlock, chestnut oak, and yellow birch in as "wild" an appearing area as occurs on West Point.

3.16.9 Cascade Ridge

Cascade Ridge is located on the western side of the Route 9W and Route 293 junction, which is the intersection of the major highways serving the West Point area. The site is dominated by a steep mountain slope. The lower slope consists of maple mesic and oak-tulip ecological communities, with numerous large specimens of oak, maple and tulip. The upper slope consists of cliff communities containing red cedar and hickories; a small chestnut oak community is located at the very summit of this mountain. Rare plants species include dittany (*Cunila origanoides*), Virginia snakeroot (*Aristolochia serpentaria*), Emmon's sedge (*Carex albicans var. emmonsii*), yellow harlequin (*Corydalis flavula*), Dutchman's breeches (*Dicentra cucullaria*), and small-flowered crowfoot (*Ranunculus micranthus*). Barn owls (*Tyto alba*) have been observed nesting here. Beautiful views of the upper cliff community are easily seen from this site, which provides especially striking contrasts of ecological communities during the autumn season. The historic stone base of an old road running through the lower slope is easily viewed from the road.

3.16.10 Mineral Springs Brook

This site is valued both for its scenic quality and brown trout spawning habitat. Mineral Springs Brook is found in a steep, mature oak-forested valley and is lined on both sides with hemlocks. The western edge

of the brook forms a steep, wooded slope supporting red oaks and mixed hardwood communities, while the east side supports poorly drained woodlands close to the stream and moderate slopes dominated by large northern red oaks. The brook itself is characterized as a small, freestone stream with numerous, small pools interspersed with short riffles. The substrate is predominantly cobble and boulder with some stretches of gravel. Brown trout (*Salmo trutta*) fingerlings were collected from this stretch in June 1996 (Linck, 1996), indicating successful spawning on this site. Larger brown trout were also captured at this site. Other species utilizing the brook include the American eel (*Anguilla rostrata*), green frog (*Rana clamitans*), and northern two-lined salamander (*Eurycea bislineata*). A bat survey conducted in 2002 documented six bat species here.

3.16.11 Cat Hollow

Cat Hollow, located in Training Areas B and I, spans the area between the northern end of Popolopen Lake and the southern end of Beaver Pond. This special natural area is bisected by Cat Hollow Creek, which flows from Beaver Pond to Popolopen Lake. The section along the eastern shore of Popolopen Lake has been used as a recreation area for Camp Buckner, providing scenic views down the lake and across to Bull Hill. A combination of diverse ecological communities is found there. There is mixed hardwood forest on the eastern shore of Popolopen Lake, composed of both pure hemlock stands (with some trees believed to be over 200 years old) and mixed forest communities. Moderate to steep slopes on the west contain maturing hardwood forests, which give way at higher elevations to drier oak forest and then to ridgetop oak-heath savanna. The rocky summit grassland community is believed to be the result of previous brush fires. Grassland species found here include little and big bluestem grass, poverty grass, Indian grass, and broom sedge. Occasional scattered patches of lowbush blueberry, scrub oak, and shadbush are common. Gneiss outcroppings may be evident and sometimes form a type of “pavement,” often partly covered with lichens and moss. A bat survey conducted in 2002 documented six species present, including a lactating small-footed bat (*Myotis leibii*) – a Federal and New York species of special concern.

3.16.12 Johnson's Meadow Woodland

The primary conservation feature of the Johnson Meadow Woodland is the forested stream valley south of the mostly herbaceous wetland known as Johnson Meadow. Also included are low-elevation talus and non-talus slopes northwest of the stream valley, and a swamp southeast of the stream. The site boundaries are fairly straightforward and clear: on the southeast the steep verge of Route 293, on the southwest the Military Reservation Boundary, on the northwest the valley slope to about 100 feet above the stream, and on the northeast the approximate line where forest gives way to shrub swamp. The elevation range of the site is about 180 feet (720 to 800 feet). In the larger landscape context the site lies in the broad valley between Black Cap Mountain to the northwest and Brooks Mountain to the southeast.

3.16.13 Crow's Nest

Crow's Nest is a rocky summit overlooking the Hudson River and lands to the south and east. It has historic military significance as a strategic vantage point during the American Revolution. From the 1300-foot summit to the railroad grade at its base along the river (at about 20 feet), there is a total elevational range of about 1,280 feet. The total Crow's Nest special natural area includes the summit and land west to Route 9 west, slopes south of Crow's Nest Road and the Crow's Nest Brook Gorge, as well as the upper portion of the North Vale and the cliff at the Storm King Park boundary. Rare plant species found at Crow's Nest include Emmon's sedge (*Carex albicans var. emmonsii*), Great manna grass (*Glyceria grandis*), small-flowered crowfoot (*Ranunculus micranthus*), midland sedge (*Carex mesochoria*), stripe-fruited sedge (*Carex striatula*), yellow harlequin (*Corydalis flavula*), violet bush clover (*Lespedeza violacea*), and Virginia pine (*Pinus virginianus*).

3.16.14 Burke Mountain

Burke Mountain is a broad, rocky ridge in the northwest corner of the West Point Military Reservation, and was designated as a special natural area in 1998. The summit elevation range is about 160 feet (1,270 to 1,430 feet). Beyond the summit, the Burke Mountain special natural area boundary is undetermined. The main topographic features are the rock exposures of the summit and its outer slopes, which are nearly

unvegetated. There are two summits with a small, intervening dip. The roughly circular north summit is considerably smaller than the long south summit. Bedrock exposures include small outcrops, flatrock areas and ledges on the summit slopes, and very steep upper slopes of bare rock, heavily weathered and more rounded off than other ridges in the area. The only water features are two basins on the north summit, and their overflow channels. The larger basin is a vernal pool-shrub swamp (VP E6E), the smaller a very shallow and ephemeral pool with state-rare cluster sedge. Soils, where they exist, are very well-drained, mineral-rich and nutrient poor. Consequently the vegetation is minimal, consisting of grassland, shrubland, woodland, or pavement with plants growing only in cracks. Rare plant species include cluster sedge (*Carex simulata*), Standley's goosefoot (*Chenopodium standleyanum*), small-flowered crowfoot (*Ranunculus micranthus*), violet bush clover (Lespedeza violacea), slender knotweed (*Polygonum tenue*), and bluets (*Hedeotis cerulea*).

3.17 FAUNA

In developing long-term census information on the fauna of USMA, several surveys, checklists, and programs have been developed and implemented.

3.17.1 Mammals

Forty-eight species of mammals have been observed and/or documented on USMA. Large and medium-sized mammals include the coyote (*Canis latrans*), black bear (*Ursus americanus*), white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), river otter (*Lontra canadensis*), fisher (*Martes pennanti*), mink (*Mustela vison*), striped skunk (*Mephitis mephitis*), porcupine (*Erethizon dorsatum*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), and beaver (*Castor canadensis*). Small mammals include the masked shrew (*Sorex cinereus*), smoky shrew (*S. fumeus*), pigmy shrew (*S. hoyi*), short-tailed shrew (*Blarina brevicauda*), starnose mole (*Condylura cristata*), hairy-tailed mole (*Parascalops breweri*), little brown myotis (*Myotis lucifugus*), northern long-eared myotis (*M. septentrionalis*), red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), the silver-haired bat (*Lasionycteris noctovagans*), the small-footed bat (*Myotis leibii*), Indiana bat (*M. sodalis*), eastern pipistrelle (*Pipistrellus subflavus*), big brown bat (*Eptesicus fuscus*), long-tailed weasel (*Mustela frenata*), ermine (*Mustela erminea*), woodchuck (*Marmota monax*), eastern chipmunk (*Tamias*

striatus), gray squirrel (*Sciurus carolinensis*), red squirrel (*Tamiasciurus hudsonicus*), southern flying squirrel (*Glaucomys volans*), northern flying squirrel (*G. sabrinus*), deer mouse (*Peromyscus maniculatus*), white-footed mouse (*P. leucopus*), red-backed vole (*Clethrionomys gapperi*), meadow vole (*Microtus pennsylvanicus*), pine vole (*M. pinetorum*), muskrat (*Ondatra zibethicus*), Norway rat (*Rattus norvegicus*), house mouse (*Mus musculus*), meadow jumping mouse (*Zapus hudsonius*), woodland jumping mouse (*Napeozapus insignis*), and eastern cottontail (*Sylvilagus floridanus*).

One other mammal species that should be noted here is the Alleghany wood rat (*Neotoma magister*). This species is listed as extirpated in New York and was historically known from USMA as recently as 1981. An extant population was recently discovered by NYSDEC along the Palisades cliffs on the Hudson River's western shore near the New Jersey border. As this species's preferred habitat in New York was talus caves, there remains a remote possibility of this species presence at USMA in a talus field located in the off-limits, Crow's Nest dud-danger area at the northeastern terminus of the reservation.

3.17.2 Birds

Two hundred and forty-nine species of birds have been observed on or near USMA. Of these, 110 species have been identified as breeding on the installation, with another 10 non-breeders considered as winter residents. Avian families represented on the installation include the following: Gavidae (loons), Podicipedidae (grebes), Phalacrocoracidae (cormorants), Ardeidae (herons), Threskiornithidae (ibises, spoonbills), Anatidae (swans, geese, ducks), Cathartidae (American vultures), Accipitridae (kites, hawks, eagles), Falconidae (falcons, caracara), Phasianidae (grouse, ptarmigans), Rallidae (rails, gallinules, coots), Charadriidae (plovers), Scolopacidae (sandpipers), Laridae (skuas, jaegers, gulls, terns), Columbidae (pigeons, doves), Cuculidae (cuckoos, anis), Tytonidae (barn owls), Strigidae (typical owls), Caprimulgidae (nightjars), Apodidae (swifts), Trochillidae (hummingbirds), Alcedinidae (kingfishers), Picidae (woodpeckers), Tyrannidae (tyrant flycatchers), Alaudidae (larks), Hirundinidae (swallows), Corvidae (jays, crows, magpies), Paridae (titmice, chickadees), Sittidea (nuthatches), Certhiidae (creepers), Troglodytidae (wrens), Musicapidae (thrushes), Mimidae (mimic thrushes), Bombycillidae (waxwings), Laniidae (shrikes), Sturnidae (starlings), Vireonidae (vireos), Emberizidae (warblers, sparrows), Fringillidae (finches), and Passeridae (weavers).

Some resident species (breeding or wintering) of note include the great blue heron (*Ardea herodias*), least bittern (*Ixobrychus exilis*), Canada goose (*Branta canadensis*), wood duck (*Aix sponsa*), turkey vulture (*Cathartes aura*), Cooper's hawk (*Accipiter cooperi*), bald eagle (*Haliaeetus leucocephalus*), red-shouldered hawk (*Buteo lineatus*), wild turkey (*Meleagris gallopavo*), killdeer (*Charadrius vociferus*), American woodcock (*Scolopax minor*), common barn owl (*Tyto alba*), barred owl (*Strix varia*), ruby-throated hummingbird (*Archilochus colubris*), pileated woodpecker (*Dryocopus pileatus*), cliff swallow (*Hirundo pyrrhonota*), fish crow (*Corvus ossifragus*), wood thrush (*Hylocichla mustelina*), brown thrasher (*Toxostoma rufum*), European starling (*Sturnus vulgaris*), red-eyed vireo (*Vireo olivaceus*), cerulean warbler (*Dendroica cerulea*), dark-eyed junco (*Junco hyemalis*), brown-headed cowbird (*Molothrus ater*), scarlet tanager (*Piranga olivacea*), and house sparrow (*Passer domesticus*).

A Checklist for the Birds of the West Point Military Reservation was created in 1988 by the NRB with assistance from two local birders. Also, since 1992, the NRB has maintained a database (BirdBase) for bird sightings on the installation. A complete listing of birds observed on or in the vicinity of USMA is presented in Appendix C.

3.17.3 Reptiles and Amphibians

Informal surveys and field observations by the Natural Resources Branch of reptiles and amphibians (herptiles) have been compiled by the Branch since the mid-1980s. Incidental sightings of other herptile species have also been reported to the Branch by personnel performing other surveys on the reservation (e.g., LCTA, timber rattlesnake surveys, threatened and endangered species surveys). In addition, since 1993, USMA has been contributing reptile and amphibian data (e.g., sightings, species, length, nesting activity, and unusual behavior) to the New York Amphibian and Reptile Atlas being developed by NYSDEC.

Twenty-two species of reptiles and 18 species of amphibians have been documented on USMA, with five others believed present, but not confirmed. The reptiles include individuals in the orders Testudinata (turtles) and Squamata (snakes and lizards). Species known to inhabit USMA are the snapping turtle (*Chelydra serpentina*), stinkpot turtle (*Sternotherus odoratus*), spotted turtle (*Clemmys guttata*), wood turtle (*C. insculpta*), eastern painted turtle (*Chrysemys p. picta*), midland painted turtle (*Chrysemys p.*

marginita), red-eared slider (*Trachemys scripta elegans*), eastern box turtle (*Terrapene carolina*), five-lined skink (*Eumeces faciatus*), northern water snake (*Nerodia sipedon*), northern brown snake (*Storeria dekayi*), red-bellied snake (*S. occipitomaculata*), eastern garter snake (*Thamnophis sirtalis*), eastern ribbon snake (*Thamnophis sauritus*), eastern hognose snake (*Heterodon platyrhinos*), ringneck snake (*Diadophis punctatus*), racer (*Coluber constrictor*), black rat snake (*Elaphe obsoleta*), milk snake (*Lampropeltis triangulum*), northern copperhead (*Agkistrodon c. mokasen*), eastern wormsnake (*Carphophis amoenus*) and timber rattlesnake (*Crotalus horridus*). The smooth green snake (*Opheodrys vernalis*) is potentially present.

Amphibians identified on the installation belong to orders Caudata (salamanders) and Anura (frogs and toads) and include the following species—the spotted salamander (*Ambystoma maculatum*), Jefferson salamander (*Ambystoma jeffersonianum*), marbled salamander (*A. opacum*), red-spotted newt (*Notophthalmus viridescens*), redback salamander (*Plethodon cinereus*), northern slimy salamander (*P. glutinosus*), four-toed salamander (*Hemidactylium scutatum*), northern red salamander (*Pseudotriton ruber*), northern two-lined salamander (*Eurycea bislineata*), American toad (*Bufo americanus*), Fowler's toad (*B. fowleri*), spring peeper (*Pseudacris crucifer*), northern gray tree frog (*Hyla versicolor*), green frog (*Rana clamitans*), wood frog (*R. sylvatica*), pickerel frog (*R. palustris*), bullfrog (*R. catesbeiana*), and eastern spadefoot toad (*Scaphiopus holbrooki*). Four species believed to be present are the blue-spotted salamander (*Ambystoma laterale*), northern dusky salamander (*Desmognathus fuscus*), Alleghany dusky salamander (*D. ochrophaeus*) and spring salamander (*Gyrinophilus porphyrictus*).

3.17.4 Fish

The fish in USMA's water bodies have been surveyed by the Adirondack Lakes Survey Corp. (1987), Cornell University (1988-95), USFWS (as part of cooperative agreement) and USMA Natural Resources personnel. In addition, fish harvest data have also been collected from completed USMA fishing report forms since 1981. These records provide a general list of fish species found on West Point and include the following: largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), redbreast sunfish (*Lepomis auritus*), blue-spotted sunfish (*Enneacanthus gloriosus*), black crappie (*Pomoxis nigromaculatus*), walleye (*Stizostedion vitreum*), yellow perch (*Perca flavescens*), chain pickerel (*Esox niger*), redfin pickerel (*E.*

americanus), rainbow trout (*Onchorynchus mykiss*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), yellow bullhead (*Ameiurus natalis*), brown bullhead (*A. nebulosus*), alewife (*Alosa pseudoharengus*), creek chub (*Semotilus atromaculatus*), golden shiner (*Notemigonus crysoleucas*), banded killifish (*Fundulus diaphanus*), four-spined stickleback (*Apeltes quadracus*), and white sucker (*Catostomus commersoni*). A listing of fish species found in USMA waterbodies is provided in Appendix C.

Several waterbodies on the reservation have been stocked in past years. Some of these fish include largemouth bass (Mine Lake, Popolopen Lake), smallmouth bass (Lake Georgina, Stilwell Lake), channel catfish (Lake Georgina, Lusk Reservoir, Mine Lake, Popolopen Lake, Stilwell Lake), walleye (Popolopen Lake, Stilwell Lake), crappie (Stilwell Lake), fathead minnow (Lake Georgina, Stilwell Lake), and various trout species (Popolopen Brook, Highland Brook, Round Pond, Bull Pond, Lusk Reservoir). Stocking records are provided in Table 4-6 (1997 – 2001) and Appendix E (historical records).

The Hudson River also provides habitat for a diverse array of fish species. Some of the more common species found along USMA properties include striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), Atlantic sturgeon (*Acipenser oxyrhyncus*), bay anchovy (*Anchoa mitchilli*), hogchoker (*Trinectes maculatus*), mummichog (*Fundulus heteroclitus*), blueback herring (*Alosa aestivalis*), sunfishes (*Lepomis* sp.), suckers (*Catostomus* sp.), and the American eel (*Anguilla rostrata*). The shortnose sturgeon (*Acipenser brevirostrum*), a federally-endangered species, is also found in this portion of the Hudson River (see Section 3.18). Bluefish (*Pomatomus saltatrix*), a species of federal management concern under the Magnuson Stevens Fishery Conservation Act of 1996, are found in the USMA section of the Hudson River in late summer and periods of low freshwater flow.

3.17.5 Invertebrates

The results of a three-year (May 1994 to August 1996) field survey of dragonflies and damselflies (belonging to the order Odonata) on USMA indicate the presence of 101 species (32 damselflies and 69 dragonflies) (Soltesz, 2000). Soltesz (2000) notes that only three counties in New York (Broome [102], Orange [122], and Westchester [107]) have odonate lists in excess of 100 species, and that the odonate

diversity at USMA is "comparable to some of the most thoroughly researched counties in the state is certainly remarkable."

Of the total species observed, six are listed as rare within the state of New York, while five others are considered regionally important (see Section 3.18 for a discussion of these special status species). Some of the nonlisted Odonata include the river jewelwing (*Calopteryx aequabilis*), amber-winged spreadwing (*Lestes eurinas*), dusky dancer (*Argia translata*), azure bluet (*Enallagma aspersum*), fragile forktail (*Ischnura posita*), fawn darner (*Boyeria vinosa*), unicorn clubtail (*Arigomphus villosipes*), calico pennant (*Celithemis elisa*), globe glider (*Pantala flavescens*), and Jane's meadowfly (*Sympetrum janeae*). (See Appendix C for complete species list.)

A survey of butterflies (belonging to the orders Rhopalocera and Lepidoptera) was conducted in 1995, 1996, and 1997 on the properties of USMA (Barbour, 1997). Seventy-six species (approximately 8,100 individuals) were identified, eight of which are considered rare in New York and six of which are considered regionally rare in southeastern New York by the NYNHP. Two species are classified as rare to West Point. Of the eight state-rare species, three were found to be abundant or common at West Point (see Section 3.18 for a discussion of state and regionally rare species) and at least six are believed to be residents. Of the six regionally rare species, all but the pipevine swallowtail (*Battus philenor*) are West Point residents. Its host plant, the pipevine, has been found in only one location on the reservation. Examples of nonlisted butterflies found during the survey include the pearl crescent (*Phyciodes tharos*), wild indigo duskywing (*Erynnis baptisiae*), common wood nymph (*Cercyonis pegagla*), spring azure (*Celastrina ladon*), northern pearly-eye (*Enodia anthedon*), red-spotted purple (*Limenitis astyanax*), painted lady (*Vanessa cardui*), and checkered skipper (*Pyrgus communis*). A complete list of butterflies identified in the survey is provided in Appendix C.

The reservation was surveyed for moths during the 1999 growing season (Barbour, 2000). A total of 234 species of moths were collected, including two species (*Chytonix sensilisas* and *Euxoa violaris*) listed as rare in New York by the NYNHP. The presence of *C. sensalis* is related to fire cycles in barrens habitats and the violet dart (*E. violaris*) is a barrens species known from dune habitats in North Carolina (Barbour, 2000). The red cutworm moth (*Abagrotis placida*) is another barrens species, near its northern range limit in southern New York. The most frequently collected species included common idia (*Idia aemula*), the

exotic large yellow underwing (*Noctua pronuba*), grayish Polypogon (*Polypogon pedipilalis*) and eastern tent caterpillar (*Malacosoma americana*). Other exotic species collected in addition to *Noctua pronuba*, include the toadflax brocade (*Calophasia lunula*), the European corn borer (*Ostinia nubilalis*), Armyworm (*Pseudeletia unipunctata*), the peppered moth (*Biston betularia cognitaria*), and the gypsy moth (*Lymantra dispar*).

As of 1998, four species of molluscs had been identified in USMA waters. These included two species of Unionid mussels, *Anodonta cataracta* and *Elliptio complinata*, the fingernail clam (*Sphaerium simile*) and the freshwater snail (*Campeloma decisum*). Both species of unionids were found in the lakes, ponds, and streams of Popolopen Brook and Cragston drainages, with *A. cataracta* being the more abundant of the two. The fingernail clam and the freshwater snail are common and widespread in USMA waters.
A comprehensive mollusks and crayfish survey of the drainages was conducted during 2000 and 2001 (Prezant and Chapman, 2002). Two species of crayfish—the spiny cheek crayfish (*Orconectes limosus*) and Appalachian brook crayfish (*Cambarus bartonii*), were collected, and thirty-three species and one subspecies of molluscs were found, including one species that is apparently new to science and two or three considered rare in New York (Prezant and Chapman, 2002). Gastropod species/subspecies outnumber bivalves (23 to 12) in total number of species/subspecies. The most abundant species included *Amnicola limosus*, *Planorbella trivolvis*, *Pisidium casertanum*, *Sphaerium partumeium* and *Pyganodon cataracta*. Twelve of the 35 species collected compose only two percent of the total individuals while the most abundant species composed 67 percent of all molluscs collected. Twenty-five species of molluscs were found in streams and brooks compared to the 27 species collected in lakes and ponds. Fifteen species were collected in both lakes/ponds and streams/brooks. The greatest number of species were collected in the Popolopen drainage, the largest drainage on the reservation. A complete list of molluscs and crayfish that have been collected in USMA waters is provided in Appendix C.

3.18 INVASIVE SPECIES

An invasive species is loosely defined as a non-native organism that aggressively propagates itself at the expense of native plants, animals, and ecosystems (Pray, 2002a). It can be a plant or an animal species, a subspecies, or even a single non-native race of a native species that has unspecific habitat requirements, produces large numbers of offspring, and may aggressively attack competing organisms. In their native

range, these organisms are kept in check by predators that co-evolved to feed upon them. Once transplanted outside this range, beyond the reach of these natural controls, the populations of these organisms may explode. Then the interactions of the invasive species and its new habitat can be difficult to fully grasp, and can be far reaching beyond the immediate and obvious.

The invasive plants that receive the most attention, Japanese barberry and multiflora rose, seriously impact training by forming impassable thickets (Pray, 2002a). Because the Corps of Cadets Control requires the open woodland of a mature forest for maneuvers, control of these species directly improves military training. Animal invasives, such as starlings, English sparrows, rock doves, rats, house mice, certain ants, earthworms, common carp, etc. are either managed when they present a problem, or are so well established that control is currently impractical. Exceptions to this rule are gypsy moth and hemlock wooly adelgid, two pests that seriously damage some of the most important forest trees on the reservation.

Table 3-28 contains a list of plant species present at West Point. Included is information on plant type, preferred plant habitat, acres infested at West Point, whether or not the NRB has attempted control, method of control and what was the outcome of that effort, what might be the preferred control method, impacts to training and biodiversity and what the impacts might be, population spread, future danger, and lastly, each species is prioritized in importance.

High priority invasives are plants that are ecologically dangerous, spreading, negatively effect training, and can be controlled with current methods. These tend to be ones that the NRB has been aware of for some time, and has been managing at least to some degree. Low priority plants may already be so incorporated into the ecosystem so as to appear native. Populations tend to be stable. These are generally small forbs – not damaging to trees, and do not directly affect training. Priorities are sure to shift as new control methods become available and as populations begin to expand.

3.19 ENDANGERED, THREATENED, AND RARE SPECIES

In 1991 and 1992, in accordance with the requirements of AR 200-3 and the ESA, a survey of threatened and endangered fauna and flora on USMA properties was conducted by the Biological Survey Unit of the

Table 3-28
Invasive Plants of West Point

Plant	Type	Habitat Infested	Acres	Control Attempted	Method	Success	Preferred Method	Chances of Success Local	Chances of Success Reservation	Impact Training (Currently)	How	Impact Biodiversity (currently)	How	Spread	Future Danger	Priority
Common Reed (*Phragmites australis)*	F	L,W,R,O	32	Y	C,S	N	S,B?,Sh	H	L	Y	I,F,R,C	Y	N,C,H,S	R	H	1
Japanese Barberry (*Berberis thunbergii)*	B	F,W,R,O,D,	800	Y	F,C	Y	F	H	L	Y	I,T,R,C,F	Y	N,H,C,N,F	C	H	1
Multiflora Rose (*Rosa Multiflora)*	B,V	W,R,O,D,R	100	Y	F,C	Y	F,S	H	L	Y	T,I,C,F,S	Y	N,H,C,N,F	C	H	1
Water Chestnut *(Trapa natans)*	A,F	L	3	Y	P	Y	P	H	H	Y	R,C,T	Y	S,N,H	R	H	1
Autumn Olive *(Elaegnus umbellate)*	B,T	O	5	Y	C,F	?	S,F	H	M	Y	I,T,C	Y	N,F,C	C	M	2
Japanese Knotweed *(Polygonum cuspidatum)*	F	R,O,S	3	Y	C,F	?	C&F,Sh	M	M	Y	C,F	Y	C	S	M	2
Japanese Bittersweet *(Celastrus orbiculatus)*	V	D,S,O	55	Y	C	?	S	M	M	Y	I,S,C	Y	S,F	R	M	2
Purple Loosestrife *(Lythrum salicaria)*	F,B	W,L	25	Y	B	Y	B,P,F	M	L	Y	I,R	Y	C,F	C	M	2
Water Milfoil (*Myriophyllum sp.)*	A	L	65	Y	B	Y	B,F	M	L	Y	R,C	Y	S,C,N,H	S	L	2
Buckthorn *(Rhamus* sp.)	B,T	O,D,F	12	N			C?,S	L	L	N		Y	N,F,S,C	C	M	3
Garlic Mustard *(Alliaria petiolata)*	F	D,S,F,R	340	N			B,P,F	H	L	N		Y	C,A	R	H	3
Japanese Honeysuckle *(Lonicera japonica)*	V	O,D,S,F	13	N			F,Sh	H	L	N		Y	C,S,F	R	M	3
Norway Maple *(Acer Platinoides)*	T	D,F	5?	N			C,S	H	H	N		Y	S,N	C	L	3
Oriental Wisteria *(Wisteria floribunda)*	V	D,R,O	15?	N			S	H	M	N		Y	S	C	M	3
Tartarian Honeysuckle (*L. tartanica)*	B	O,D,W	3	N			S,F	H	M	N		Y	C,F,H	C	M	3
Tree-of-Heaven *(Ailanthus altissima)*	T	D,S	9	Y	C	N	S	M	L	Y	C,S	Y	A,S,H	S	H	3
Winged Euonymus *(Euonymus alatus)*	T,B	D,F	28	N			P,C,F	H	M	N		Y	C,F	R	M	3
Black Locust *(Robinia pseudoacacia)*	T	O,D	100+	N			S	H	L	N		Y	N,F,S,C,H,N	S	L	4
False Indigo *(Amorpha fruticosa)*	B	R	2	Y	C	N	F	H	M	Y	R,C	N		S	L	4
Japanese Stiltgrass *(Microstegium vinineum)*	V	R,D,F	87	N			F,P	H	L	N		Y	C,N	R	H	4
Princess Tree *(Paulownia tomentosa)*	T	D	<1	N			C,S?	H	H	N		N		C	L	4
Mimosa *(Albizia julibrizzin)*	T,B	S	<1	Y	C	N	S,F	H	H	Y	C	N		C	L	4
Wineberry (*Rubus phoenicaolasias*)	B	O,D	?	N			F?	?	L	Y	I	Y	F,C,N	C	L	4

Table 3-28
Invasive Plants of West Point

Plant	Type	Habitat Infested	Acres	Control Attempted	Method	Success	Preferred Method	Chances of Success Local	Chances of Success Reservation	Impact Training (Currently)	How	Impact Biodiversity (currently)	How	Spread	Future Danger	Priority
Black Swallowtail Wort *(Vincetoxicum nigrum)*	V,F	O,S	5?	N			F,Sh	?	L	N		Y	C,S	S	L	5
Coltsfoot *(Tussilago farfara)*	F	R,W	20+	N			P?,F?	?	L	N		Y	C	S	L	5
Russian Knapweed *(Centaurea repens)*	F	O	3	N			F?	?	L	Y	F,E	Y	A,C	S	L	5
Dame's Rocket (*Hesperis metronalis*)	F	O,S	?	N			F?	?	L	N		?		S	L	5
Watercress (*Natrutium officinale*)	A	R,W	?	N			P?	?	L	N		?		S	L	5

Codes:

Type: A = Aquatic, F = Forb or Grass, B = Bush, V = Vine, T = Tree
Habitat Infested: F = Forest, L = Lake/pond, W = Wetland, R = Riparian, O = Open Field, D = Disturbed forest, S = Side of road
Control Attempted: Y = Yes, N = No

Method: C = Cut, F = Foliar Spray, S = Stump Treatment, P = Pull, B = Biocontrol
Success: Y = Yes, N = No, ? = Unknown

Preferred Method: Sh= Shade, C = Cut, F = Foliar Spray, S = Stump Treatment, P = Pull, B = Biocontrol "?" Indicates untested method
Chances of Success Local: H = High, M = Medium, L = Low, ? = Unknown

Chances of Success Reservation: H = High, M = Medium, L = Low, ? = Unknown

Impact Training (Currently): N = No, Y = Yes

How: T = Thorny Structures, R = Recreation, I = Impassible, C = Cost, F = Fire Danger, S = Forest Structure, E = Erosion

Impact Biodiversity (Currently): Y = Yes, N = No

How: A = Allelopatric, N = Nesting, F = Food, S = Shade, C = Crowd, H = Habitat, N = Nitrification

Spread (populations on West Point): R = Rapid, C = Creeping, S = Stable,

Future Danger: H = High, M = Medium, L = Low, ? = Unknown

Priority: 1 = Highest, 5 = Lowest

New York State Museum (New York State Museum, 1994). The survey did not include the USMA section of the Hudson River. Results of the survey indicated that no species listed under ESA as endangered or threatened were found to be permanent residents of or to breed on USMA. The survey did find, however, that the bald eagle, a state and federally threatened species, is a frequent winter visitor to

both the reservation and Constitution Island and that suitable habitat existed for the state and federally endangered Indiana bat and the then federally threatened peregrine falcon (the pergrine falcon is no longer federally listed). Three bird species — golden eagle, red-shouldered hawk, and osprey (which at the time were state-listed) — were observed in forested areas on the reservation during the survey, but were not considered residents. The only state-listed terrestrial animal species found to be a permanent resident of the West Point reservation was the timber rattlesnake.

Since that initial survey, much work has been done to better understand the rare animal species found at USMA, in New York, and in the U.S. Some species — the peregrine falcon, osprey, and red-shouldered hawk — have recovered enough to be downgraded from endangered species lists. Other species have gone the other way, becoming more rare and eventually requiring inclusion on the protected species lists. New resident and visitor species have been discovered at West Point, and those previously identified have been more intensively studied. Table 3-29 lists those Federal and state-listed species documented at USMA, as well as species listed as 'special concern' by NYS and candidates for possible future inclusion on the federal endangered species list.

Table 3-29
Federal and State Listed Endangered and Threatened Animal Species Found on West Point and Constitution Island

Scientific Name	Common Name	Location	Federal and State Status	USMA Status
Mammals:				
Myotis leibii	small-footed bat	West Point (WP)	C, SC	R
Myotis sodalis	Indiana bat	WP	FE, SE	P, V
Neotoma magister	Allegheny Wood Rat	WP	SE, X	X (?), H
Birds:				
Accipiter cooperii	Cooper's hawk	WP	SC	R
Accipiter gentilis	northern goshawk	WP	C, SC	V, P
Accipiter striatus	sharp-shinned hawk	WP	SC	R
Aquila chryseatos	golden eagle	WP	SE	V, H (?)
Botaurus lentignosus	American bittern	WP, Constitution Island (CI)	SC	R
Buteo lineatus	red-shouldered hawk	WP	SC	R(?), V
Caprimulgus vociferus	whip-poor-will	WP	SC	R
Chordeiles minor	common nighthawk	WP	SC	P
Dendroica cerulea	cerulean warbler	WP	C, SC	R
Falco peregrinus anatum	peregrine falcon	WP	SE	V, H

Table 3-29
Federal and State Listed Endangered and Threatened Animal Species Found on West Point and Constitution Island

Scientific Name	Common Name	Location	Federal and State Status	USMA Status
Gavia immer	common loon	WP, CI	SC	V
Haliaeatus leucocephalus	bald eagle	WP, CI	FT, ST	V, W, H
Icteria virens	yellow-breasted chat	WP	SC	V, P
Ixobrychus exilis	least bittern	WP, CI	ST	R
Melanerpes erythrocephalus	red-headed woodpecker	WP	SC	V
Pandion haliaeatus	Osprey	WP, CI	SC	V, R(?)
Podilymbus podiceps	pied-billed grebe	WP, CI	ST	P, V
Pooecetes gramineus	vesper sparrow	WP	SC	V, P
Vermivora chrysoptera	golden-winged warbler	WP	SC	R
Reptiles:				
Carphophis amoenus	eastern wormsnake	WP	SC	R
Clemmys guttata	spotted turtle	WP, CI	SC	R
Clemmys insculpta	wood turtle	WP	SC	R
Crotalus horridus	timber rattlesnake	WP	ST	R
Heterodon platyrinos	eastern hognose	WP	SC	R
Terrapene caroliniana	eastern box turtle	WP, CI	SC	R
Amphibians:				
Ambystoma jeffersonianum	Jefferson salamander	WP	SC	R
Ambystoma laterale	blue-spotted salamander	WP	SC	R(?)
Ambystoma opacum	marbled salamander	WP	SC	R
Scaphiopus holbrookii	eastern spadefoot toad	WP (?)	SC	R (?)
Fish:				
Acipenser brevirostrum	shortnose sturgeon	WP, Hudson River	FE, SE	R (Hudson River)
Acipenser oxyrhynchus	Atlantic sturgeon	Hudson River	CD	R
Insects:				
Enallagma laterale	Lateral Bluet	WP	C	R

Federal Status:	State Status:	USMA Status:
FE=Federal Endangered	SE=State Endangered	R=Resident
FT=Federal Threatened	ST=State Threatened	V=Visitor, Migrant
C=Federal Species of Concern	SC=Special Concern	P=Possible Resident
F=Federal Protected; listed under CITES	X=Extinct/Extirpated	H=Historical Resident
		?=Status Unknown
		X=Locally Extinct

Source: Beemer, 2001a.

***Shortnose Sturgeon* (*Acipenser brevirostrum*).** This federally and state endangered fish occurs at USMA in the Hudson River adjacent to the cantonment area and Constitution Island. USMA occurs at river mile 51-53, and owns three miles of the western shore, and 1.5 miles of shoreline at the island on the east bank. This includes the river bottom from the shore out to the river's midpoint.

While the shortnose sturgeon does occur offshore of the Reservation, recent studies by the New York Cooperative Fish and Wildlife Research Unit at Cornell University and other researchers suggests that the species may be limited in its usage of this part of the Hudson River. Juvenile shortnose sturgeon showed a preference for water depths greater than two meters and were more common in depths exceeding six meters (Haley et al 1996). Further, juveniles were not sampled below river mile 64 (Haley et al). In the Hudson River, the shortnose sturgeon's spawning area is located north of Catskill, NY up to the Troy Dam. Little is known about the distribution of non-breeding adults, but pre-spawn adults overwinter in the section of the river near Kingston before heading towards Troy in the spring when water temperatures are right. The species is a deepwater benthic feeder, feeding on mollusks and other macroinvertebrates.

USMAs Natural Resources Branch prepared an Endangered Species Management Plan for the Shortnose Sturgeon (Appendix K) in 1997, and an update is planned for 2003.

Bald Eagle (Haliaeetus leucocephalus). The bald eagle is listed both by the federal government and the state of New York as 'threatened'. At West Point, the bald eagle is a commonly sighted wintertime resident, often observed near the Reservation's larger water bodies. This is one of the most intensively studied species at West Point, and the Natural Resources Branch performs, or contracts for, a variety of surveys to document day and nighttime use of the USMA properties by these birds.

Eagles may be seen anywhere on the WPMR where they scavenge fish and bait left behind by ice-fishermen when the lakes are frozen, scavenge deer carcasses, and hunt ducks and catch fish after ice-out. They are even known to occasionally land in trees in the populated cantonment area.

Eagles are most consistently viewed resting in the tall trees on the shoreline of Constitution Island or foraging among the ice-floes on the Hudson River. This part of the Hudson River is an important wintering area for eagles because tidal movement, strong currents, and Coast Guard ice-cutters keep open

water available for the birds long after other, smaller, less turbulent water bodies have frozen solid. Indeed, during harsh winters birds wintering in the Delaware River/Mongaup River wintering area may shift to the Hudson River during particularly cold, snowy winters. Other locations favored by bald eagles at USMA are Stilwell and Popolopen Lakes.

In addition to resting and foraging activities, bald eagles have been documented using parts of West Point for communal winter night roosts. Satellite telemetry data from 1997-2000 showed a variety of locations where single eagles roosted overnight, and up to eight eagles have been observed roosting in trees at another location.

Although eagles have been seen on USMA properties every month of the year, it has been over 100 years since an eagle nest has been documented for the West Point area (Bull, 1985). Apparent nest-building and pair-bonding activities by a pair of bald eagles observed near Stilwell Lake in February and March 2002 were followed with much interest, but did not result in active nesting.

An Endangered Species Management Plan has been prepared for this species (Appendix J).

Indiana Bat (Myotis sodalis). Indiana bats have been observed three times on the reservation, and there is evidence to suggest that the species may use some parts of USMA for foraging and resting.

In September 1992, James Beemer, the post biologist, observed a single Indiana bat perched on a wall in an abandoned mine near the main impact area. In January 1993, a return visit to the mine found eight or nine bats huddled in a bore hole at the back of the mine. These two sightings seem to be an anomaly, and have never been repeated in subsequent surveys. In the winter of 1999-00, the reason became clear. The Indiana bat has a very narrow range of acceptable temperatures in which it can hibernate. If conditions are too warm, the bat's metabolism never slows sufficiently, and the bats starve before spring; if it is too low, the sleeping bats freeze. A thermograph placed in the mine by in 1999 recorded temperatures that were too warm to support sleeping bats (Gannon and Sherwin, 2000).

The likely explanation for the sightings in 1992-93 is that bats are aware of the mine, and may use it as a stop-over during migration. This is supported by the sighting of the single bat in September. The winter

of 1992-93 arrived early with freezing temperatures below normal. It is theorized that the bats seen in January 1993 were short-stopped before they could reach their normal hibernaculum, and spent the winter in what is normally a temporary shelter.

In 1999 and 2000, a survey to document the bat communities on USMA properties was conducted (Gannon and Sherwin, 2000). During the survey, one male Indiana bat was captured in a mist net, and 39 call sequences attributed to the species were recorded with ANABAT detectors.

These findings prompted a second survey in 2002 following USFWS Indiana bat survey protocols to further document the population of Indiana bats using the WPMR (NYNHP 2003). In 96 trap-nights, no Indiana bats were caught. The conclusion that was drawn from this was that while Indiana bats may use the WPMR, it may be that only transient males or non-breeding females use the property for foraging. Breeding females, which are closely tied to their communal nurseries, would have certainly been caught had there been a nursery in the vicinity of the mist nets used. The greater concentrations of feeding bats around a nursery tree would have increased the probability of their capture. Males and non-breeding females wander during the summer and are much more dispersed, utilizing a wider variety of habitats. This would make them less likely to be captured, and would explain both the single bat caught in the 1999-2000 survey, as well as the 39 recorded bat calls purportedly identified as Indiana bats.

Timber Rattlesnake (Crotalus horridus). This snake is a sensitive and retiring species, unable to persist in the face of too much human disturbance. The timber rattlesnake is listed as 'threatened' by New York, and the species and its hibernacula are of special interest for protection. Five extant timber rattlesnake dens have been identified within, or very near, the West Point Reservation boundary, with one extinct population also known from USMA lands.

Since 1993, USMA has contracted with a local rattlesnake expert to track and monitor timber rattlesnake populations at West Point. Using radio telemetry equipment and field surveys, hibernacula and high-use summer areas have been identified. Two areas with hibernacula have been placed off limits to training in order to prevent negative troop/rattlesnake interactions.

There are occasional conflicts between humans and snakes at USMA. Most commonly, snakes are accidentally killed when crossing or basking on roadways. During the summer of 2002, seven snakes were killed on NY Route 218 adjacent to USMA. During summer months, military and civilian personnel occasionally encounter rattlesnakes on the Reservation, and while regulations prohibit harming or harassing the snakes, negative results sometimes happen. Lastly, snakes sometimes find their way into housing areas in the cantonment area, and these snakes are promptly relocated by the Natural Resources Branch.

Pied-billed Grebe (Podilymbus podiceps). The state threatened pied-billed grebe can occasionally be found in West Point's ponds and sloughs. The grebe has been seen in Mine Lake, Brooks Hollow, Cranberry Pond, and Weyants Pond during the breeding and brood rearing seasons, but has never been observed paired or in the company of young. The pied-billed grebe is a secretive species, and it is possible that this species is a resident breeder that has not been confirmed to date.

Least Bittern (Ixobrychus exilis). At West Point, the state threatened least bittern is only known to occur in the Constitution Island marsh. Breeding for this species has never been confirmed on the island, but it is a confirmed breeder in the adjacent Constitution Marsh Sanctuary managed by the National Audubon Society.

Cerulean Warbler (Dendroica cerulea). In 1997 and 1998, a survey was conducted by the U.S. Geological Survey Biological Resources Division to document the distribution, abundance, and habitat associations of the cerulean warbler (*Dendroica cerulea*) and other forest-nesting birds on the reservation. Bird counts were conducted at 411 points, divided between two basic survey designs, a systematic sample (205 points) and a habitat-based sample (206 points). Cerulean warblers were detected at 20 points (8 systematic points, 12 community points). Breeding was confirmed at four of these points, and was probable at the other 16, based upon recorded bird behavior. On October 23, 2002, the USFWS announced a petition to list cerulean warbler presented substantial information indicating that listing the species may be warranted. The USFWS also initiated a 12-month status review for the species.

Small-Footed Bat (Myotis leibii). During the 1999-2000 bat survey, two lactating female small-footed bats (*Myotis leibii)* were captured on the WPMR (Gannon and Sherwin, 2000). In the 2002 survey, the

New York Natural Heritage Program captured two lactating female small-footed bats — one in the Cat Hollow Special Natural Area, and the other in the Constitution Island SNA (NYNHP 2003). Currently, this species is listed by New York State as a species of special concern. The USFWS is currently evaluating this bat's status for possible listing under the ESA. As with the cerulean warbler (*Dendroica cerulea*), an upgrade in this species' status will warrant special attention.

Peregrine Falcon (Falco peregrinus anatum) and Golden Eagle (Aquila chryseatos). The peregrine falcon and the golden eagle, both state endangered birds, are sometimes seen on USMA. Golden eagles are most often seen in the winter, usually near Stilwell Lake or the Popolopen Brook valley. These are usually immature birds but adults are seen at times, most often corresponding with migration. The peregrine falcon was a historic resident of West Point and its preferred nesting habitat is available on the Reservation. However, no recent data suggests that this species has nested on USMA in recent history. Nevertheless, this is a rebounding species, and active nests have been found both north and south of West Point at Breakneck Ridge and the Bear Mountain Bridge, and this may mean a return of this bird as a resident to USMA.

Allegheny Woodrat (Neotoma magister). The Allegheny woodrat (*Neotoma magister*), a federal candidate species and a New York endangered species, was historically found at USMA. This animal's preferred habitat in New York is large talus caves near its preferred food — red oak acorns. USMA has both in abundance. A survey by the NYSDEC Endangered Species Unit in 1981 identified only one possible USMA site that might have still possessed an extant woodrat population, but no woodrat was ever captured. Following tests conducted on woodrat carcasses collected at the Mohonk Preserve in upstate NY in 1987, the NYSDEC concluded that an extreme susceptibility to the nearly ubiquitous raccoon roundworm (*Baylisascaris procyonis*) had doomed the species, and consequently listed the Allegheny woodrat as officially extirpated in the wild (NYSDEC, 1994).

However, because of the relatively recent nature of the apparent extirpation of the woodrat in NY, surveys are still carried out for this species. Since woodrats are known to still exist in remnant populations in the Northeast, and since the habitat for this species is still available at West Point, it is not inconceivable that there may be a hidden population of woodrats somewhere on West Point. As of yet, there has been no

data to suggest this. In 1994, a follow-up survey at USMA by the NYSDEC Endangered Species Unit could not locate any extant population of woodrats at USMA.

Species of Special Concern. . NY special concern species that are confirmed residents or breeders on USMA include marbled salamander, Jefferson salamander, spotted turtle, wood turtle, eastern box turtle, eastern hognose snake, eastern worm snake, sharp-shinned hawk, Cooper's hawk, American bittern, whip-poor-will, and golden-winged warbler.

Several rare species investigations have been conducted on West Point, including surveys of rare Odonata (dragonflies and damselflies), butterflies, and plants. Although rare species are not formally protected under federal or state law, they are afforded special consideration and protection by the Army as a matter of responsible land stewardship.

The NYNHP assigns a global and state rank to each rare community or species element present within the state. The global rank reflects the rarity of the element throughout the world, and the state rank provides a measurement of rarity within New York State (The Nature Conservancy, 1982). Global ranks for communities are not yet standardized by TNC, so the ranks listed here are estimates only. Rankings and their definitions are provided in Table 3-30.

Odonata. The 4-year field survey of Odonata on West Point began in 1994. Preliminary results, presented after the second field season, revealed the presence of 101 species from 53 survey sites, including 14 considered rare or otherwise noteworthy (Soltesz, 2000). These rare species and their NYNHP rankings are listed below.

- New England bluet (*Enallagma laterale*). Globally listed as G3 and state-listed as S2, this species occurs along a relatively narrow corridor from northern Pennsylvania and New Jersey eastward to Cape Cod and Maine. The Cranberry Pond population is the eighth for New York and appears to be healthy and well established.

Table 3-30
Natural Heritage Program Rarity Ranks

Global Ranks	
G1	Critically imperiled throughout its range due to extreme rarity (5 or fewer occurrences, or very few remaining individuals, acres, or miles of stream) or extremely vulnerable to extinction due to biological factors.
G2	Imperiled throughout its range due to extreme rarity (6 to 20 occurrences, or few remaining individuals, acres, or miles of stream) or highly vulnerable to extinction due to biological factors.
G3	Either very rare throughout its range (21 to 100 occurrences), but with a restricted range (but possible locally abundant), or vulnerable to extinction due to biological factors.
G4	Apparently secure throughout its range (but possibly rare in parts of its range).
G5	Demonstrably secure throughout its range (but may be rare in certain areas).
State Ranks	
S1	Typically 5 or fewer occurrences; very few remaining individuals, acres, or miles of stream; or especially vulnerable to extirpation in New York State for other reasons.
S2	Typically 6 to 20 occurrences; few remaining individuals, acres, or miles of stream; or very vulnerable to extirpation in New York State for other reasons.
S3	Typically 21 to 100 occurrences, limited acreage, or miles of stream in New York State.
S4	Apparently secure in New York State.
S5	Demonstrably secure in New York State.
SH	No extant sites known in New York State, but it may still exist.

The Nature Conservancy, 1982.

- Spatterdock darner (*Aeshna mutata*). This rare species is listed as G3/G4 and S2. The West Point populations are the southernmost in New York and the first for the Hudson Highlands. The breeding site may be within the central range/danger area or possibly Owl Swamp.

- Comet darner (*Anax longipes*). Listed as globally secure (G5) and rare (S2) in New York, its occurrence at Lake Georgina is the second record for the Hudson Highlands and likely represents vagrant individuals rather than a breeding population.

- Sable clubtail (*Stenogomphurus rogersi*). Ranked S1 in New York, this species is previously known from the outlet at Little Cedar Pond in Sterling Forest.

- Arrowhead clubtail (*Cordulegaster obliqua*). The arrowhead clubtail is rare statewide (S2/S3) though not uncommon locally in the Hudson Highlands. It appears to be more abundant at West Point than anywhere else in the northeast.

- Umber Shadowfly (*Neurocordulia obsoleta*). This species occurs at three sites at West Point, with one site, Bull Pond, being particularly populous. It is previously known from only four other locations in New York.

- Mocha emerald (*Somatochlora linearis*). Rare (S2/S3) in New York, one specimen was taken on Cragston Brook.

- Martha's pennant (*Celithemis martha*). Primarily a coastal plain species (before West Point, it had not been found on the mainland of New York), the apparently well-established population on Cranberry Pond is highly unusual.

- Golden-winged skimmer (*Libellula auripennis*). Previously known in New York by a single specimen collected in the 1930s, the West Point specimen was a freshly emerged teneral taken in a field at the Mine Road gravel pits. The nearest habitat that may be considered suitable for this species is the sedge meadow flats of the Popolopen Brook on the south side of Mine Road. This location was searched on July 3, 1995, without success.

- Bar-winged skimmer (*Libellula axilena*). Listed as G5 (globally secure) and S1, this skimmer was previously known from only two locations in New York. The West Point record is part of a migratory flux that occurred in the spring of 1995, bringing seven additional records to the state. The West Point record (from Deep Hollow Brook) is the northernmost of the records and a slight range extension for the species.

- Dusky Dancer (*Argia translata*). Listed S2. This is a southern species that apparently finds scarce habitat in the north. Though fairly common in Westchester County, the Popolopen population is unique in the Highlands and Orange County.

- Lillypad Forktail (*Ischnura kellicotti*). Listed S2. The West Point populations are among the northernmost known.

- Brush-tipped Emerald (*Somatochlora walshii*). This species, listed S2/S3, was once more abundant when beaver-provided habitat was more common, but is now uncommon in southern New York State.

- Needham's Skimmer (Libellula needhami). This skimmer is only found in the tidal marshes of the lower Hudson, and is listed S2/S3.

Butterflies. An inventory of West Point butterflies was initiated in 1995 (Barbour, 1997). Originally planned for two years, because the first years were exceptionally poor for butterflies, the survey was extended into 1997. Of the total species identified, eight are designated as rare in New York State and six species are designated as regionally rare in southeastern New York State. Two are considered rare at West Point. These species and their rarity rankings are discussed below.

- Falcate orange-tip (*Anthocaris midea*). Listed as S3/S4, this species was found in three rich rocky woodland communities (Crow's Nest East Slope, Long Pond Mountain, Long Mountain) in association with its larval hosts, lyre-leaved rock-cress (*Arabis lyrata*) and smooth rock-cress (*A. laevegata*). While the species itself is listed as rare in New York, its habitat, rich rocky woodland, is not.

- Hackberry emperor (*Asterocampa celtis*). This species (S3/S4) was observed along the Hudson River shore in woodland edges and park-like areas. Its larvae are commonly associated with hackberry (*Celtis occidentalis*), which is abundant on West Point.

- Dusted skipper (*Atrytonopsis hianna*). All observations of this species (S3) were made within a few meters of its larval host, little bluestem (*Schizachirium scoparius*), in dry old fields, rocky summit grasslands, power line cuts, and road verges.

- Black dash (*Euphyes conspicua*). This species (S2/S3) was found in high abundance, due in part to its ubiquitous sedge larval hosts. Individuals were observed in both wetland and nonwetland sites. High counts were obtained at Johnson's Meadow, the Mine Torne Road-Route 293 wetland, and a small wetland on the power line cut south of Ridge Road near Route 6. The black dash appears to be common only in the southeastern part of New York.

- Edwards' hairstreak (*Satyrium edwardsii*). Ranked at S3/S4, this species is relatively common to West Point. Scrub oak (*Quercus ilicifolia*), the larval host of Edwards' hairstreak, is widespread on the installation.

- Northern hairstreak (*Satyrium favonius ontario*). The West Point distribution of this S1/S3-ranked species is unknown, though the one specimen found during the survey was located at the junction of Route 293 and Bull Pond Road. Its larval hosts are believed to be oaks.

- Horace's duskywing (*Erynnis horatius*). The habitat of this S3 species is open, dry, sunny areas. Its distribution on West Point is unknown, though two individuals were observed at Range 5 and the power line just south of the Range 5 road. Its larval hosts are oaks.

- Tawny emperor (*Asterocampa clyton*). This species is ranked as S3. Its habitat is woodland edges and parklike areas, and its larval host is the hackberry (*Celtis* sp.). Individuals were observed in the Eagle Rock Cemetery near Route 9W and on Constitution Island.

Butterflies found during the survey with a ranking of "regionally rare in southeastern New York State" include the brown elfin (*Callophrys augustinus*), Harris' checkerspot (*Chlosyne harrisii*), sedge skipper (*Euphyes dion*), Leonard's skipper (*Hesperia leonardus*), cobweb skipper (*Hesperia metea*), and pipevine swallowtail (*Battus philenor*). The two species designated as "rare at West Point" are the black swallowtail (*Papilo polyxenes*) and comma (*Polygonia comma*).

Rare Plants. An inventory of rare plants on USMA conducted in 1994/1995 (Barbour, 1996) indicated the presence of 63 special status plant species. A follow-up survey was conducted during the 2000

growing season (4 May to 19 October) (Barbour, 2001). Of the 75 species placed on the West Point rare plant list, 62 have been state-rare (NYNHP-listed), while 18 have been species rare in the Hudson Highlands region or rare on West Point lands (Barbour, 2001). Of the 62 state-rare species, 13 have been relegated to the NYNHP Watch List, and 7 have been dropped from all NYNHP lists, leaving 22 West Point plant species on the NYNHP Active List. USMA also keeps information on 6 possibly extirpated species in the event they reappear. The total number of sites identified with special status plants is currently 230. Table 3-31 lists the rare plants at USMA, along with their rarity status, habitat, and frequency and distribution. A plan for the protection of these rare species was developed in 1996 and is updated annually (Deschenes, 2002) (Appendix H).

Table 3-31
Rare Plants at USMA[1]

Species Name	Common Name	NYS Legal Status	West Point Status
S1 Plants			
Aristolochia serpentaria	Virginia Snakeroot	Endangered	Secure
Carex aggregata	Glomerate Sedge	Endangered	Unknown
Carex striatula	Stripe-fruited Sedge	Endangered	Apparently Secure
Elatine americana	American Waterwort	Endangered	Secure
Geranium carolinianum	Carolina Cranesbill	Endangered	Apparently Secure
Juncus debilis	Weak Rush	Endangered	Apparently Secure
Potamogeton diversifolius	Pondweed	Endangered	Secure
Scripus georgianus	Georgia Bulrush	Endangered	Possible at Risk
S2 Plants			
Cardamine longii	Long's Bittercress	Threatened	Secure
Carex abscondita	Thicket Sedge	Endangered	Unknown
Carex mesochoria	Midland Sedge	Endangered	Apparently Secure
Digitaria filiformis	Slender Crabgrass	Threatened	Secure
Hottonia inflata	Feathefoil	Threatened	Secure
Linum medium var. texanum	Texas Wild Flax	Threatened	Declining
Oxalis violacea	Violet Wood Sorrel	Threatened	Secure
Podostemum ceratophyllum	Riverweed	Threatened	Secure
Polygonum careyi	Carey's Smartweed	Threatened	Unknown
Potamogeton pulcher	Pondweed	Threatened	Secure
Ranunculus micranthus	Small-Flowered Crowfoot	Threatened	Secure
Utricularia radiata	Small Floating Bladderwort	Threatened	Secure
S2S3 Plants			
Callitriche terrestris	Pigmy Starwort	Threatened	Secure
Carex cumulata	Cluster Sedge	Threatened	Secure
S3 Plants			
Asclepias purpurascens	Purple Milkweed	Unprotected	Possibly at Risk

Table 3-31
Rare Plants at USMA[1]

Species Name	Common Name	NYS Legal Status	West Point Status
Betula nigra	River Birch	Unprotected	Secure
Carex albicans var. emmonsii	Emmon's Sedge	Unprotected	Secure
Carex bicknellii	Bicknell's Sedge	Threatened	Unknown
Carex bushii	Bush's Sedge	Threatened	Possibly at Risk
Carex lupuliformis	False Hop Sedge	Rare	Apparently Secure
Carex seorsa	Weak Stellate Sedge	Threatened	Secure
S3 Plants (continued)			
Corydalis flavula	Yellow Harlequin	Unprotected	Secure
Lechea racemulosa	Racemed Pinweed	Rare	Secure
Lespedeza violacea	Violet Bush Clover	Rare	Secure
Polygonum tenue	Slender Knotweed	Rare	Secure
Utricularia geminiscapa	Gemmed Bladderwort	Unprotected	Apparently Secure
Woodwardia areolata	Netted Chainfern	Unprotected	Secure
Delisted Species			
Aster schreberi	Schreber's Aster	Unprotected	No Longer Monitored
Carex agyrantha	Hay Sedge	Unprotected	No Longer Monitored
Chenopodium standleyanum	Standley's Goosefoot	Unprotected	No Longer Monitored
Cunila origanoides	Dittany	Unprotected	No Longer Monitored
Pilea fontana	Green-Fruited Clearweed	Unprotected	No Longer Monitored
Uticularia biflora (gibba)	Two-Flowered Bladderwort	Unprotected	No Longer Monitored
Rare in the Hudson Highlands			
Arctostaphylos uva-ursi	Bearberry	Unprotected	Generally, these plants are out of their normal distribution range. They are not formally monitored.
Betula cordifola	Mountain Paper Birch	Unprotected	
Eupetorium altissimum	Tall Bonesett	Unprotected	
Eupetorium sessilfolium	Upland Bonesett	Unprotected	
Lespedeza nuttallii	Nuttall's Bush Clover	Unprotected	
Mitella diphylla	Miterwort	Unprotected	
Mitella nuda	Naked miterwort	Unprotected	
Sorbus Americana	Mountain Ash	Unprotected	
Rare on the West Point Reservation			
Bartonia virginica	Bartonia	Unprotected	Generally, these plants are specific to habitats uncommon to West Point.
Dicentra cucullaria	Dutchman's Breeches	Unprotected	
Drosera intermedia	Narrow-Leafed Sundew	Unprotected	
Drossera rotundifolia	Round-Leaf Sundew	Unprotected	
Glyceria grandis	Grand Manna Grass	Unprotected	
Hedeotis cerulea	Bluets	Unprotected	
Juncus torreyi	Torrey's Rush	Unprotected	
Sencio obovatus	Round-Leaved Ragwort	Unprotected	
Thelipteris simulata	Massachusetts Fern	Unprotected	
Rare on the West Point Reservation (continued)			
Vaccinium oxycoccos	Small Cranberry	Unprotected	
Vaccinum macroarpon	Large Cranberry	Unprotected	

Note: For a definition of the NYS Natural Heritage Rankings and the NYS legal rankings, see the Rare Plant Management Plan in Appendix H.

3.20 CULTURAL RESOURCES

The natural setting at West Point, cut and shaped by receding glaciers ca. 15,000 years before the present (B.P.), provided a rich environment for human occupation throughout prehistory and into the historic period, when the land began to be purchased for use by the United States, beginning in the late 18th century.

3.20.1 Prehistoric Period Resources

Current evidence suggests that the earliest humans on this continent arrived approximately 12,500 years B.P. The prehistoric period in the New World dates to that time. Prehistory in North American is divided into three broad time periods: Paleo-Indian, Archaic, and Woodland.

As of 2001, 150 sites were identified at USMA. This number includes 29 prehistoric sites, 46 revolutionary war sites, 32 Early Settlement Period sites, five Early Industrial Sites, 26 multicomponent sites (including sites with both prehistoric and historic components), and 12 unidentified historic sites (foundations, and artifact scatters) (Geo-Marine, Inc., 2001). Site types range from prehistoric Archaic sites in rockshelters (Round Pond rockshelter no. 1, USMA #46a) through various 18th-century hutments and batteries, to a 19th-century residence (Denton farm, USMA #70b). A total of 65 sites have been identified as eligible for listing on the National Register of Historic Places (NRHP) (Geo-Marine, Inc., 2001). Sixty-two sites are potentially eligible, and 23 sites are identified as ineligible. The USMA Integrated Cultural Resources Management Plan (ICRMP) provides a list of all the sites (Geo-Marine, Inc., 2001).

Paleo-Indian Period (12,500 B.P. to 10,000 B.P.). The Paleo-Indian Period is the earliest evidence of humans in the New World. The climate during this time period was cooler and wetter than the present environment and large animals, such as mammoth and giant sloth, flourished. Paleo-Indian peoples lived in small, mobile groups of hunter-gatherers and maintained low population densities. They relied on wild plants and animals for food, clothing, and other aspects of their material life. The spears they used for hunting are identified by a manufacturing technique called fluting, where one large flake is driven off the spear point longitudinally.

Paleo-Indian sites have been identified near USMA. They include Duchess Quarry Cave (Orange County) and West Athens Hill (Greene County). Potential for these sites within USMA is considered to be high (The Research Foundation at SUNY-Albany, 1995). Faunal remains of mammoth, bear, and caribou, all food sources for these peoples, have been found in Orange County. No Paleo-Indian sites have been identified within the boundaries of USMA.

Archaic Period (9,000 B.P. to 3,700 B.P.). The Archaic Period is divided into three time frames, Early (circa (ca.) 9,000 B.P. to ca. 8,000 B.P.), Middle (ca. 8,000 B.P. to ca. 6,000 B.P.), and Late (ca. 8,000 B.P. to ca. 6,000 B.P.). Between ca. 10,000 B.P. and ca. 5,000 B.P. substantial ecological changes occurred across the North American continent. These changes were accompanied by a change from Paleo-Indian to Archaic traditions.

The colder Pleistocene Period and its associated flora and fauna gave way to the warmer, wetter Holocene Period, with an accompanying change in plants and animals. Coniferous forests were gradually replaced with deciduous forests, and mammals included white-tail deer, turkey, bear, elk, and smaller mammals and birds. These animals became a major source of food for the emergent Archaic and Woodland peoples. In particular, the remains of foods found at Archaic sites include white-tail deer, bear, turkey and small mammals, nuts (acorn, butternut and hickory), wild greens, fruit, and fresh and salt-water shellfish. As these indigenous peoples adjusted to this changing environment, their technologies, camps, and homes gradually changed as well. Archaic sites include special-purpose camps, for example, for hunting or fishing, longer term 'base' camps, seasonal camps in upland, mountaintop, or riverine environments, and camps at stone quarries and in rockshelters. People at this time still lived a mobile, nomadic life, depending on wild plants and animals. During the Late Archaic Period the ecology and climate became much the same as they are today, with a higher sea level and wetter climate than the previous period. This change led to an increase in floral and faunal diversity. With these changes a population explosion occurred, with the result that archaeological sites that date to the Late Archaic Period are common throughout the Northeast. Associated with this increase in size, number, and diversity of settlements is the development of food preparation and storage pits, which indicate changes in social and economic patterns.

To date 20 Archaic sites or sites with Archaic period remains have been identified within the USMA. These are: Site #7, at the Marine Barracks, Crow's Nest Mountain Shelter, a rockshelter, Site #12LA at Redoubt no. 4, and the Garrison Site (The Research Foundation at SUNY-Albany, 1995, Geo-Marine, Inc., 2001). Other sites with Late Archaic components are Rockshelter USMA-18, Gravel Hill Battery (USMA-39), Stone Ramp (USMA-40), Mineral Springs (USMA-42), the Round Pond Rockshelters, numbers 1, 2, and 3, The Plain (USMA-48), the Superintendent's Quarters (USMA-51), the Field House Path (USMA-60), and Late Archaic components at Trophy Point (USMA-51), Roman's Battery (USMA-63), Round Point Rockshelter #6 (USMA-97), Gee's Point (USMA-110), and PCI/WP#3 PX. A possible Early Archaic component was identified at PCI-WP#4 PX.

Transitional Period (3,700 B.C. to 1,300 B.C.). Some archaeologists identify this period between the more traditionally known Archaic and Woodland Periods, as marking a distinct time of transition between mobile peoples who relied on hunting and gathering of wild plants and animals and more settled groups that began to rely on domesticated plants as a dietary supplement. This period is characterized by the appearance of carved steatite bowls, the introduction of projectile points that are "fishtail"-like in appearance, and the first evidence for true fired ceramic vessels. Sites from this period are located near rivers, and include inland rockshelters, and sites on high bluffs, floodplains and near inland streams.

Two Transitional Period sites are located within USMA boundaries. One is the Bog Meadow Rockhouse Site, a rockshelter located near Bog Meadow Road. It was excavated in the 1930s by Max Schrabisch. The other is a Transitional Late Archaic site, Linck Area X (USMA-58).

Woodland Period (700 B.C. to A.D. 1600). The Woodland Period is marked by the introduction of true ceramic pottery. This period was similar to the Late Archaic Period in climate and ecology. However, dramatic changes in social structure occurred during this time, especially a change from somewhat egalitarian hunter-gatherers who relied primarily on wild plants and animals, to villagers who practiced agriculture and lived in stratified, hierarchical societies with "chiefs." Remains of Woodland Period settlements are larger and distinct from Archaic Period sites.

Along the Hudson River Valley, the Early Woodland Period also includes elaborate burials. In this region, the Early Woodland Period includes the site of the distinct Meadowood Culture also. The Late Woodland

Period witnesses the introduction of maize horticulture. Archeological remains include the appearance of stockaded villages, ceramic pottery, storage pits and hearths, and smaller stone projectile points.

Nine sites within USMA yielded Woodland Period artifacts. Woodland Period components were found at the Marine Barracks (USMA-7) and at Roman's Battery (USMA-63). A Middle to Late Woodland site was identified at Trophy Point (USMA-51), and a Late Woodland component was found at Stone Ramp (USMA-40). Middle and Late Woodland components were also found at Gee's Point (USMA-110) and at the Route 6 Rockshelter (#A07120-000212). Late Woodland remains were discovered at the Round Pond Rockshelter #6 (USMA-97) and at Breezy Point (USMA-102). Finally, an Early to Middle Woodland component was found at the Crow's Nest Rockshelter (Geo-Marine, Inc., 2001).

3.20.2 Historic Period Resources

Historic Period archaeological sites include Revolutionary War period sites, especially in the area surrounding Dassori Pond. Other historic period archaeological sites include early settlement sites (from the 18th century); early industrial sites, especially remains of iron works; and sites related to the development of USMA, especially in the Plain.

European Contact Period. The Algonkian-speaking Munsee lived in the region that includes what is now the USMA during the late prehistoric period. By the close of the 17th century, most of these groups had migrated to west of the area.

The Dutch were the earliest explorers to systematically explore the Hudson Highlands Region. In 1624 they established a commercial trading post at Fort Orange. In 1664 the Dutch gave over their lands to the English, and Orange County was established in 1683. The region known as the Hudson Highlands, which includes USMA, grew in population during the colonial period, and towns and farms were settled. Private farmers owned and cultivated what is now the USMA until parcels were purchased by the U.S. Government and the area was consolidated into a military fortification. The Queensboro Iron Furnace, an iron-smelting furnace, was built in the late 18th century. It is located about 150 feet north of Popolopen Creek, off Queensboro Intake Road. The original tract included a sawmill, and three houses. The furnace closed in 1800, was sold in 1810, and had been operating at least through 1838. The Federal Government

restored it in 1912, and the property on which it still stands was purchased by USMA in 1942 (National Park Service, 1983).

Historic Period. On May 5, 1775, the Continental Congress decided to fortify "each side of Hudson's River" (Hasting 1889-1914:505-508 in The Research Foundation at SUNY-Albany, 1995). Constitution Island, then known as Martelaer's Rock, was fortified first. In 1777, during the Revolutionary War, British General William Tryon burned the fortifications on Constitution Island. The next year, in 1778, new defenses, consisting of six fortified units spaced along in a row, were constructed. The main garrison was named Fort Clinton. Above Fort Clinton is Fort Putnam. Below that fort, covering the southern approaches, Forts Wyllis, Meigs, and Webb were constructed. Today only Forts Wyllis and Meigs exist. Four redoubts were also constructed, above and to the west of Fort Putnam. Three additional redoubts were constructed on Constitution Island; 5 and 6 are situated on the east side and are still in fair condition. Redoubt 7, which is well preserved, is located at the tip of the Island.

Other construction included barracks and hutments along the river bank. During this period a chain and boom were laid across the Hudson River as further defense against British intrusions. Remains of the chain exist today near Trophy Point. During the Revolutionary War, George Washington used West Point as his headquarters. Later in the War, Major General Benedict Arnold became the Fort's commander, while secretly planning to hand the Fort to the British. During his leadership, the fort's physical plant deteriorated. While Arnold was completing plans to deliver West Point to the British, his British counterpart, Major Andre, was arrested, and the plans fell into the hands of the Americans. Benedict Arnold escaped from West Point on his ship, the Vulture.

After the Revolutionary War, West Point no longer served a critical role as a defensive fort. On July 4, 1802, the USMA was officially established with the mission of training cadets. As the Academy grew, new buildings were constructed. For example, in 1814, a refectory and dormitory were built. Today the oldest structure at the USMA is the Superintendent's Quarters, built in 1820, during this period of expansion. Under the command of Sylvanius Thayer, the Superintendent from 1817 to 1833, more improvements and construction occurred. A cemetery was laid out in 1816-1817, and included a grounds keeper's quarters, the old Cadet Chapel, and a greenhouse. A communal garbage dump was instituted in the 1820s, and running water was installed.

During the Civil War, graduates and cadets of USMA, including the Military Academy Detachment of Dragoons, participated on both sides of the fighting. After the war ended, the curriculum changed to include liberal arts, as well as traditional training in engineering and mathematics.

After the Civil War the USMA continued to expand. African-Americans were admitted to USMA beginning in 1870, and the first African-American graduate was Henry Flipper, who graduated in 1877. New structures were constructed during the last half of the 19th century, also. These include an administration building in 1871, new residences in 1872, located north and west of the cemetery, a new observatory in 1882, the Cadet Hospital in 1884, the gymnasium in 1891, and the Soldiers' Hospital, finished in 1894. The Edward V. Kinsley estate, 225 acres, was purchased in 1889. In 1908, Constitution Island, a 280-acre estate was gifted to the USMA.

During the early part of the 20th century a plan to renovate much of the campus was begun. The number of cadets was increasing, and the physical plant was old and somewhat deteriorated, and lacked modern facilities. During this period, new building construction included the Mess Hall, the Riding School, the Catholic Chapel and Rectory, the Gymnasium, the heating plant, and the Cadet Chapel. In addition, a remembrance in the form of the Buffalo Soldiers Field was created in 1908 to honor the 19th-century African-American 9th and 10th Cavalry Regiments (The Research Foundation at SUNY-Albany, 1995; National Park Service, 1984).

Starting in the 1930s USMA began to purchase additional property as the number of cadets almost doubled (National Park Service, 1984). As part of these purchases, the Queensboro Furnace became part of USMA in 1942. It is now designated the Queensboro Furnace Historic District. New construction continued throughout the 20th century, including new cadet housing and officers quarters in the 1960s, and the establishment of New South Post, with the purchase of Lady Cliff College in the 1980s on which it is located.

3.20.3 Historic Structures

The ICRMP lists all the USMA buildings and structures. A total of 433 have been identified as eligible or potentially eligible for listing on the NRHP; 23 still require evaluation; and the remaining 506 have been identified as not eligible for listing on the NRHP (Geo-Marine, Inc., 2001).

In 1960 USMA was listed as a National Historic Landmark. Approximately 2,500 acres of USMA are designated an Historic District, which includes about 550 buildings. Of these, 227 were identified as possessing preservation significance on the basis of an Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) survey conducted by the National Park Service (National Park Service, 1984). The survey inventoried every building at USMA except for identical or similar buildings that were of no architectural or historic significance. Also, in outlying areas, one representative structure was surveyed among many similar types, e.g., range towers. The survey also included memorials and monuments, except for those within the cemetery, unless of outstanding significance. All the buildings surveyed were classed into five categories, Category I (outstanding), Category II (significantly contributing to the historic integrity of the district), Category III (contributing), Category IV (noncontributing), and Category V (intrusions) (see Tables 3-32 and 3-33).

Category I and II historic properties should not be altered or demolished. Category III structures are not considered NRHP eligible as individual buildings. However, Category III buildings that are within the district should be treated as contributing buildings, and those outside the District should not be demolished or altered in a way that affects their historic appearance. No preservation efforts are required for Category IV buildings to date, and Category V buildings should be removed when feasible (National Park Service, 1984).

The survey found that the period and mission of most historic value and national importance at USMA was its teaching mission, rather than its mission as a military installation, although it is one of the oldest installations in the United States. Therefore the survey assigned highest importance to structures that represent aspects of the teaching mission of USMA. In addition, the survey identified one unifying architectural type, the Gothic style, as over-arching at USMA.

Table 3-32
Category I Buildings

Building Number	Name
21, 25, 32, 34, 42, 45, 48, 116, 118, 120, 122	Cram, Goodhue and Ferguson Multi-family Housing
60	Chaplain's Quarters
100	Superintendent's Quarters
101	Commandant's Quarters
102	Dean's Quarters
103, 105, 107	Professors Row
126	Enlisted Men's Quarters
146	Married Enlisted Men's Quarters
147	Cadet Restaurant
374	Hospital Steward's Quarters
600	Administration Building
601	Thayer Hall
604	Power House
620	Artillery Barracks
624	Cavalry Barracks
635A, 635B, 637, 671, 671A	Ordnance Compound
689	Old Cadet Chapel
696	Railroad Station
722	Cadet Chapel
747	Old Central Barracks
751	West Academic Building (Pershing Barracks)
753	East Academic Building (Bartlett Hall)

Table 3-33
Category II and III Buildings

Category II		Category III	
Building Number	**Name**	**Building Number**	**Name**
109	Officer's Quarters	149	Bachelor Officers' Club
602	Grant Hall	603	Officers' Club
605	Cullum Hall	606	Cadet Hospital
622, 626	Stables	618	Gun Shed
727	Gymnasium	635	Ordnance Compound
735	Scott Barracks	738, 740	Sherman and Lee Barracks
745	Washington Hall (older sections only)	752	Mahan Hall
1183	Warner House	757	Library

In 2000, a re-evaluation of the National Historic Landmark District (NHLD) was completed (Prior, 2000 in Geo-Marine, Inc., 2001). The evaluation also identified 19 historic landscapes as eligible for listing on the NRHP. Table 3-34 lists the landscapes. The re-evaluation identified 328 buildings and structures as potentially contributing elements to the district.

Table 3-34
National Register-Eligible Historic Landscapes

The Plain	Kosciuszko's Garden
West Point Cemetery	Delafield Pond
Flirtation Walk	Professors Row
Doubleday Field	Academic Area
Buffalo Soldiers Field	Thayer/Wilson Housing Area
Target Hill Athletic Field	Thayer/Wilson Housing Expansion Area
North Athletic Field	Scenic Roadways (certain areas only)
Howze Field	Lee Housing Area
Superintendent's Garden	Forest and Park Woods (certain areas only)
Lusk Reservoir and Lusk Housing Area	

Source: Geo-Marine, Inc., 2001.

Buildings at Camp Buckner were inventoried during 2000 (Sabo, et al., 2001 in Geo-Marine, Inc., 2001). A total of 97 buildings were inventoried. Three iron industry properties and 19 World War II-era properties were identified as eligible. No Cold War era buildings were recommended as NRHP eligible.

In 2000 the bridges within USMA were inventoried (Nolte and Cinquino, 2000 in Geo-Marine, Inc., 2001). Of 34 bridges inventoried, 16 were identified as contributing to the NHLD. The consultants also recommended two bridges located outside of the NHLD as NRHP eligible.

A study of five historic landscapes was also completed in 2001 by USACERL (Timlin and Loechl, 2001 in Geo-Marine, Inc., 2001). The landscapes examined were the Plain, Flirtation Walk, Kosciuszko's Garden, the West Point Cemetery, and the Superintendent's Garden.

The U.S. Bullion Depository, built in 1938, also known as the West Point Silver Depository, is also listed on the NRHP (National Park Service, 1988).

Remants of some of the old iron mines are still present on the WPMR and provide habitat for some wildlife species, primarily bats.

3.20.4 Previous Work Within USMA

Archaeological excavations and surveys have been conducted within the boundaries of USMA since the late 19th century, and a number of prehistoric and historic sites have been identified. To date approximately 2,100 or 13 percent of USMA has been systematically surveyed for archaeological sites. A total of 13,900 acres remain to be surveyed for archaeological sites (Geo-Marine, Inc., 2001).
Seven projects involving management plans have been completed for USMA. These include a comprehensive HABS/HAER survey (National Park Service, 1984); a survey of family housing quarters which includes preservation standards and guidelines (Mariani and Associates, Architects, 1987); and a historic resources management plan, which includes locations of prehistoric and historic properties, drawings, and preservation and maintenance guidelines for maintaining significant properties and was completed in association with the Advisory Council for Historic Preservation (USMA, 1988). This last plan is maintained as a set of HyperCard files. A preservation plan for Revolutionary War Period sites located near Stoney Lonesome II Housing Facility also included preservation plans for maintaining Redoubts 1 and 2 (Benton, 1995), and a historic building survey for the Queensboro Iron Works also included a management plan for maintenance (Benton, 1995).

A management plan to manage the cultural resources, including prehistoric and historic resources within the Academy's boundaries, was completed in 1995 (The Research Foundation at SUNY-Albany, 1995). This plan developed a predictive model that identifies areas of high, medium, and low sensitivity for the presence of archaeological sites. The project also included development of a set of archaeological sensitivity maps available at USMA on MapInfo GIS software. All these resources are available at USMA.

An historic landscape management plan was prepared in 2001. The plan provides guidelines to identify and manage the historic landscapes within the Main Post area (Loechl, et al., 2001 in Geo-Marine, Inc., 2001).

Most recently an Integrated Cultural Resources Management Plan (ICRMP) was completed for USMA, in 2001 (Geo-Marine, Inc., 2001). The purpose of the plan is to serve as a five-year plan for the integrated management of the historic properties and cultural resources contained within the limits of USMA, West

Point. The plan covers the years FY 2001 to 2006. The ICRMP includes Standard Operating Procedures (SOPs) as guidelines to manage the historic resources within USMA. It also includes a list of all USMA buildings and structures with their NRHP-eligibility status. In addition, Table 3-1 of that document lists all archaeological and architectural history surveys and studies completed at USMA.

A Programmatic Agreement (PA) was signed on June 22, 1987, among the Department of the Army, the Advisory Council on Historic Preservation, and the New York State Historic Preservation Officer (SHPO) for the Operation, Maintenance, and Development of USMA at West Point, New York. The agreement ensures the development of a Historic Preservation Plan, in accordance with AR 420-40, to manage the historic, architectural, and archeological resources at USMA (Advisory Council on Historic Preservation, 1987). A new PA is currently being routed for signature (Halin, personal communication, 2002). This PA is an agreement among the USMA, the Advisory Council on Historic Preservation, and the National Park Service regarding implementation of SOPs concerning inventory and maintenance and protection of cultural resources at USMA (Geo-Marine, Inc., 2001).

Archaeological Surveys. Archaeological surveys are conducted prior to any timber harvest, a potentially ground disturbing activity, to identify the location of any archaeological site and to determine its potential eligibility for inclusion in the NRHP. All archaeological sites that have been identified are avoided by the timber harvest operations.

3.21 LAND USE

The lands that now constitute West Point were historically used for tree harvesting, agriculture, and settlement. During the 19th and 20th centuries, much of the land was deforested to provide timber to the charcoal and brick industries in the region (Barbour, 1995a). After being acquired by the U.S. government in the 1930s and 1940s, most of the lands have been used to support the military mission of USMA.

The present land uses on West Point are the result of the lack of buildable areas, past policy objectives, and support for the military mission. Most of the lands on the Main Post are highly developed or are considered undevelopable due to steep slopes. Recent new construction has been concentrated in the Stony Lonesome Area. In addition to the Stony Lonesome II housing area, there is a Post Exchange, a

shoppette, a gas station with two service bays, and a fire station. As indicated in Table 3-35, most lands on the Reservation are used to support field training and maneuvering and therefore have not been developed. For planning purposes, USMA lands have been divided into four land use zones based on functional categories which reflect the missions (Galloway, 1988). A description of these land use zones and their uses are provided in Table 3-36.

Table 3-35
Land Categories on West Point

Habitat Type	Acreage
West Point Main Post and Reservation	
Open Water	552
Wetlands	567
Deciduous Shrubland	109
Deciduous Forest	11,308
Evergreen Forest	188
Built-up	1,393
Open Space	1,576
Constitution Island	
Wetland	13
Deciduous Forest	262
Built-up	4
Open Space	1
Total Acreage	15,973

Source: USMA, 1994a.

Table 3-36
Land Use Zones at West Point

Land Use Zone	Uses
Cadet	Academic, intramural athletic, billeting, and parading. The center of the Cadet zone is Washington Hall, and the zone was designed so that anything within the zone was less than a 10 minute walk from the center.
Cadet Support	Intercollegiate athletic fields and some cadet support facilities.
Post Support	Housing, commercial, and service support to staff and faculty, non-West Point military personnel, and military retirees.
Recreational, Industrial, Field Training	Building and storage area support for industrial operation, field training areas, recreation areas, and open space.

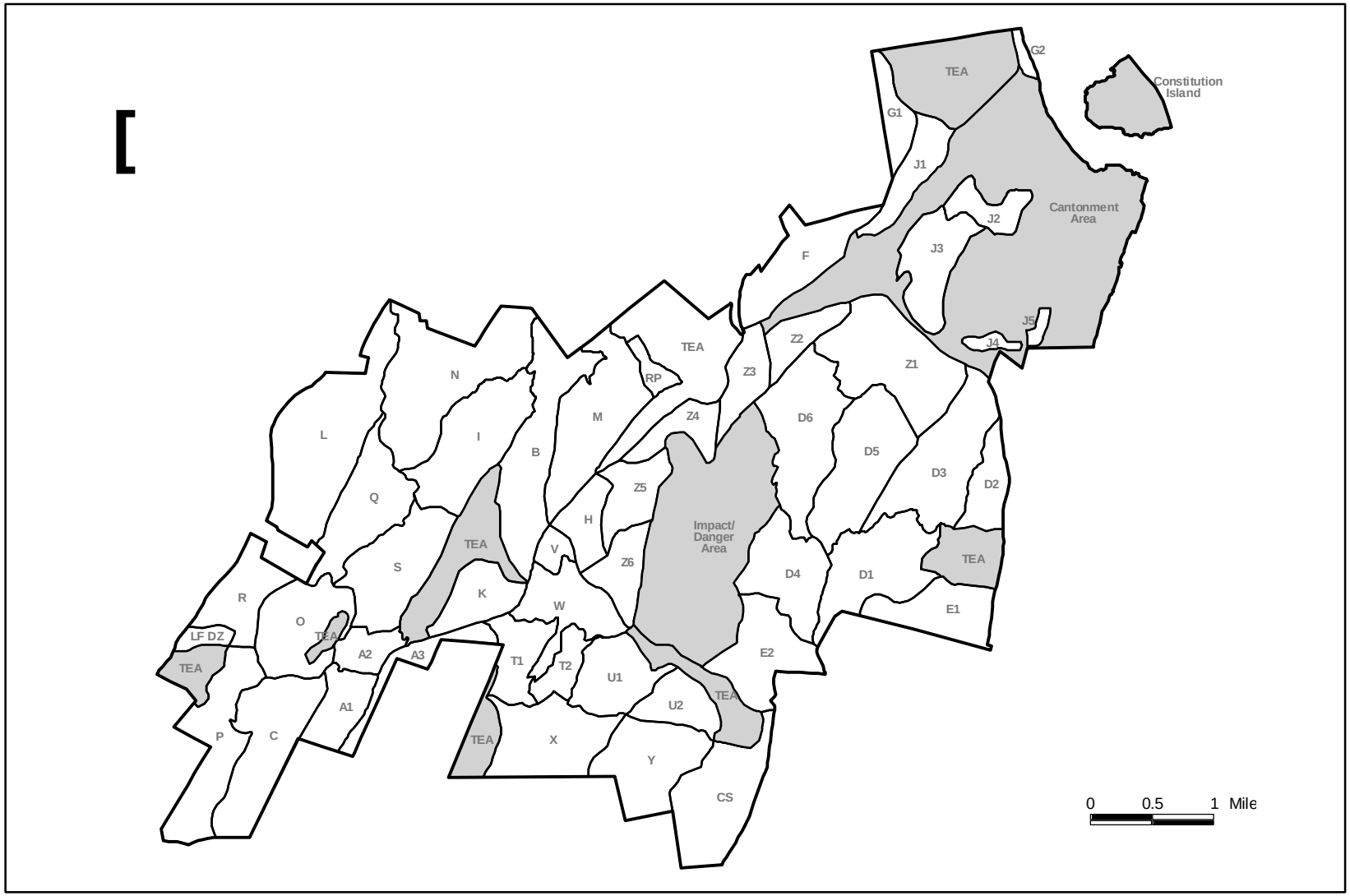
Source: Galloway, 1988.

Main Post. The Main Post of West Point is the developed portion of the installation and contains the majority of buildings and structures. It generally encompasses the area bounded by the Hudson River on the east, Route 218 on the north, Route 9W on the west and the Village of Highland Falls on the south. Land uses on the Main Post include academic, administrative, limited military field training, recreation, facility support and residential. The golf course and ski area are both on the main post.

Golf Course. The golf course at West Point is located on the Main Post adjacent to NYS Route 293 on the northwest, NYS Route 218 on the northeast and is bisected by U.S. Route 9W. The course is crossed by Highland Brook, Sinclair Pond Brook, and Cascade Brook, flowing in a southeasterly direction. The golf course is open to West Point military government personnel, visiting military personnel, military retirees, cadets, and civilian employees. The course is a major recreational facility for the installation's community and has averaged 20,000 to 22,500 rounds played per year since its opening in 1997 (USMA, 1993). The DCFA manages the golf course upkeep and maintenance; however, pesticide application is done through the DHPW pest management contract for USMA, not by golf course personnel.

Ski Area. The ski area at West Point is located on the Main Post to the south of the U.S. Silver Depository and adjacent to NYS Route 218 on the northeast. The ski area is open to West Point military government personnel, visiting military personnel, military retirees, cadets, and civilian employees. The ski area is not open to the general public, but family members and guests of the eligible users may use the facility. The CRD of DCFA manages the ski area and offers a well-rounded ski program that includes lessons, competitive events and recreational skiing. There is a full service snack bar located in the lodge. When natural snowfall is low, water from the Stony Lonesome Water Treatment Plant is used to make snow. Snowmelt run-off from the ski slope flows into Sinclair Pond Brook.

Ranges and Training Areas. Military training of cadets is conducted on 49 training areas (see Figure 3-7 and Table 3-37), ten ranges, and one artillery and three mortar firing points on over 14,000 acres of land. Most of the ranges direct weaponry into the approximately 2,000 acres of land on the reservation that are designated as permanent impact/dud danger areas. Ranges and munitions used on the installation are summarized in Table 3-38, and installation training facility usage is summarized in Table 3-39.



LEGEND

B Training Area and Name

Impact/Danger Areas and TEAs (Training Exclusion Areas)

Training Areas

United States Military Academy
West Point, New York
Figure 3-7

Table 3-37
Training Areas and Acreage

Training Areas	Acreage	Training Area	Acreage
A1	151.78	L	606.25
A2	98.84	LF DZ	43.39
A3	113.97	M	400.38
B	417.87	N	558.18
C	381.39	O	291.96
CS	362.72	P	347.82
D1	353.15	Q	306.89
D2	137.38	R	204.86
D3	408.23	RP	49.73
D4	280.34	S	337.07
D5	393.31	T1	160.01
D6	405.79	T2	93.67
E1	227.88	U1	219.33
E2	280.75	U2	145.25
F	279.71	V	50.38
G1	104.71	W	243.88
G2	24.67	X	328.67
H	129.02	Y	313.54
I	380.72	Z1	458.44
J1	156.28	Z2	119.74
J2	106.66	Z3	140.40
J3	235.54	Z4	127.16
J4	29.54	Z5	163.81
J5	21.29	Z6	145.06
K	166.99		
		TOTAL	**11,504.40**

Source: Coleman, 1995.

Several areas on the installation and all of Constitution Island are Training Exclusion Areas (TEAs) (Figure 3-7). These areas include Camps Buckner and Natural Bridge, which provide administrative and housing in support of CFT, and Round Pond, Bull Pond, Lake Frederick, and Morgan Farm, which are recreational areas. The other TEAs are off-limits to most training activities because of the cultural, historical and wildlife resources that exist there.

Table 3-38
Ranges and Munitions Used at West Point

Range Number	Formerly	Weapons Used
1	1	Hand grenade
2	2	81 mm, 4.2 inch mortars, and 105 mm Howitzer
4	3B	5.56 mm (include SAW) or weapons requiring less than 3,000 m SDZ
5	3A	Weapons firing 7.62 mm or less, including SAW
7	4D	LAW, M72, M136, At4, M18, and MK19
8	4C	40 mm grenade launcher, M203, M79, and MK19
9	4B	Recreational pistol range
10	4A	Trap and Skeet
11	5	Weapons firing 5.56 mm or less, excluding shotguns.
12	6	Demolitions

Source: USMA, 1996c.

The training areas and camps (i.e., Buckner and Natural Bridge) at West Point are able to accommodate 2,000 to 3,000 soldiers and cadets during the summer training period. Other uses on training areas include a rappelling and mountaineering site and one parachute drop zone.

Training areas are used throughout the year but are most heavily used from May until August when training areas are used exclusively for field training by the U.S. Corps of Cadets. From September to April, the training areas are used by military units at West Point (e.g., 1st BN 1st IN, MEDDAC (Medical Department Activity)), National Guard and Reserves units, Reserve Officer Training Corps (ROTC) units, Treasury Department, Immigration and Naturalization Service, local gun clubs, local police departments, and other law enforcement agencies. A Summer Training Task Force, is stationed at West Point each summer to assist in the training of Cadet Third and Fourth classes. Primary billets for the Task Force are at Camp Natural Bridge.

Crow's Nest. Crow's Nest is a dud danger zone located in the northern part of the reservation. Though not currently in use, this area has been used in the past as an impact area for artillery fire, and therefore, has been designated as off-limits (USMA, 1989).

Table 3-39
USMA Installation Training Facility Usage

Facilities	Number of Facilities	Average Days Used (FY 99 – 00)
Basic Marksmanship Facilities		
10 – 25 mm Range	1	71
Field Fire Automated	1	54
Record Fire RETS	1	54
Pistol Range – 9 mm	1	42
Grenade Launcher/AT-4/Claymore	2	40
Collective Live-Fire Facilities		
Ambush L-F Sites	3	48
Indirect Fire Facilities		
Mortar Range	2	17
Light Artillery	1	17
Observation Points	2	17
Maneuver Training Areas		
Light Maneuver Areas	45	1,126
Other Training Facilities		
NBC	1	12
Combat Pit	1	24
Rappel Site	2	27
Drop Zone	1	16
MOUT Site	1	65
Land Navigation	3	49
Special and Other Live-Fire Facilities		
Bayonet Assault Course	1	24
Hand Grenade Familiarization	1	17
Light Demolition	2	22
Confidence Course	4	96
Skeet Range	1	51

Source: USMA, 2002.

Camps Buckner and Natural Bridge. Camp Buckner is located at Popolopen Lake and Camp Natural Bridge is a satellite camp of Camp Buckner located approximately 0.5 mile from Camp Buckner. Camp Buckner has administrative buildings and provides summer housing for cadets during CFT. Camp Natural Bridge provides housing for support/training personnel (e.g., 10th Mountain Division). The Camps are located off of Route 293 about 6 miles west of the Main Post.

Bivouac Sites. Bivouac sites are located within Ranges 1 through 6 and the following Training Areas: B2, C, CS, H, J, K, L, N, O, P, R, T1, T2, U2, V and W (USMA, 1996c). Bivouac sites typically have a latrine located within 200 meters of the site.

Master Plan. The Master Plan for West Point was completed in 1997 and addresses future land use issues.

3.22 FACILITIES

Facilities at West Point include an extensive transportation network and utilities systems. The transportation network links West Point internally by roadways and externally by roads, water, and rail. Utilities that serve West Point include potable water, wastewater, storm drainage, electricity, fuel oil, steam, and communications systems.

3.22.1 Transportation System

Roadways. Roadways on the installation are maintained by DHPW and traffic is controlled by the Military Police (USMA, 1996a). The roads on the Main Post, which consist of a double spine layout, were developed in response to the topography of the land as well as the historic and scenic nature of the area (USMA, 1989, 1996a). All roads on West Point are hard-surfaced with designed drainage. Traffic circulates throughout the Academy by means of a curving, continuous roadway consisting of Mills Road and Washington Road. This roadway runs from Thayer Gate on the southwest of the installation to Washington Gate (USMA, 1989). The more heavily used spine is that of Thayer Road and Washington Road.

On the reservation, US Route 9W is the major divided state highway, which runs for 3.5 miles through West Point. There are approximately 16 miles of paved secondary roads which provide access within the reservation, including NY Route 293, which is the major east-west road traversing the reservation. In addition, there are approximately 60 miles of unimproved roads (generally referred to as Range Roads) that provide access to all of the training areas and ranges.

The only new road construction currently anticipated is for timber harvest purposes. Temporary woods roads might be built for travel by timber harvesting machines. These roads, averaging no more than 1 to 2 miles per year, will be blocked to access following timber harvest to allow for natural revegetation or seeding, if necessary.

Surrounding Roadways. Six major highways serve the West Point area. Direct access to the Main Post is by US Route 9W and NY Route 218. Interstate 87 is 9 miles west of the Main Post and is accessible by NY Routes 293 and 6 or US Route 9W, and the Palisades Interstate Parkway (PIP). Interstate 84 is 13 miles north of the Main Post and is reached by US Route 9W. The PIP is 5 miles south of the Main Post and leads to the George Washington Bridge, which provides access to New York City. The PIP is reached via US Route 9W (USMA, 1989).

Railways. Passenger rail service in the vicinity of West Point is provided by Metro North, which operates out of Grand Central Station in New York City and makes three stops on the east side of the Hudson River. The stop at Garrison is directly across the Hudson River from the Main Post. The stop at Croton-Harmon is 15 miles southeast of West Point. The stop at Peekskill is 5 miles northeast of the Main Post (USMA, 1989). From these stations, West Point is accessible by car.

Conrail's Port Jervis Line also provides rail service near West Point. A station at Harriman, southwest of the installation, is operated from Hoboken, New Jersey, and does not provide direct rail to New York City (USMA, 1989). From Hoboken, however, the Port Authority Trans Hudson train provides access to New York City.

Freight service is provided along Conrail's West Shore Line. The rail is single track and runs through West Point.

Waterways. The Hudson River at West Point is navigable to barges, cargo ships and passenger boats. USMA serves as a stopping point for commercial and tourist boat traffic. Shipments of fuel oil to USMA ended in 2002 with an upgrade of natural gas service.

3.22.2 Utilities

Potable Water. Potable water for West Point is derived mainly from the Popolopen Brook watershed, which is contained largely on West Point's property on the Military Reservation (USMA, 1980b). The Queensboro watershed provides additional water to the potable water supply. The Main Post receives potable water from the Lusk and Stony Lonesome water treatment plants, which are shipped from water

intakes in Stilwell Lake and Popolopen Brook. Camp Buckner and Camp Natural Bridge receive potable water directly from Popolopen Lake (USMA, 1980b).

West Point has a license agreement with the PIP Commission to provide potable water to the installation during the high demand period of October 16 through May 31 each year. The agreement states that West Point will be provided with whatever quantity of water is needed. The agreement also states that during the nonpeak period, the Commission will provide a minimum of 300,000 gallons per day (gpd) to West Point, so long as the Queensboro watershed water levels are not lowered more than 1 foot (USMA, 1980b).

Main Post Water Supply. Most of the water supply for the USMA at West Point is derived from the Popolopen Brook watershed, which is completely contained on the Military reservation. Water is also provided to the Academy as a result of an agreement with the Palisades Interstate Park Commission (USMA, 1999).

Potable water is supplied to the Main Post by the Lusk and Stony Lonesome water treatment plants. Camp Buckner and Camp Natural Bridge receive their water supply through a system which draws water directly from Popolopen Lake (USMA, 1999). The Lusk water treatment plant is located on the northern side of Lusk Reservoir. It is supplied with raw water from Popolopen Brook. The Lusk treatment plant, built 52 years ago, is of the rapid sand filter type. The Stony Lonesome water treatment plant became operative in 1971. Water for this plant is obtained from Stillwell Lake and Long Pond. Water from Long Pond is used as a back-up supply.

Camp Buckner Water Treatment Plant. The Camp Buckner water treatment plant provides potable water to Camp Buckner and Natural Bridge from raw water from Popolopen Lake. Treatment consists of pH adjustment and chlorination. A report by the U.S. Army Environmental Hygiene Agency (AEHA) on water quality at Camp Buckner indicated the turbidity of the treated water sometimes exceed the State standards. The AEHA report recommends replacement of this facility with a modern sand filter treatment plant (USMA, 1999).

Water Use. Potable water at West Point is used for drinking water, watering of lawns and athletic fields, recreational use at Delafield Pond, and snow making at the ski slope when natural snow is low (USMA, 1980b).

Uses of water at Camp Buckner and Camp Natural Bridge is highest in the summer months (USMA, 1980b). In the winter, Camp Buckner and Camp Natural Bridge are winterized and potable water supply to them is unavailable (USMA, 1980b). The current rate of potable water consumption on the Main Post is 2.3 mgd (Packard, personal communication, 1996). Consumption of potable water at Camp Buckner in 1996 averaged 0.97 million gallons per day, which is 49 percent of the plant's capacity (USMA, 1996a).

Fire Protection. There are three fire stations on the reservation; the Main West Point fire station on Washington Road, the Stony Lonesome station, and the Reservation fire station on Route 293, next to Range Control. Water for fire protection on Camp Buckner is provided by the Camp Buckner treatment plant and consists of fire hydrants that are adequate and well spaced throughout the area (USMA, 1980b). The fire protection system at West Point is adequate for its demand. Every few years, the Fire Underwriters Insurance tests the system. Approximately two to three times each year, West Point flushes the fire hydrants and conducts tests on the system (Packard, personal communication, 1996).

The USMA Fire Prevention and Protection Division is responsible for the suppression of wildland fires on the reservation. For more detail on fire prevention, suppression and management on the reservation see Section 5.13.

Wastewater Treatment. Two wastewater treatment systems serve West Point. The system serving the Main Post consists of a wastewater collection system, which is separate from the storm draining system, pumping stations, and the Target Hill Secondary Treatment Plant. The Target Hill Secondary Treatment Plant has a capacity of 2 mgd and discharges to the Hudson River.

Camp Buckner and Natural Bridge are served by a wastewater collection system, pumping stations, and an extended aeration-type secondary treatment plant. The plant is used from May until October and has a capacity of 0.25 mgd. Treated water is discharged into Popolopen Brook below Queensboro Furnace.

Dewatered sludge from these treatment plants is disposed of at a private landfill in Goshen, New York, located approximately 20 miles west of USMA.

Storm Drainage. Storm water from the cantonment area drains into Crow's Nest Brook, Highland Brook, Kinsley Farm Brook, Dassori Pond, or various channels and pipes, all eventually emptying into the Hudson River.

Storm drainage on Camps Buckner and Natural Bridge, and on the firing ranges and training areas throughout the reservation consists of natural swales, man-made ditches, and storm pipes where roads cross drainage ditches. Water from Camps Buckner and Natural Bridge is discharged into Popolopen Lake.

Electricity. Electricity is provided to the Main Post from Orange and Rockland Utilities, Incorporated (O&R). Substations transmit electricity through overhead lines, which terminate at Wilson Gate and substation A. The system has three separate meters (USMA, 1989). O&R serves Camps Buckner and Natural Bridge through overhead lines connected to the O&R Dean Substation at the intersection of Route 293 and Mine Road. This service is metered separately and is considered separate from that provided to the Main Post.

Heat. Heat is provided through a central plant in Building 604. This plant consists of three fuel-oil boilers and three steam-turbine-driven generators. The total capacity of the steam system is 370,000 pounds per hour of steam at 160 pounds per square inch (psi) at a temperature of 425 °F. A separate gas/oil fired steam plant is located in Building 845 and is used for several buildings in the Washington Gate area, including the hospital. This plant consists of two 40,000-pound-per-hour water tube boilers. Total annual consumption of fuel oil between these two plants is 5 million gallons per year (USMA, 1989).

Natural Gas. Central Hudson Gas & Electric Co. supplies natural gas to West Point. Natural gas on the installation is used for cooking, domestic hot water generation, residential heating, and the laundry plant. Only a few outlying buildings use liquid petroleum gas.

Cooling System. Buildings at West Point are served by local electric or steam absorption cooling systems. There is no centralized cooling system on the installation.

Communications Systems. Communications systems at West Point consist of telephone, fire alarm, security, fire, and cable. Telephone service is provided by New York Telephone, but all infrastructure is owned by the Army. Many of the buildings are connected to fiber optic cables. The Gamewell fire alarm and security systems use these cables. Cable television is provided through three services operated by a local cable company. A microwave tower for cellular telephone communication is now located at the top of the ski slope in Area J3.

Solid Waste. Solid waste generated at USMA is initially trucked to an Army-owned solid waste transfer facility and later trucked from the transfer station to the Alliance Landfill in Taylor, Pennsylvania (Morgan, personal communication, 2003). Construction and demolition debris, and scrap metal is sent off for recycling. Other recyclable material (e.g., glass, aluminum, paper) is separated at each building and temporarily stored with other solid waste at the transfer station until pick-up. Some recyclables, such as paper, are recycled and sold on the commercial market.

3.22.3 Projected Changes in Facilities

Proposed improvements to the range and training areas are described in USMA's Range and Training Land Program (RTLP) (USMA, 2002). The RTLP introduces a program for managing range facilities and training areas in a manner, which compliments the installation's master planning process and installation commander's range vision. The proposed projects for West Point RTLP Planning are provided in Table 3-40.

Currently, West Point's training areas can support all cadet, tenant, and non-tenant units and no additional requirements are needed in the near future.

Table 3-40
Proposed Range and Training Land Projects

Proposed Project
FY 2003
Repair Range 7, 8, 9, and 10 Access Roads
Leadership Reaction Course (LRC) Repair and Upgrade
Range 11/12/ Road Repari
FY 2004
Modify Range 5 to also serve as a Night Infiltration Course
Repair Range 4 Access Road
Range 1 Handgrenade (HG) Modification – construct new observation tower and two additional throwing bays.
FY 2005
Construct Combat Pistol Qualification Course
Repair Proctoria Road
Modification of the Bayonet Assault Course
FY 2006
Range 11: Construct new generation target systems (INGATS/NGATS) that will provide immediate feedback to the instructor and trainee.
Repair Range Roads 1 and 10
Upgrade Water Confidence Course
FY 2007
Repair Ridge Road
Build New Rappel Tower

3.23 HAZARDOUS AND TOXIC MATERIALS

Hazardous and toxic materials are used by several activities at the USMA. Examples of hazardous and toxic materials used include pesticides, PCBs, chemicals, and radiological substances. Pesticides include insecticides, herbicides, fungicides, and rodenticides. Pesticides are handled and stored in accordance with AR 420-76, AR 200-5 and USMA's Pest Management Plan. Surveys conducted to identify PCBs have been conducted at USMA since 1973. Materials containing PCBs are present at USMA and are handled in accordance with USEPA regulations. Examples of activities conducted that involve the use of chemicals include laboratory operations, pest control services, vehicle maintenance, printing operations, and fuel supply functions. Radiological substances are stored and handled by the USMA's Department of Physics and chemistry laboratory. These substances are monitored on a regular basis.

3.24 SOCIOECONOMIC RESOURCES

The socioeconomic resources of a region are typically characterized in terms of population, housing, and employment. These resources are often interrelated in that an increase or decrease in population could change the demand for housing or employment. Socioeconomic conditions are usually expressed in terms of total population and density, housing units and vacancy rates, and industry earnings and employment.

3.24.1 Population

USMA is located in Orange County in the Newburgh-Middletown Standard Metropolitan Statistical Area. The most developed portions of Orange County include the cities of Newburgh and Middletown, which are located north and west of USMA, respectively. The areas immediately surrounding USMA are relatively rural in nature and not densely populated.

During the 10-year period from 1990 to 2000, population in the county increased from 307,647 to 341,367, or 11.0 percent (U.S. Census Bureau, 1990a, 2000a). The population density in 2000 for Orange County was 418 persons per square mile (U.S. Census Bureau, 2000b). In comparison, New York's population increased by 5.5 percent during the same time period (U.S. Census Bureau, 2000b). New York's population density in 2000 was 402 persons per square mile (U.S. Census Bureau, 2000b).

3.24.2 Housing

During the 10-year period from 1990 to 2000, the total number of housing units in Orange County increased from 110,814 to 122,754, or 10.8 percent (U.S. Census Bureau, 1990a, 2000a). In comparison, the number of total housing units in New York increased by 6.3 percent during the same time period (U.S. Census Bureau, 1990b, 2000c). In addition, homeowner and rental vacancy rates for Orange County in 2000 were 1.5 percent and 4.3 percent, respectively (U.S. Census Bureau, 2000a). For comparison, homeowner and rental vacancy rates for New York were 1.6 percent and 4.6 percent, respectively (U.S. Census Bureau, 2000c).

3.24.3 Industry Earnings and Employment

All industry sectors in Orange County experienced growth in earnings from 1990 to 2000 (U.S. DOC, BEA, 2002a). Based on earnings, in 1990, government, services, and manufacturing were the three largest industry sectors in Orange County (U.S. DOC, BEA, 2002a). By 2000, government, services, and retail trade were the three leading industry sectors in Orange County, with manufacturing dropping to fourth (U.S. DOC, BEA, 2002a). The leading earning industry sectors in 2000 for New York were services; finance, insurance, and real estate; government; and manufacturing (U.S. DOC, BEA, 2002a).

Employment increased in all industry sectors in Orange County between 1990 and 2000, with the exception of farming, manufacturing, and mining (U.S. DOC, BEA, 2002a). In 2000, services, government, retail trade, and manufacturing were the four largest employers in Orange County (U.S. DOC, BEA, 2002a). The leading employers by industry for New York in 2000 were services; government; retail trade; and finance, insurance and real estate (U.S. DOC, BEA, 2002a).

The Orange County unemployment rate decreased from 4.3 percent in 1990 to 3.3 percent in 2000 (NYSDOL, 2002). The county's civilian labor force increased from 153,600 to 157,100 during the same time period (NYSDOL, 2002). The 2000 unemployment rate for Orange County was lower than New York's unemployment rate of 4.6 percent (NYSDOL, 2002).

Orange County's per capita personal income (PCPI) was $26,940 in 2000, below the state and national levels of $34,689 and 29,469, respectively (U.S. DOC, BEA, 2002b). Orange County PCPI increased by 37.8 percent between 1990 and 2000 (U.S. DOC, BEA, 2002b). By comparison, New York PCPI increased by 48.9 percent and the United States PCPI increased by 50.6 percent during the same time period (U.S. DOC, BEA, 2002b).

3.25 ENVIRONMENTAL JUSTICE

On February 11, 1994, President Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. This order directs agencies to address environmental and human health conditions in minority and low-income communities so as to

avoid the disproportionate placement of any adverse effects from federal policies and actions on these populations. The general purposes of this Executive Order are as follows:

- To focus attention of Federal agencies on human health and environmental conditions in minority communities and low-income communities with the goal of achieving environmental justice.

- To foster non-discrimination in Federal programs that substantially affect human health or the environment.

- To give minority communities and low-income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment.

Consideration of environmental justice concerns includes race and ethnicity and the poverty status of populations. Table 3-41 depicts these characteristics for the population in Orange County. In 2000, 83.7 percent of the county's population was white and 8.1 percent was Black African American. All other racial groups combined totaled 8.2 percent of the population. Latinos and Hispanics, which may be of any race, made up 11.6 percent of the total population. By comparison, both New York and the United States have higher percentages of minority populations.

Table 3-41
Race, Ethnicity, and Poverty Status

	Orange County	New York	United States
White	83.7%	67.9%	75.1%
Black African American	8.1%	15.9%	12.3%
American Indian and Alaska Native	0.4%	0.4%	0.9%
Asian	1.5%	5.5%	3.6%
Native Hawaiian and Other Pacific Islander	Z[1]	Z[1]	0.1%
Other	4.1%	7.1%	5.5%
Two or More Races	2.2%	3.1%	2.4%
Hispanic or Latino[2]	11.6%	15.1%	12.5%
Persons Below Poverty[3]	11.4%	15.6%	13.3%

[1] Z: Value greater than zero but less than half unit of measure shown.
[2] Persons of Hispanic origin may be of any race.
[3] Percent of persons living below poverty is for 1997.
Source: US DOC, Census, 2002b.

Approximately 11.4 percent of the population may be characterized as living in poverty, which is lower than the rate for New York and the United States.

Executive Order 13045, *Protection of Children from Environmental Health and Safety Risks*, requires federal agencies, to the extent permitted by law and mission, to identify and assess environmental health and safety risks that might disproportionately affect children. The Executive Order, dated April 21, 1997, further requires federal agencies to ensure that their policies, programs, activities, and standards address these disproportionate risks. The Order defines environmental health and safety risks as "risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (such as the air we breathe, the food we eat, the water we drink and use for recreation, the soil we live on, and the products we use or are exposed to)." Children might be present at West Point as visitors. On such occasions, the Army takes precautions for their safety by a number of means, including, but not limited to, limitations on access to certain areas and provision of adult supervision.

SECTION 4.0:
MANAGEMENT PROGRAMS AND INITIATIVES

4.1 NATURAL RESOURCES MANAGEMENT

The overall installation natural resources program, directed by the NRB of DHPW, is described in this INRMP. It consists primarily of activities, detailed in Section 5.0 of this Plan, in the management of the natural resource elements discussed in Section 3.0.

Discussed below are other programs that are integral to, or otherwise related to, natural resources management at USMA.

4.2 INTEGRATED TRAINING AREA MANAGEMENT

The Army's ITAM program is a management and decision-making process geared toward integrating Army training and other mission requirements for land use with sound natural resource management of its lands (HQDA, 1995c). The Army's goal in establishing the ITAM program is to achieve optimum, sustainable use of training lands by implementing a standardized methodology for inventorying and monitoring land condition, integrating training requirements with land capacity, educating land users to minimize adverse impacts, and providing for land rehabilitation and maintenance (HQDA, 1995b; HQDA, 1995c; USMA, n.d.d.).

The ITAM program at USMA is administered by DPTM. DPTM has established a strong partnering relationship with the NRB for ITAM implementation. The program consists of four components:

- Land Condition Trend Analysis (LCTA)
- Land Rehabilitation and Maintenance (LRAM)
- Training Requirements Integration (TRI)
- Environmental Awareness (EA)

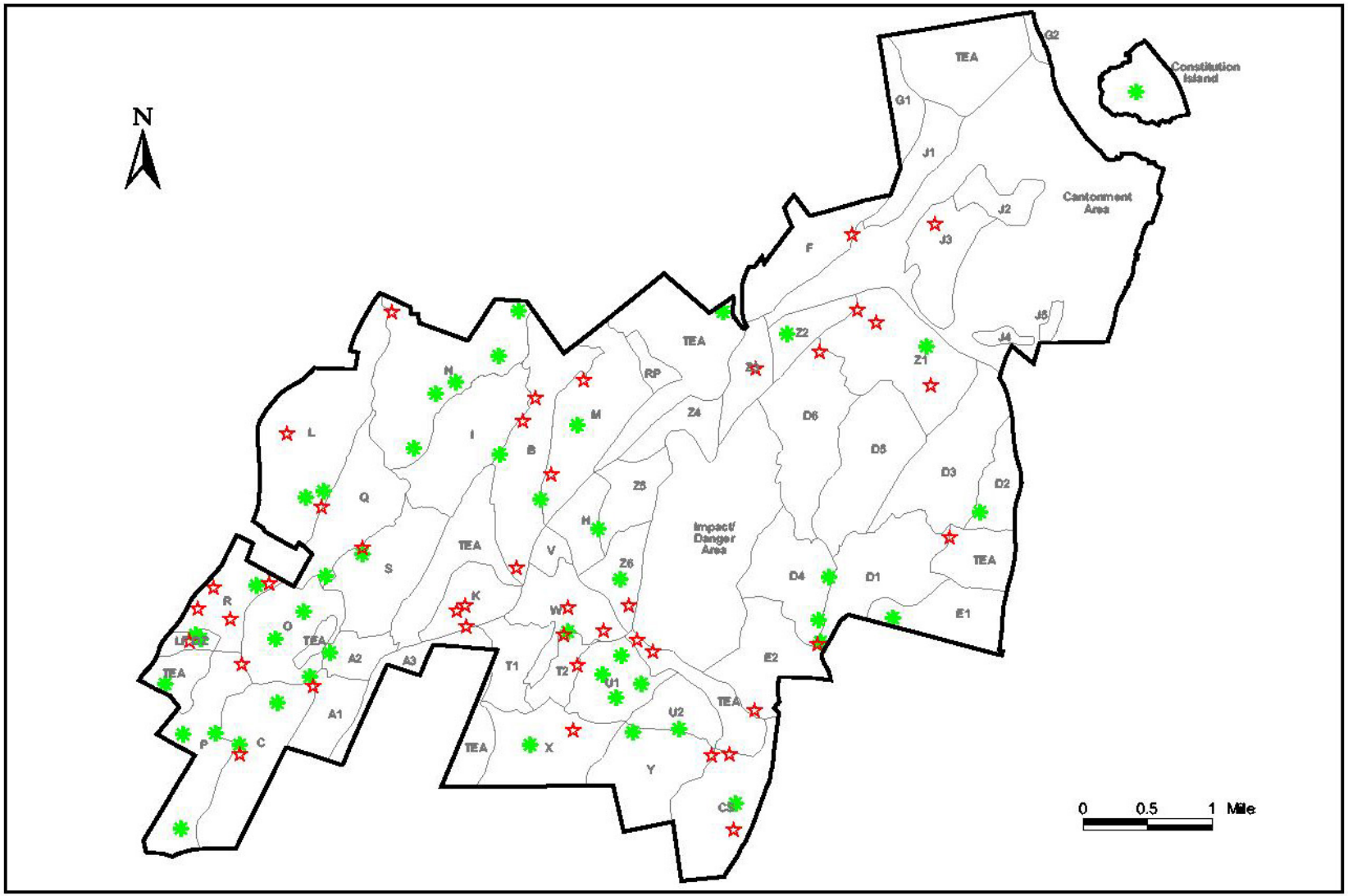
The specific activities for each of these components are detailed in a comprehensive ITAM Annual Work Plan prepared by DPTM and covering the current year and several out years. Much information from that Work Plan has been incorporated into this Natural Resources Plan as part of the integration of the overall natural resources management program at USMA. A synopsis of each component at USMA is provided below.

4.2.1 Land Condition Trend Analysis

Land Condition Trend Analysis (LCTA) provides for the collecting, inventorying, monitoring, managing, and analyzing of tabular and spatial data concerning land conditions throughout the training areas. The LCTA program collects physical and biological resources data to relate land conditions to training activities. It provides data needed to evaluate the capability of training lands to meet multiple use demands on a sustainable basis. It also incorporates a relational database and GIS to support land use planning decision processes. The USMA ITAM GIS is responsible for managing and maintaining the GIS database used to support both natural resources management, as well as the management of the USMA ranges and training areas. These data are intended to provide information to effectively manage land use and natural resources, and supply information for a variety of decision support and information management systems such as RFMSS (Range Facility Management Support System) and ATTACC (Army Training and Testing Area Carrying Capacity).

The LCTA program was first implemented at USMA during FY 90 when the Brooklyn Botanic Garden conducted a survey of the installation's flora (Coleman, 1995). In 1991, 34 permanent plots representing the major vegetation and soil communities were established to collect long- and short-term monitoring data on vegetation, soils, small mammals, and birds. In 1992, 11 special use plots were added to the program at specific locations, including areas of heavy training activity and sensitive habitat sites (e.g., wetlands). Figure 4-1 shows the locationsof the LCTA plots.

The 1995 LCTA summary report for USMA indicated that 44 percent of the monitored plots showed no visible evidence of military use, and the overall disturbance is low (Coleman, 1995). The primary cause of disturbance of the natural resources is foot traffic, which was evident at approximately 30 percent of the plots. Other disturbances include water erosion (i.e., sheet erosion) at approximately 20 percent of the



LEGEND

- ☆ LRAM (Land Rehabilitation and Maintenance) Site
- ✱ LCTA (Land Condition Trend Analysis) Plot
- ▭ Training Area

LRAM Sites and LCTA Plots

United States Military Academy
West Point, New York
Figure 4-1

plots, and accidental forest fires set during the use of blank ammunition, flares, and simulators at approximately 9 percent of the plots (Coleman, 1995).

Because training activities consist primarily of light infantry and foot maneuvers, and vehicle movement is largely limited to maintained range roads, overall impacts on the natural resources are minimal. Training-related fires, bivouac and other training activities do cause significant site-specific disturbances throughout the training areas and ranges. To minimize these impacts, the 1995 LCTA report provided the following suggestions: (1) continue the restrictions on the type and timing of pyrotechnic use, particularly during the summer months; (2) carefully monitor the stability of the soils in and around training areas, particularly where ground cover is limited; and (3) restrict vehicular traffic on sensitive slopes to reduce the potential for erosional problems (Coleman, 1995).

4.2.2 Land Rehabilitation and Management

The Land Rehabilitation and Management (LRAM) component mitigates the impacts that result from training and the mission (HQDA, 1995c). Based on the training requirements and priorities, LRAM develops land rehabilitation and maintenance projects (Figure 4-1). To successfully rehabilitate, repair, and maintain the natural resources, LRAM makes use of best management practices, training area redesign and reconfiguration, and long-term maintenance planning.

The LRAM program at USMA has been operational since 1995. The majority of the LRAM projects either in progress or planned through FY 08 are targeted at repairing and controlling soil erosion. The repairs and controls being implemented at firebreaks, former tank trails, bivouac sites, and other training sites include revegetation, the addition of erosion controls, water diversion structures, and filling, grading, seeding, and mulching. To assist in a number of these projects, USMA has enlisted the services of USDA's NRCS, through a Memorandum of Understanding. The projects are detailed in the ITAM Annual Work Plan and are briefly described in Table 4-1.

Table 4-1

LRAM Project Priority List

Priority	Planned Execution FY	Project Location	Project Short Description	Long Description
2	2002	Area Z4 (WL83658068)	Soil Protection and Stream Crossing Rehabilitation	Several trails within Area Z4 was damaged due to construction and use of the CALFEX range during FY00. Soil damage and gully formation is already present. Damage is close to a protected wetland. The need is to create a more hardened or permanent access road into this part of the training Area to repair present damage and to prevent future damage from continued use of this trail. Repair project includes a hardened stream crossing and hardened gravel road with appropriate drainage.
3	2003	Range Road 2 (WL83408110)	Range Road 2 Stream Protection	The concern at this particular stream crossing is the temporary nature of the culvert placement, the angle of the culvert placement, and the potential for rock and gravel to continue to get washed into the stream. The recommendation is to place a more permanent, long term fix for this stream crossing. Recoment placing two 24" culverts, or a single larger culvert, at the crossing with Gabion headwalls and Cable Concrete crossing surface over the culverts. Fill Cable Concrete with stone for crossing.
4	2003	Highland Brook - Z1 (WL84408152)	Sandhurst Stream Crossing site stabilization	This site is located on Highland Brook at WL844813. This site is used during the Sandhurst Competition each year as a water crossing exercise. Use of this site over the past 2 to 3 years has caused damage to the stream banks and surrounding areas. Stabilize the Highland Brook stream banks using a "bio-log" made of natural material, such as straw or coconut fiber. Hardening and stabilization of the upper banks on both sides of the stream will be required to prevent soil loss. Seed and mulching of the slope and upper bare areas to stabilize the soil and prevent its subsequent loss into the stream
5	2003	Lake Frederick - LFDZ (WL75407725)	ITT Trench Rehabilitation	This area is no longer used for Infantry Tactics Training (ITT). The plan is to remove obstacles, repair soil erosion, fill pits and gullies and reseed area. Area is close to a wetland.
6	2003	Range 4 (WL82538063)	Burm Rehabilitation and Soil Stabilization	The present firing berm on this range is in need of replacement. This project will protect the adjacent wetland as well as eliminate the potential for materials to move off the range. The project will entail building a new firing berm closer to the firing line in front of old berm, regrading the range floor to contain water runoff, and re-seeding the surface of the old range berm as well as the rest of the range floor and new berm to eliminate soil

Table 4-1

LRAM Project Priority List

Priority	Planned Execution FY	Project Location	Project Short Description	Long Description
				loss from the area.
7	2003	TA T2 West (WL80257740)	Area T2 Engineer Site stabilization and rehabilitation	This area is used to support Engineer training activities Cadet summer training. Rehabilitation of this area is required for the area to continue to support Cadet training. Rehabilitation includes seeding an mulching to help re-vegetation the ground cover in the over-used areas. Holes and unused defilades will be filled in graded, seeded and mulched to re-establish vegetation and to eliminate soil loss at the site. The access trail to the site will also be graded and stabilized to repair washout areas, of which there are many and gullies. At the present time, this road is not easily trafficable and could cause injury to personnel and damage to vehicles using it. If this repair is not done the area will quickly become so heavily damaged that it will be unusable for proper training and will become more of an environmental issue with increased soil loss and erosion.
8	2003	Ridge Rd TA C (WL76357666)	Water Erosion repair and stream protection	Water Erosion repair and stream protection. Past water runoff continues to damage road each year. Rock and gravel from past repair has ended up in stream. Need to repair damage to stream and install protection so future efforts will not continue to damage stream.
9	2004	TA T2 East (WL58047694)	Old Demolition Pit Rehabilitation	Sift soil of metal debris, fill, grade, mulch and reseed.
10	2004	Mine Torn Road (WL81127732)	Popolopen Ford Restoration	This site was previously used as a crossing site for access to the southern training areas (gate 68). Because of the classification of the stream as a Class A, vehicles are not longer permitted to use this as a crossing point. This area will be closed to vehicle access. The plan is to restore the crossing site to a more natural condition. The adjacent parking and access area will be removed and rehabilitated by disking and seeding. Located off Mine Torne Road on Popolopen Creek below Stilwell dam.
11	2004	Range Road 17 (WL79928027)	Closure and Rehabilitation of old road	This area has become heavily damaged and gullied due to use of this wet area for parking and travel of vehicles. Plan is eliminate access to this old trail and to add a hardened parking area at edge to eliminate rutting and erosion.
12	2005	TA C (WL77097676)	BlackCap Trail Soil Erosion Repair	Trail is severely eroded from water runoff and overuse. Fill, grade and reseed gullies. Install waterbars to eliminate further water damage.
13	2005	Training Area	Rehabilitation of old	This area has been severely damaged by tree fall due to heavy winds. Area is also

Table 4-1

LRAM Project Priority List

Priority	Planned Execution FY	Project Location	Project Short Description	Long Description
		R (WL76017762)	Bayonet Training Site	heavily overgrown with thorny vegetation such as blackberry, multiflora rose and barberry. Downed trees need to be removed and nuisance vegetation controlled. This will open up new area to be used for training.
14	2005	Sapper Island (WL80657745)	Sapper Island Stabilization and rehabilitation	Sapper Island is a small, 1/2 acre, isolated island in Stilwell Lake. For several years this island has been used for summer Cadet engineer committee amphibious assault training. At this time Sapper Island is in need of soil rehabilitation and general rest from use to be able to properly recover from overuse. Plan is to remove old structures and debris, and seed and mulch unvegetated and damaged and eroded areas. This rehabilitation effort will be needed on a regular basis as long as there is regular use of the island for training purposes.
15	2005	Area L (WL76615800)	Rehabilitation and Reconfigure Area L Bivouac	Site is inaccessible because of a damaged stream crossing. Repair access to this site and upgrade maneuverability within the site. Reconfigure area by removing invasive vegetation, adding hardened sites to improving usability of the area.
16	2006	Training Area M (WL 80017939)	Maneuver trail erosion repair	This trail leads to a heavily used training site in Training Area M. The 200 meter long trail is steep (approximately 15% slope) and heavily eroded from vehicular traffic, water runoff and overuse. Most of the soil has been eroded from the trail. Gully formation is extensive. Trail edges have been heavily cut by traffic, and in many places only rock and boulders are present. Trail begins at WL 80017939 off Range Road 15. Trail maintenance, diversion ditches and water bars need to be emplaced.
17	2006	Training Area E2 (WL 82557647)	Sweeny Pit rehabilitation and reconfigure	This area is an old burrow pit that is no longer used for that purpose. A wetland, which is adjacent to the old burrow pit, makes this a somewhat sensitive site. The plan includes regrading much of the approximately 5 acre area, which now consists of various sized mounds of debris and vegetation. Will then plant seed and mulch to re-vegetate and stabilize area. This will make the area available for use as a possible staging area or other training related activity.
18	2006	TA D4 (WL83327726)	Range Road 6 Soil erosion control and trail closure	This trail is heavily eroded from water damage. Road is not used and the plan is to close it and allow it to recover to it's natural state. Block entrance to road. Regrade to channel water off road and eliminate erosion. Road begins at WL 83327727 and runs north toward Cranberry Pond.

Table 4-1

LRAM Project Priority List

Priority	Planned Execution FY	Project Location	Project Short Description	Long Description
19	2007	TA R (WL76057828)	TA R Soil Erosion repair and rehabilitation - Lower Section	This area is no longer accessible by vehicle due to severe trail washout and subsequent gully formation. Plan to re-grade and install water erosion structures, such as waterbars, along the present trail to repair the present erosion and eliminate any further erosion of the soils. Black locust trees have taken over much of the open areas adjacent to the trail. Removal of this invasive vegetation will also me done by mechanical means as well as some herbicide application. Other invasive vegetation includes barberry and multiflora rose. This will open up new training area that is presently inaccessible and little used.
20	2007	TA P/O (WL76327689)	Georgina Hill erosion control and repair	Maneuver trail is severely eroded from previous water damage. Install water bars, re-grade to eliminate channeling. Grade and re-seed upper section of trail to eliminate water erosion. Located between TA P/O. Trail begins at WL 76327689 and runs NW for approximately 300 meters.
21	2007	Area K (WL 78987784)	Maneuver trail soil stabilization and runoff control	Install waterbars and plant vegetation to eliminate further gully formation and soil erosion on steep (20%) trail. Trail is approximately 100 meters long. Add new culvert at bottom of slope to eliminate ponding and soil erosion.
22	2007	Training Area D6 (WL 83628066)	Calfex Damage – Live fire repair	Damaged occurred in Training Area D6 (WL 83628066) due to construction and use of the Live Fire range over the past years. Soil damage and gully formation is already present. Damage is close to sensitive wet areas. The need here is to repair the damage from the past activities stabilize sensitive areas. This will involve grading, seeding and mulching of the area approximately 150 meters long, extending up a slope of approximately 15%. It will also include removing deadfall to reduce forest fire risk.
23	2007	Training Area C	Soil stabilization at Land Nav site 3	Due to heavy use of this site, much of the groundcover has been removed from the main (classroom) area of this site. Soil stabilization is necessary. Topsoil, seed and mulch site and adjacent areas. Stabilize foot-trails around site with erosion control structures.
24		Overall Installation	Invasive Species Control	Control of Barberry and other thorny invasive plant species on the USMA training reservation. This is part of a ongoing program to reduce and control the spread of invasive plant species in the training areas. ($800.00/acre) This is done using the present pest-control contract. The areas to be sprayed are selected based on information from Trainers and field surveys.
24	2007	Training Area	Live fire site rehab and	Site will need soil stabilization and seeding from damage due to live fire activities.

Table 4-1

LRAM Project Priority List

Priority	Planned Execution FY	Project Location	Project Short Description	Long Description
		Z4, north of ranges	Forest fire suppression	Removal of dead vegetation will also be done to reduce the risk of forest fires at the site. Possible stabilization will be needed on access road to site along with drainage work. Site is North of Range 7.
25	2008	TA B (WL79637862)	Old Range 8 upland rehabilitation	Remove old firing burms, grade, reseed.
26	2008	TA R (WL76187831)	Erosion repair and control of upper section	Regrade trail to eliminate water channeling. Extensive gully formation is already present. Install erosion control and water diversion structures along length of trail. Seed and mulch trail edges and slopes. Begins at WL76187831 and runs East for nearly 450 meters.
28		Overall Installation	Forest fire suppression	Removal of excessive deadfall from past storms to reduce future risk of forest fires in select areas throughout the training reservation. Maintenance and clearing of firebreaks around training reservation boundaries.
29		Training Area O	NBC Site work and reconfiguring	Assistance in site preparation and stabilization in conjunction with relocation of the NBC site. Work may include soil stabilization and protection, water drainage, construction of hard stands and related land work.
30		Training Area D5	Bridging site rehabilitation	Cleanup and stabilization of bridging and abite sites associated with CALFEX training. Soil protection work, seeding and stabilization will be needed at a minimum.
31		Training Area B	Camp Buckner Wetland	This wetland is adjacent to old Range 8, which is no longer used as a firing range. Plan to remove berms that disect the wetland to enhance functionality. These burms were put in as a part of the old range function.
32		Training Area Z1	Range 1 Rehabilitation	Remove old rail lines and rehabilitate area to upgrade open up area for training.
33		Training Area C	Ridge Road Intersection	Rehabilitation of area adjacent to Sager Rd and Ridge Road intersection. Area has degraded from heavy use. Reseed and rest area. Find temporary alternate site for training site set-up.

4.2.3 Training Requirements Integration

Training Requirements Integration (TRI) integrates the installation's land use requirements for training, range operations and training land management process and the installation's readiness requirement, with the natural resource conditions of the installation's lands (HQDA, 1995c). Training land and range requirements are derived from the Range and Training Land Program (RTLP), using the installation's assigned units' Mission Essential Task List (METL) and Combined Arms Training Strategy (CATS). Procedures for the day-to-day management of range and training lands are also outlined by the RTLP. Using RTLP information, TRI integrates the training requirements with the capabilities of the natural resources to support those requirements.

DPTM at USMA has fielded the Range Facility Management Support System (RFMSS) since 1996. RFMSS, which was developed by the USACE, is a collection of microcomputer-based software programs designed to automate the training facility management functions at an installation. RFMSS consists of components that provide for customization to a particular installation, scheduling of ranges and training areas, collection and analysis of range and training area usage data, and generation of various administrative reports.

The overall goal is to link GIS capabilities with scheduling and training information to more closely track multiple training activities. The linkage of these capabilities will be integrated with other ITAM program components (i.e., LCTA and LRAM) to provide a comprehensive management and decision-making program for integrating Army training and other mission requirements for land use with sound natural resource management of its lands.

4.2.4 Environmental Awareness

The objective of environmental awareness at West Point is to minimize training impacts by improving the land users' understanding of the effects the mission, mission training, and other activities have on the environment. The environmental awareness component of ITAM applies to commanders, unit leaders, soldiers, and others who may make use of an installation's training areas. This is accomplished by providing training and educational materials, and having the command emphasize the importance of environmental stewardship.

Leader's Handbook. The training environment at USMA consists of natural resources, such as timber; water; wildlife, including threatened and endangered species; recreational resources; and cultural resources (USMA, n.d.f.). Military leaders and commanders at West Point have the responsibility for the protection and conservation of the installation's training resources. The *Leader's Handbook* was compiled for the unit commanders to provide them with the know-how to prevent and minimize environmental damage while implementing the military mission (USMA, n.d.f.). The handbook describes why the environment is important to the training mission. It identifies the activities that have the potential to impact the environment and the results of those impacts. The handbook is divided into Field Activities and Protected Resources. Field Activities include fire prevention; camouflaging and field fortifications; waste disposal; petroleum, oil, and lubricants (POLs) and hazardous materials; and policing of training areas. Protected Resources includes items such as protected growth areas, wildlife, and training exclusion areas.

Soldier's Field Guide. In addition to the *Leader's Handbook*, ITAM provides a guide entitled *Training and the Environment: Soldier's Field Guide*. This guide is a pocket-sized, laminated card that provides summarized examples of what should and should not be done to prevent destruction of the environment. Topics included on the card are Fire Prevention, Vehicle Movement, POLs, Training Activities, and Protected Areas.

Instructive Signage. *Area Off Limits* signs are posted around rehabilitation projects in the training areas to minimize disturbance from training activities.

4.3 LAND MANAGEMENT

Overall land management at USMA is the responsibility of the DHPW, and includes the natural resources program, as well as programs in pest control and roads and grounds maintenance throughout the reservation. DPTM, of which Range Control is an element, has responsibility for routine grounds maintenance in the camps and range/training areas and for maintenance of the training area roads. Under the ITAM program, DPTM and DHPW cooperate in identifying requirements and developing land protection and rehabilitation operations in the training areas.

4.4 NATIONAL ENVIRONMENTAL POLICY ACT PROGRAM

Prior to initiation, all projects pertaining to training, construction and natural resources activities, and facility maintenance are subject to a comprehensive review process by the USMA to evaluate the potential impacts that could occur to 18 different resource areas as a result of these activities. As part of that review, the NRB evaluates the potential for these activities to impact vegetation, wildlife, habitats, and rare/endangered/threatened species. The NRB determines the significance of potential impact (none, minor, major) that could occur and provides recommendations (no action, record of environmental consideration, EA, or EIS) for the level of analysis and documentation required to comply with NEPA. The potential impacts and recommendations in addition to comments are documented on a Project Environmental Review Checklist. All NEPA documentation is coordinated by a NEPA manager in DHPW.

4.5 COMMUNITY AWARENESS

USMA is one of the most popular tourist attractions in New York State and is visited by millions annually (Hamburger, A. 2003. Personal comm.). Besides having the opportunity to enjoy the natural beauty and resources of West Point, community members are also encouraged to participate in the environmental education and public information programs that are offered by DHPW's EMD. Some of the events and environmental programs sponsored by EMD and the NRB include:

- EMD is a major participant in annual Earth Day activities, which normally cover several weeks and include Arbor Day activities.

- An environmental awareness video entitled *Stewards of the Castle* focuses on the West Point environment and the environmental protection responsibilities of USMA employees. It is shown to all new employees; is occasionally broadcast on the USMA internal information TV channel, which is viewed in offices, barracks, and family housing; and is shown on a variety of other occasions.

- An EMD manager presents the USMA environmental program in all Basic Supervisory Training courses.

- EMD has an information booth at the annual Health Fair for USMA employees.

- Natural Resources and other environmental topics are the subject of occasional articles in the *Pointer View*, the USMA weekly community newspaper.

- NRB assists in the outdoor education activities of the West Point Elementary and Middle School, advises and assists Eagle Scout candidates in their projects, assists in other scout projects on occasion, and annually participates in a country extension outdoor education program for area schools.

- NRB conducts spring nature hikes for the USMA community.

4.6 OUTDOOR RECREATION PROGRAMS

The outdoor recreation program is designed to provide the cadets, military and civilian staff, and residents with ample resources and opportunities to participate in enjoyable outdoor-related activities. The outdoor recreation program at West Point includes a wide variety of activities including hunting, fishing, trapping, boating, hiking, birdwatching, horseback riding, cross country skiing and camping. The level of enjoyment that is derived from these activities is directly related to the quality of USMA's natural resources. Maintaining a quality outdoor recreation program is dependent on proper management of the natural resources and efficient program administration and oversight.

Hunting, fishing, and trapping on West Point lands are aimed at USMA personnel and cadet use, with limited public access. Fees from special permits for hunting, fishing, and trapping are deposited into the USMA Wildlife Conservation Fund Account (i.e., 21X account), which is used by DHPW for the protection, conservation, and management of fish and wildlife (USMA, 1995). A recreational activity fee is also collected for hunting, fishing, and trapping on USMA lands. Funds generated from this fee are deposited into the Installation Morale, Welfare, and Recreation Fund (USMA, 1995).

4.6.1 Military Mission Considerations

Outdoor recreation activities occur throughout West Point on the Main Post, reservation, and Constitution Island. Because the primary mission of USMA is military training, particularly, the training of the Corps of Cadets, outdoor recreation on military lands is secondary. Outdoor recreation activity in designated training areas is prohibited during times of actual training use, and the dud/danger areas are always off limits. When not in training use, the training areas are available for outdoor recreation activities under the access systems established by the Range Control Office. All of the major water bodies on West Point may be used for outdoor recreation. Those areas, which also provide for training, however, assign training as a higher priority. All outdoor recreation activities that occur on the installation must be scheduled so as not to interfere with the military mission.

4.6.2 Public Access

USMA is considered an "open post" and the cantonment area is visited by over three million people annually to attend special events and for general sightseeing. There are public picnic facilities available on the main post.

Access to the USMA training areas, however, is strictly controlled for safety and security reasons. Limited manpower resources for law enforcement and visitor control restrict the degree to which public participation in outdoor recreation activities is feasible.

Fishing by the general public is not permitted at USMA due to the intense level of summer training that occurs. Also, the low fertility waters found at USMA could not sustain additional fishing pressure that would occur if the waters were open for general public fishing.

Public access to the USMA training areas for outdoor recreation is limited to trapping and deer hunting. Trapping permits, available to USMA and general public personnel, are issued primarily to control nuisance animals, and typically involve only one or two permits per year to control beaver where their activity is causing flooding, affecting facilities. Approximately one thousand general public hunters annually obtain a Deer Management Permit from New York State that allows them to hunt within the

state-designated Wildlife Management Unit (WMU) 3P. These hunters are then eligible to obtain a permit to hunt deer at USMA, which is within the boundaries of WMU 3P.

Mine Torne Road, a paved secondary road open to the public except during certain periods of range firing, passes along Popolopen Brook and the associated large wetland that has been designated a significant wildlife habitat by New York State. This road is a popular spot for individual general public birders and local bird clubs.

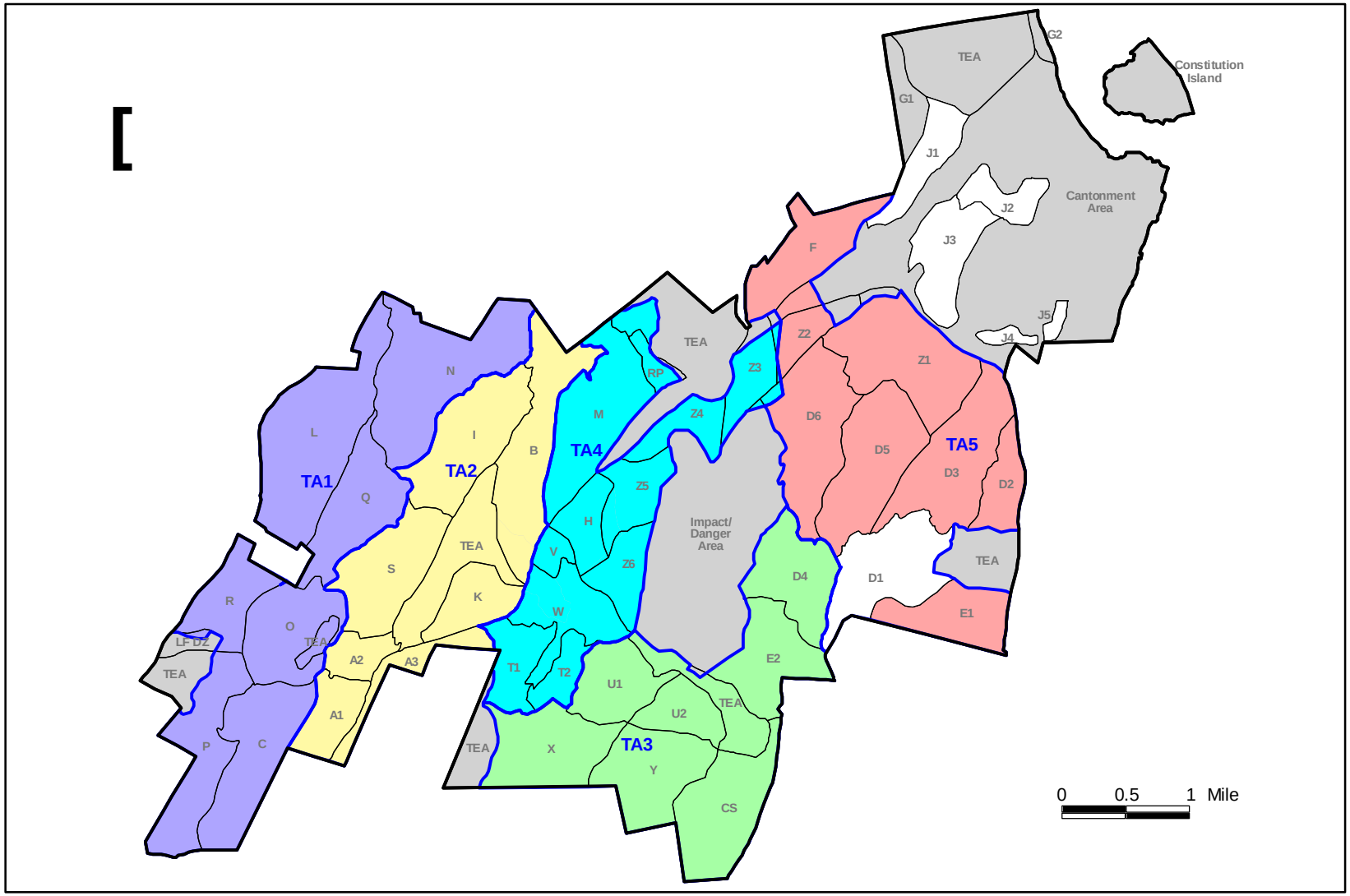
One recreation area at West Point is not available for use by USMA personnel. Long Pond, with swimming, boating and picnicking facilities, is leased to the Town of Highlands for exclusive use by town residents, and is not available for use by USMA personnel.

4.6.3 Hunting, Fishing, and Trapping Programs

All hunting, fishing, and trapping on USMA lands must be compliant with USMA Regulation 215-5 (Hunting, Fishing and Trapping), the USMA Cooperative Plan for Fish and Wildlife Management, applicable federal laws, and the New York State Environmental Conservation Law (USMA, 2000). Hunting, fishing and trapping programs are administered by the CRD with cooperation and assistance from the NRB, Provost Marshal and Range Control. Eligibility to hunt, fish, or trap at West Point is determined by USMA Regulation 215-5, AR 215-2, and AR 200-3. Those eligible to hunt, fish and trap on the reservation include military personnel (active and retired) and their families, DoD civilian personnel and their families, and guests of military and DoD civilian personnel. In addition, members of the general public holding a valid NYSDEC Deer Management Permit for Unit 54 are permitted to hunt white-tailed deer on the reservation during the New York State general firearms season.

The NRB is responsible for managing the biological aspects of the hunting, fishing, and trapping programs, stocking fish and pheasants on the Reservation, and monitoring the angler diary project at West Point.

Hunting. West Point has 45 established hunting areas for the recreational pursuit of both small and large game (Figure 4-2). Small game species include turkey, waterfowl, raccoon, squirrel, rabbit, grouse, ring-



LEGEND

- H Hunting Area and ID
- No Hunting or Trapping

Trapping Areas (Hunting Also Permitted)

- TA1
- TA2
- TA3
- TA4
- TA5

Hunting and Trapping Areas

United States Military Academy
West Point, New York

Figure 4-2

necked pheasants, northern bobwhites, woodcock, and coyote. Large mammals hunted include white-tailed

Big game licenses are issued by NYSDEC and allow the taking of one antlered deer per hunter. Additionally, wildlife management unit (WMU) permits are also issued by the state: within a specified WMU, one antlerless deer is allowed to be harvested per hunter per license year. West Point lands are among those included in WMU 3P. Hunters must enter a lottery system through NYSDEC to obtain a WMU 3P permit. Last season (2001), 1,900 WMP 3P deer permits were issued. Small game licenses are purchased from the state and small game permits are issued by USMA. Participation in the hunting program at West Point averages about 500 hunters annually.

Season and bag limits follow those prescribed by the Environmental Conservation Law of New York State and any applicable federal laws, except where West Point's restrictions are more stringent (USMA, 2000). For example, members of the general public hunting on West Point are required to harvest their allotted antlerless deer before taking a buck. Violators may be subject to disciplinary action under the Uniform Code of Military Justice and may be permanently barred from USMA (USMA, 2000). Hunting seasons are listed in Table 4-2.

Table 4-2
Hunting Seasons

Game Species	Season
Small game	Variable, dependant upon species, but will fall between 1 September and the end of February.
Turkey (Spring season)	1-31 May
Special Archery Season for Big Game (deer and bear)	October 15 to the Sunday before the opening day of the Regular Season and five days immediately following the close of the regular big game season.
Deer (Regular Season)	Monday after November 15 to the second Tuesday in December
Special Muzzle Loader Season for Big Game	Seven days following the close of the regular season
Bear (Regular Season)	Saturday after the opening day of the regular season for deer through the second Tuesday in December

Table 4-3
2001 Deer Harvest Summary (2000 in parentheses)

Season	*Males*	Females	Total
Early Bow #	15 (17)	6 (16)	21 (33)
Regular Firearms	55 (105)	[2] ([2])	55 (105)
DMP 3P Program [1,2]	24 (44)	91 (136)	115 (139)
Late Bow	0 (0)	0 (0)	0 (0)
Muzzleloader	2 (4)	0 (2)	2 (6)
Totals	96 (170)	97 (154)	193 (324)

[1] Totals include deer tagged with Deer Management Assistance Permits.
[2] Antlered-deer-only program.

Source: Beemer, 2001.

The 2001 deer harvest included 193 deer (96 males, 97 females), representing a 40 percent decrease from the 2000 deer take, and 31 deer below the 20-year average of 224 (Table 4-3) (Beemer, 2001). This lower take reflects the significant impact that the events of September 11, 2001 had on access for hunting at West Point. Hunting pressure in 2001 decreased 19 percent from the previous year. The deer harvest at West Point from 1982 through 2001 is provided in Figure 4-3.

During the 2002 season, 128 small game animals were taken (Beemer, 2002). The harvest record of small game species from 1982 through 2002 is presented in Table 4-4.

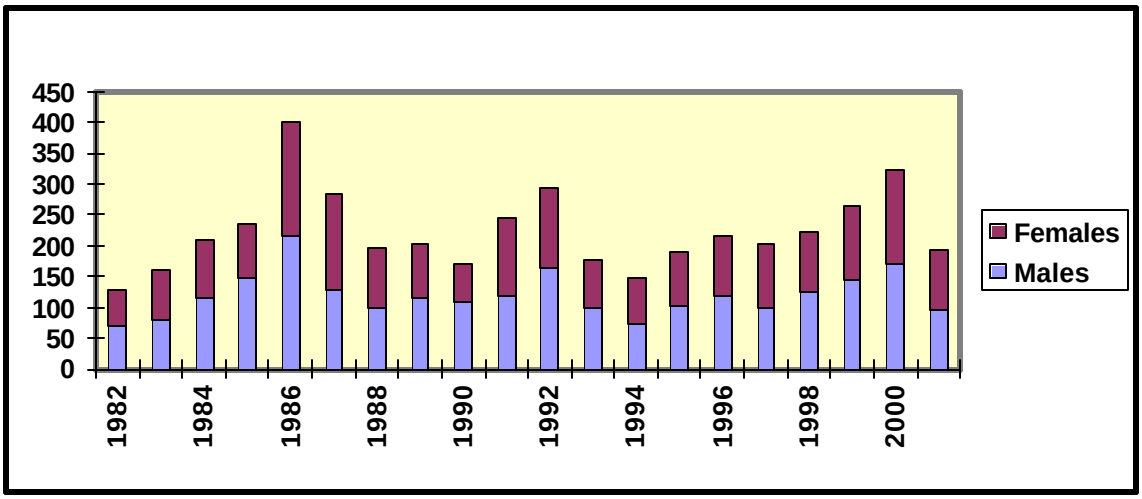


Figure 4-3. West Point Deer Harvests, 1982-2001

Table 4-4

Small Game Harvest by Species: 1982 - 2002

Year	Species											
	Gray squirrel	Rabbits	Ruffed grouse	Woodcock	Ducks	Geese	Pheasants	Turkey		Coyote	Crow	Total
								Spring	Fall			
1982	30	1	44	8	10	1	72					166
1983	4	0	19	6	10	6	112	6				163
1984	6	10	40	5	8	9	81	5				164
1985	66	1	35	2	4	14	101	6				229
1986	117	6	40	10	1	9	93	5				281
1987	183	1	57	9	2	8	131	7				398
1988	87	1	37	16	3	1	116	10	1	0	0	272
1989	80	5	62	13	13	10	134	6	6	0	0	329
1990	46	0	28	12	14	2	127	9	6	0	0	244
1991	83	0	9	1	6	3	47		2	0	0	151
1992	168	6	47	3	6	6	124	17	3	0	0	380
1993	281	4	45	6	0	4	123	19	14	1	0	497
1994	158	2	18	9	1	6	53	21	9	1	0	278
1995	267	5	33	4	16	7	0	28	23	2	3	388
1996	289	8	40	2	14	6	0	31	26	0	0	416
1997	355	8	10	0	16	23	0	34	28	0	0	474
1998	160	15	21	2	3	45	0	48	20	0	0	314
1999	137	16	6	0	17	29	1	42	19	0	0	267
2000	83	26	3	0	21	21	40	42	13	1	0	250
2001	49	14	0	2	14	14	82	29	16	1	0	222
2002	24	6	0	2	3	3	50	32	6	2	0	128
Total	2673	135	594	112	182	227	1487	343	192	8	3	6011

Fishing. The waters at West Point offer a variety of angling opportunities for both coldwater and warmwater species. Trout are either stocked or are native to a number of streams and ponds on the reservation, and there are a number of water bodies that provide excellent bass fishing, as well as providing healthy populations of panfish, and catfish. Other species that can be caught in West Point waters include eels, suckers, perch, pickerel and walleye. Appendix C lists the water bodies on West Point where these game fish species can be found. West Point also sponsors special events such as bass tournaments and ice fishing derbies (USMA, 2000).

Fishing permits, guest passes, and boat passes can be obtained at the Community Recreation Office and the Round Pond Recreation Office. In addition, the Round Pond Recreation Office also offers bait and fishing supplies, as well as boat rentals (USMA, n.d.b.). Approximately 1400 anglers participate in West Point's fishing program. Of these 1400 participants, 1000 purchase seasonal passes, 200 to 300 are children, and 100 to 200 guest passes are sold.

Although the fishing seasons follow those established by New York State, the installation has set its own size limits (Table 4-5). These size limits are more restrictive than the general state limits because of the low productivity of many of the water bodies on West Point. Fish in these waters require more years to grow to catchable sizes.

Table 4-5
Fish Size and Catch Limits

Species	Size Limits (inches)	Daily Limits
Bass	15 [1]	3 [2]
Channel catfish	12	5
Crappie	6	25
Pickerel	15	5
Trout		5
Walleye	18	1

[1]Exceptions: Wilkins Pond, where it is 20 inches; Cranberry and Weyants Ponds, where it is 15 inch minimum.
[2]Exceptions: Wilkins Pond, where it is 1 per year; Cranberry and Weyants Ponds, where it is 1 per day.
Source: USMA, n.d.b.

In 2001, USMA stocked a total of 7,140 trout at Bull Pond, Round Pond, Lusk Reservoir, Popolopen Brook, Highland Brook and Queensboro Brook (Table 4-6). Periodically, Stilwell Lake and Popolopen Lake are stocked with walleye. The 2001 harvest totaled 1,242 fish, including 21 bass, 121 sunfish, 120 crappie, 2 channel catfish, 1 bullhead catfish, 15 yellow perch, 7 chain pickerel, and 955 trout (Beemer, 2002d). Reported fish harvest data for 1997 through 2001 is provided in Table 4-7.

In 1999, a creel survey of selected lakes (Round Pond, Wilkins Pond, Mine Lake, Stilwell Lake, and Popolopen Lake) was conducted to determine the quality of fishing, harvest levels and sustained yield for trout (Linck, 1999). The results of the 1999 survey are provided in Table 4-8.

Table 4-6
Fish Stocking Record Summary 1997 - 2001

Year/Species Stocked	Bull Pond	Round Pond	Lusk Reservoir	Popolopen Brook	Highland Brook	Queensboro Brook	Popolopen Lake	Stilwell Lake
1997								
Brook Trout	1,590	500	350					
Brown Trout	1,490	2,660	470	300	250	100		
Rainbow Trout	200	400	100	150				
Walleye							2,000	
1998								
Brook Trout	1,560		250					
Brown Trout	900	2,170	500	350	300	100		
Rainbow Trout	230	370	80	85				
Walleye								1,000
1999								
Brook Trout	400							
Brown Trout	450	100	100	50	250	50		
Rainbow Trout	3,140	4,060	600	390		10		
Walleye								2,000
2000								
Brook Trout	1,750	100						
Brown Trout	200	2,400	450	300	250	50		
Rainbow Trout	900	440	150	120		30		
Walleye							1,000	
2001								
Brook Trout	1,750	100						
Brown Trout	200	2,400	450	300	250	50		
Rainbow Trout	900	440	150	120		30		
Walleye							1,000	

Sources: Beemer, 2002d.

Table 4-7
Reported Fish Harvest Record

Species	1997	1998	1999	2000	2001
Black Bass	56	15	18	54	21
Bluegill/Sunfish	268	300	414	245	121
Crappie	68	2	102	49	120
Channel Catfish	51	12	16	2	2
Bullhead	15	4	14	21	1
Yellow Perch	74	14	631	51	15
Walleye	2	0	3	1	0
Chain Pickerel	2	19	13	6	7
Trout	1,213	760	1,293	980	955
TOTAL	1,749	1,126	2,504	1,409	1,242

Table 4-8
Summary of 1999 Creel Survey

Date	No. of Angler Contacts	Total Angler Hours	No. of Fish Kept	No. of Female Anglers	No. of Anglers Under 16	No. of Hours on Route
7/3	34	95.25	47	3	10	7.50
7/4	16	27.75	1	1	6	6.50
7/5	19	31.00	15	1	1	6.75
7/6	6	8.00	3	1	4	5.00
7/7	17	23.00	8	5	4	5.50
7/8	14	41.00	5	2	1	5.50
7/9	13	22.50	4	3	5	4.50
7/10	27	54.00	11	3	4	7.00
7/11	9	15.50	2	1	0	5.50
7/12	16	32.00	7	4	8	5.50
7/13	11	27.00	3	2	3	3.50
7/14	8	14.75	7	3	3	3.50
7/15	2	8.00	4	0	0	2.50
7/16	11	23.50	3	1	1	4.50
7/17	12	25.00	26	0	3	6.00
7/18 (1/2 day)	8	19.50	8	0	1	2.00
TOTALS	223 [1]	467 3/4	156 [2]	30	54	155

Harvest Per Unit Effort (HPUE) = 0.33
Catch Per Unit Effort (CPUE) = 0.43
Percent Female Anglers = 13.5
Percent Anglers Under 16 yrs of age = 24

[1] 164 different anglers, 59 repeats, one of them 8 times.
[2] No. of fish caught (estimate from anglers' comments) = 199

Trapping. Trapping at West Point is primarily conducted as a wildlife management tool. Trapping is allowed for the removal or control of problem and nuisance animals or for wildlife research and disease surveillance (USMA, 1995); recreational trapping is not allowed. There are five established trapping units on the reservation (Figure 4-2).

Trapping at West Point requires a trapping license from NYSDEC and a permit from USMA. The NRB determines how many trappers will be allowed to trap each season (typically only one) and assigns the trapping areas (USMA, 1995). Animals caught that are domestic animals or protected species must be released at the capture site. All other animals must be reported to the Natural Resource Branch (USMA, 1995). All traps must be in conformance with the state's conservation laws. Snares are prohibited from use (USMA, 2000).

4.6.4 Nonconsumptive Recreation Programs

Other outdoor recreation opportunities on the installation include swimming, boating, jogging, hiking, birding, camping, cycling, picnicking, skiing, ice skating, and horseback riding (USMA, 1989). These opportunities are open to the cadets, military personnel (active and retired) and their families, and DoD civilian employees and their families. There is not public access to these recreation programs. Table 4-9 lists the locations for outdoor activities and morale support outdoor sports.

Round Pond Recreation Area. Located on the reservation, the Round Pond Recreation Area has a lake, beach, playgrounds, picnic areas, and campsites. Access to the facilities at Round Pond is limited to active and retired military personnel and their families, Reservists and National Guard members, and civilian employees of West Point. Management of this recreation area is handled by Round Pond Recreation Area, a branch of the DCFA.

Lake Frederick Recreation Area. Lake Frederick is a popular and well-utilized recreation site located on the western edge of the reservation between Smith Clove Road and Training Areas R and P. A meeting house, a mess hall, and several cabins are located on the western edge of the lake. The area is used for camping and swimming during the summer, and in August the fields adjacent to the lake are used as the

Table 4-9
Recreation Activities and Locations at West Point

Activity	Location(s)
Birding	Throughout reservation
Boating	Popolopen Lake, Round Pond, Sail Boat Dock, Beaver Pond, Brooks Hollow, Cragston Lake, Cranberry Pond, Lake Frederick, Lake Georgina, Lusk Reservoir, Mine Lake, Stilwell Lake, Weyants Pond, Wilkins Pond
Golf	Golf Course
Horseback Riding	Morgan Farms vicinity
Picnicking	Constitution Island, Delafield Pond, Lee Gate, South Fill
Skiing	
Cross-country	Throughout reservation
Downhill	USMA Ski Slope
Swimming	Delafield Pond, Lake Frederick, Popolopen Lake, Round Pond

Source: Dumoulin, T., 2002; Beemer, 1996b USMA, 1989.

basic training bivouac site for the incoming class of cadets. Throughout the remainder of the year, the area is used for camping by the scouts and for outdoor education sessions by local elementary schools.

Lake Frederick is host to the annual scout camporee, involving the interaction between 3,000 scouts and cadets. Access is limited to active duty military personnel and their families, Reservists and National Guard members, and DoD civilian employees of West Point.

Bull Pond Cottages. Located on the reservation, Bull Pond offers two full service cottages and a boat house from May - Oct, located exclusively on a mountain top pond. Access is by seasonal lottery limited to active duty military personnel and their families, Reservists and National Guard members, and DOD civilian employees of West Point.

Boating. All West Point waters may be used for boating, with some restrictions on water body and boat type. Gasoline-powered boats may be used on Stilwell and Popolopen lakes as long as a daily permit is obtained from the Round Pond Recreation Office (USMA, n.d.b.). Boats with electrically-powered trolling motors may be used on all West Point water bodies except Lusk Reservoir, where only boats with oars or paddles may be used. Boats are available for rent from the CRD of DCFA. Table 4-10 lists rental boat usage by waterbody for 2001.

Table 4-10
2001 Rental Boat Usage (Number of Boat Sign-outs)

Waterbody	April	May	June	July	August	September	Oct./Nov.	Total
Bull Pond	82	47	53	37	15	25	5	264
Round Pond	101	51	77	74	63	32	13	411
Popolopen Lake	2	46	36	25	27	23	11	170
Stilwell Lake	0	24	38	43	18	16	7	146
Wilkins Pond	10	41	44	70	34	23	15	237
Weyants Pond	0	8	10	5	5	6	0	34
Mine Lake	0	12	8	12	4	6	2	44
Cranberry Pond	0	4	3	4	6	9	0	26
Lake Frederick	0	1	8	9	11	4	0	33
Total	195	234	277	279	183	144	53	1365

Source: Dumoulin, T., 2002.

Off-Road Vehicles. The use of recreation off-road vehicles is prohibited on the West Point Military Reservation. The steepness and heavily wooded nature of the terrain makes such use impractical without causing significant environmental damage. Unauthorized use is prevented by the system of access gates that are controlled by Range Control.

4.6.5 Safety and Security

Safety on USMA for hunting, trapping, and fishing is regulated under USMA Regulation 215-5. Examples of safety precautions at West Point include a sign-out/sign-in procedure at the Range Control Office, safety instructors for explosive ordinance identification, and no discharge of longbows or firearms within 500 feet of an occupied dwelling. Vehicles must park in areas so as not to block any established roads, gates, or firebreaks (USMA, 2000). No alcoholic beverages or other drugs may be used during hunting, fishing, or trapping. All spent fishing line, bait containers, lure packaging, ammunition boxes, and other related trash must be removed (USMA, 2002).

4.7 ENFORCEMENT

Effective enforcement of laws and regulations applicable to natural resources contributes to the protection of those resources, promotes public safety, and ensures an equitable opportunity for participation in outdoor recreational activities, such as hunting and fishing.

4.7.1 History and Authority

The Provost Marshal's Office (PMO) has overall responsibility for security and law enforcement on the installation. Currently, the PMO has military police personnel performing the mission.

There are three types of jurisdictions in the West Point community: exclusive, concurrent, and proprietary interest. Although the federal government owns all of the property occupied by USMA, the jurisdiction of police powers varies. Exclusive jurisdiction applies to areas where only the federal government or federal law enforcement officials have the authority and obligation to investigate and prosecute criminal activity. Concurrent jurisdiction applies to those areas where all law enforcement agencies (i.e., municipal, state, and federal) share equally investigational and prosecutorial obligations. It should be noted, however, that often the local law enforcement agencies choose to subordinate their authority and obligation to the federal authorities for cases involving concurrent jurisdiction. In areas with proprietary interest, the federal government (i.e., USMA) does not have police power and the municipal law enforcement agencies must be notified to investigative criminal activity. The exception to this occurs if the perpetrator is military personnel, in which case the Uniform Code of Military Justice applies and the federal government investigates and prosecutes the case.

The enforcement actions that are pursued depend on the location of the offense(s) and the jurisdiction: exclusive jurisdiction is referred through the Uniform Code of Military Justice (UCMJ) or Federal Court; concurrent and or proprietory is turned over to local or state authorities. For administrative action, all cases are referred to the Deputy Garrison Commander for review or action.

4.7.2 Enforcement Activities

Procedures for enforcing hunting, fishing, and trapping laws and regulations are provided in USMA Regulation 215-5, Chapter 6. The Director, Community and Family Activities (CFA), the PMO and Range Control have some responsibility for enforcement activities. The Director, CFA maintains records of written warnings, suspensions, or revocations; the PMO provides military police for game warden duties, and Range Control maintains absolute control of access to all training areas, ranges and danger areas no matter what the hunting, fishing or trapping activity.

Enforcement procedures can involve the issuance of warnings and citations, or suspension or revocation based on the offense (a list of offenses and their actions is provided in USMA 215-5, Appendix I). Written warnings may be issued for relatively minor infractions such as failure to sign in from a hunting area or failure to display USMA backtag or parking permit. Violators of USMA Reg. 215-5 and/or Federal fish and wildlife laws are issued citations from the Military Police and administrative action is taken by the Deputy Garrison Commander.

Violators of State fish and wildlife laws are referred to the local New York State Environmental Conservation Officer. Enforcement actions are also taken by USMA against violators of State laws if the violation occurs in an area of the reservation under exclusive or concurrent federal jurisdiction. Violators receiving suspensions or revocations will be notified by letter from the Deputy Garrison Commander. Failure to comply with a suspension may subject the violator to further actions including barring civilians from access to the installation.

Military Police staffing levels do not permit a full program of enforcement of natural resources laws and regulations. Military Police are able to respond to individual complaints but routine patrolling of the outlying reservation is minimal, so many violations go undetected and there is little deterrent effect. Other federal and state agencies are available when requested for a specific circumstance but are not available for routine patrolling.

Law enforcement staffing obstacles have been difficult to overcome, but efforts will continue. An initiative in recent years to establish some natural resources law enforcement authority at Range Control was unsuccessful due to an increase in other responsibilities at that office. Funding for acquiring contract law enforcement resources has been proposed, but is currently on hold while the possibility of establishing a full time government position is being investigated.

4.7.3 Training

Military Police (MPs) are trained federal police officers. Additional training consists of a West Point Law Enforcement Certification Course. Prior to the big game firearms season, NYSDEC law enforcement personnel provide training to MPs regarding New York game and hunting laws.

4.8 CULTURAL RESOURCE PROTECTION

The primary cultural resources objective of the natural resources management program is to implement this INRMP in a manner consistent with conservation of cultural resources at USMA.

4.8.1 Cultural and Historic Resources Program

The Cultural Resources Manager (CRM) is responsible for the care, maintenance, improvements, and management of the cultural and historic resources located at USMA. A number of management plans have been developed for these resources, including most recently an ICRMP and associated standard operating procedures (SOPs) (Geo-Marine, Inc., 2001).

The ICRMP includes descriptions of existing historic structures and archaeological sites with general recommendations for preservation and maintenance according to the Secretary of the Interior's standards and guidelines. The existing Programmatic Agreement (PA) between the Department of the Army, the Advisory Council on Historic Preservation, and the New York SHPO addresses routine maintenance and repair work and follows the Secretary of the Interior's guidelines. A new PA has been written and is undergoing review and coordination.

When work at USMA is to be undertaken, a work order is reviewed by the CRM. The CRM is located in the Installation Branch (IB) of the Engineering, Plans, and Services Division (EPSD) of the DHPW.
If the work may affect historic resources and is covered under the existing PA, it is approved without further review by state or federal agencies. If the work is not covered by the agreement, work plans are sent to the SHPO. A "No Effect" determination requires approval by the SHPO, while a determination of "No Adverse Effect" requires approval by both the SHPO and the Advisory Council on Historic Preservation (ACHP). An "Adverse Effect" determination must be mitigated in consultation with the SHPO and the ACHP.

The NRB consults and coordinates with the CRM if an activity or project is planned that might have the potential to impact historic or cultural resources. For example, annual timber harvests that are conducted on the reservation are preceded by cultural resources surveys. The purpose of the surveys is to determine

whether historic or cultural resources are in close proximity to the harvest area and whether harvest activities have the potential to adversely affect those resources.

4.8.2 Natural Resources Management Implications

The CRM reviews all projects submitted through work requests (DD Form 4283) as well as alumni-generated gift projects. A substantial amount of work concerning the management of the prehistoric and historic cultural resources at USMA is already available, including text, computer files, and maps. Prior to any soil disturbance or modification of structures, these maps are consulted to determine the probability of disturbing any archaeological sites or historic structures that may be eligible or potentially eligible for listing on the NRHP or may be of significance to federally listed Native American tribes or groups.

Job Order Contracts (JOCs), major construction projects, estimating, and projects from other directorates are all reviewed through environmental checklists designed to provide the CRM with the information needed to determine if historic resources may be impacted by a proposed activity. Checklists include the *Environmental Preview Sheet* (for JOC and estimate use), *Environmental Checklist* (for use by other directorates) and the *Submittal Package Checklist*, which is required during the conceptual phase of major construction projects. If a project is determined not to be a Categorical Exclusion, a *Project Environmental Checklist* is also completed.

The ITAM acts as a liaison between the CRM, training office, and Range Control Staff. Natural and Cultural Resources personnel consult maps and texts as an early step in the natural resources management planning process. Appropriate steps are as follows:

- Identify the area or structure to be affected and coordinate with the CRM.

- Using the GIS database and maps, examine for the presence of existing or potential archaeological sites or standing structures. The archaeological sensitivity maps are broken down into five different site types and rockshelters, and a set of maps displaying the West Point cantonment at 11 different historic times, from 1780 to 1978 (The Research Foundation at SUNY-Albany, 1995).

- To comply with the National Historic Preservation Act (Section 106), and the Archeological Resources Protection Act, contact the New York SHPO to determine further necessary action. This action may require completion of a Phase IA or IB archeological survey, including background research and archaeological excavations. If archaeological sites considered to be potentially NRHP-eligible are found, further excavation work (Phase II and/or Phase III) may be required by the New York SHPO. If historic structures are involved, any proposed modifications or demolition must be approved by the New York SHPO. All work would be completed in accordance with the ICRMP. Another concern at USMA is the theft of cultural properties. Remote areas should be monitored by law enforcement personnel to prevent and deter theft.

- To comply with the Native American Graves Protection and Repatriation Act and the American Indian Religious Freedom Act, federally listed tribes or groups must be notified early in the process. A list of tribes or groups in New York is available from the National Park Service (Telephone No. 202-343-4101) or the New York SHPO (Telephone No. 518-237-8643).

4.9 ECOSYSTEM MANAGEMENT

This INRMP follows the direction set forth in the memorandum issued by the Deputy Under Secretary of Defense for Environmental Security (8 August 1994) regarding the *Implementation of Ecosystem Management in the DoD*. The memorandum states that ecosystem management will become the basis for future management of DoD lands and waters. In this context, ecosystem management will include:

Ecological Approach: There will be a shift from individual species management to the management of ecosystems.

Partnerships: Ecosystems cross political boundaries, making the need for cooperation, coordination, and partnerships essential for managing ecosystems.

Participation: Public needs and desires will be emphasized in management decisions.

Information: The best available scientific information will be used to select technologies to be used in managing natural resources.

Adaptive Management: Adaptive management techniques will be incrementally applied as they are identified.

DoD's overall goal regarding ecosystem management is ". . . to preserve, improve, and enhance ecosystem integrity. Over the long term, this approach will maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies and communities." The specific principles and guidelines that DoD has identified to achieve this goal are listed below. These principles and guidelines are reflected in the management measures set forth in Section 5.0 of this plan.

- Maintain and improve the sustainability and native biodiversity of ecosystems.
- Administer with consideration of ecological units and time frames.
- Support sustainable human activities.
- Develop a vision of ecosystem health.
- Develop priorities and reconcile conflicts.
- Develop coordinated approaches to work toward ecosystem health
- Rely on the best science and data available.
- Use benchmarks to monitor and evaluate outcomes.
- Use adaptive management.
- Implement through installation plans and programs.

Ecosystem management recognizes that humans are ecosystem components and that sustainable human activity does not mutually exclude the preservation and enhancement of ecological integrity. Therefore, it is ecosystem management that provides USMA the means to both protect biodiversity and continue to provide high-quality military readiness.

The management measures and strategies that have been proposed for USMA have been developed with consideration for the interrelationships between the individual components of the ecosystem, the

requirements of the military mission, and other land use activities. The focus is on maintaining the structure, diversity, and integrity of the biological communities, while recognizing that the cadets, soldiers, and military mission are a vital component of the ecosystem. An adaptive management strategy has been incorporated into this INRMP to monitor the temporal and spatial dynamics of the ecosystems and to adjust the management measures and strategies based on improved knowledge and data. The monitoring programs generate the data needed to determine whether the management measures and strategies are effective in achieving their intended goals and objectives. This management approach will preserve and enhance the natural resources, while providing the optimum environmental conditions required to sustain the military mission and realistic training conditions.

SECTION 5.0:
NATURAL RESOURCES MANAGEMENT

This chapter begins with an overview of the general goals and objectives established by the Natural Resources Branch (NRB) at USMA for the management of the resources. Section 5.2 provides a description of the methods used to develop this INRMP and the management measures for each resource area. Resource-specific discussions, provided in Sections 5.3 through 5.14, provide detailed explanations of the goals and objectives, management strategies, and other management alternatives considered for each resource area. Resource-specific goals and objectives are provided, as well as the relationship of the resource in supporting the mission. The subsections entitled *Management Measures* describe the management measures selected to be implemented to meet the resource-specific goals and objectives. This section provides the rationale for why the management measures have been selected and their potential relationship to or impact on other natural and cultural resources and the military mission. Other management alternatives that have been considered but have been rejected for reasons such as economical or ecological impracticality are discussed as a subheading under each resource area. Section 5.17 provides a summarization of the management measures, including inventorying and monitoring programs, for all resource areas, their relationship to each other and the military mission, and how they serve to achieve the goals and objectives of the natural resources management program at USMA. Table 5-10 summarizes the management measures for each resource area. Table 5-11 summarizes the inventorying and monitoring requirements for each resource area.

5.1 GOALS AND OBJECTIVES OF THE NATURAL RESOURCES MANAGEMENT PROGRAM

The goal established by USMA for the natural resources management program is to maintain ecosystem viability and ensure the sustainability of desired military training area conditions. The NRB has identified a number of objectives necessary to achieve this goal:

- Conduct a natural resources management program that reflects the principles of ecosystem management.
- Use adaptive management techniques to provide the flexibility to adapt management strategies based on

increased knowledge and data gained from monitoring programs and science literature.

- Seek to maintain or increase the level of biodiversity of native species.

- Protect forest resources from unacceptable damage and degradation resulting from insects and disease, animal damage, invasive species, and wildfire; and manage the resources in a manner that supports the military mission.

- Prevent the degradation of water quality, protect aquatic and riparian habitats, and identify and restore degraded habitats.

- Protect soil resources from erosion and destabilization through prevention and restoration efforts.

- Protect and preserve cultural resources in accordance with state and federal laws, and the Integrated Cultural Resources Management Plan (ICRMP).

- Provide special protection and management that lead to the recovery of threatened and endangered species and protects species of special concern.

- Protect species identified as state or locally rare, but without legal protection status, to the extent practical without undue restrictions on operations.

- Protect Special Natural Areas that have unique ecological significance, geologically unique structures, or areas that offer significant aesthetic and educational values.

- Manage wildlife and fisheries resources within the principles and guidelines of ecosystem management to maintain productive habitats and viable populations of native species.

- Provide outdoor recreational opportunities that avoid conflict with the military mission.

- Provide a positive contribution to the community by offering informative and educational instruction and opportunities.

- Continue to resolve weakness in natural resources law enforcement.

5.2 METHODS

The preparation of this INRMP involved the review and analysis of past natural resource management practices, ongoing programs and the current conditions of the existing resources as detailed in Section 3.0. The review process included interviewing USMA personnel, as well as key individuals from state and federal agencies (e.g., USFWS and NYSDEC); collecting existing environmental documentation; and conducting field reconnaissance of the installation.

The findings from the interviews, field reconnaissance, and document review process have been synthesized and incorporated into this INRMP using the ecosystem management approach described in Section 4.9. Where data gaps exist, inventorying and monitoring programs have been proposed. These programs are designed to collect the data necessary to fill those information gaps and to achieve the objectives of the natural resources program.

The approach used to develop the discussion of the management strategies for each resource followed three general steps:

- ***Goals and Objectives***. The goal and objectives for the management of the resource, as well as the relationship of the resource to other components of the ecosystem (including the human component) and the military mission, were described.

- ***Management Measures***. An evaluation of past management strategies, current conditions, and an array of management strategies based on a more-informed knowledge of ecosystem management principles were considered to develop management strategies that would achieve the goals and objectives for the resource, as well as those of the overall natural resources management program. An inventory of needs and monitoring programs necessary to generate data to ensure continued success of the program and to provide the information needed to facilitate the integration of adaptive management techniques was included.

  Adaptive management is a continuing process of action(s) based on planning, monitoring, evaluation, and adjustment. When adequately designed and effectively implemented, the process allows managers to

determine how well their actions meet their objectives (whether that is protection of sensitive habitats or maintenance of scenic beauty) and what management steps are needed to increase the chances of achieving the objective.

- ***Other Management Alternatives.*** Other management alternatives were considered during the screening process, but eliminated because they were economically infeasible, ecologically unsound, or incompatible with the requirements of the military mission. A discussion of these alternatives was included.

5.3 SOIL MANAGEMENT

The primary goals of soil conservation and management on West Point are to identify eroded soils, protect soil resources, and prevent soil erosion and its potential impacts on water quality, habitat, and mission objectives. Approximately 13 percent of the soil mapping units that occur on the installation are considered to be moderately to severely susceptible to erosion. Most problems associated with soil erosion on the installation occur in areas where vegetation has been removed or disturbed on steep slopes, or on long, moderately steep slopes.

Objectives of the soil conservation and management on West Point are to avoid disturbance of soils that are considered to be moderately or severely susceptible to erosion. Where these areas are disturbed, either as a result of anthropogenic activities or due to natural causes, they are stabilized and repaired in a timely manner to avoid the development of excessively eroded sites. Installation sources of erosion and sedimentation, runoff, and dust will also be controlled to prevent damage to land, water resources, equipment, and facilities on both the installation and adjacent properties.

5.3.1 Management Measures

Soil erosion at USMA would be expected to be low; however, it is a problem in localized areas that are heavily used throughout the year, or where land disturbance has occurred (Coleman, 1995). Soil erosion problems on USMA have resulted in difficulties in accessing training areas at various locations due to road washouts and erosion from rain and snowmelt. Maneuver exercises consist primarily of light infantry foot traffic. These exercises typically have much less of an impact on the magnitude of soil erosion than the use of tracked vehicles, which are not used at USMA. However, areas that are used repeatedly for training activities show an increase in

the amount of ground cover damage and soil erosion. The majority of the current or planned projects detailed in the Annual ITAM Work Plan and in Table 4-1 are designed to address problems resulting from erosion due to land disturbance. Because of the potential for erosion of disturbed areas on USMA, it is necessary that a comprehensive soil resource management approach be followed. The current policy of addressing problem erosion areas as they occur through the LRAM program will be continued. In addition, a management approach designed at avoiding the disturbance of potential problem erosion areas will be developed, when possible, in a manner consistent with mission objectives.

USMA will implement the following general and specific soil conservation provisions:

- Range 4 Berm Rehabilitation and Soil Stabilization. This project will entail regarding the range floor to contain water runoff, build a new firing berm in front of the old berm, and re-seed the surface of the old range berm to eliminate soil loss from the berm. (FY 03)

- ITT Trench Rehabilitation. This area is no longer used for Infantry Tactics Training (ITT). The plan is to remove obstacles, repair soil erosion, fill pits and gullies and reseed area. Area is close to a wetland. (FY 03)

- Area T2 Engineer Site stabilization and rehabilitation. This area is used to support Engineer training activities Cadet summer training. Rehabilitation of this area is required for the area to continue to support Cadet training. Rehabilitation includes seeding an mulching to help re-vegetation the ground cover in the over-used areas. Holes and unused defilades will be filled in graded, seeded and mulched to re-establish vegetation and to eliminate soil loss at the site. The access trail to the site will also be graded and stabilized to repair washout areas, of which there are many and gullies. At the present time, this road is not easily trafficable and could cause injury to personnel and damage to vehicles using it. If this repair is not done the area will quickly become so heavily damaged that it will be unusable for proper training and will become more of an environmental issue with increased soil loss and erosion. (FY 03)

- Old Demolition Pit Rehabilitation. Sift soil of metal debris, fill, grade, mulch and reseed. (FY 04)

- Popolopen Ford Restoration. This project will entail regarding the range floor to contain water runoff, build a new firing berm in front of the old berm, and re-seed the surface of the old range berm to eliminate soil loss from the berm. (FY 04)

- Closure and Rehabilitation of old road. This area has become heavily damaged and gullied due to use of this wet area for parking and travel of vehicles. Plan is eliminate access to this old trail and to add a hardened parking area at edge to eliminate rutting and erosion. (FY 04)

- Black Cap Trail Soil Erosion Repair. Trail is severely eroded from water runoff and overuse. Fill, grade and reseed gullies. Install waterbars to eliminate further water damage. (FY 05)

- Rehabilitation of old Bayonet Training Site. This area has been severely damaged by tree fall due to heavy winds. Area is also heavily overgrown with thorny vegetation such as blackberry, multiflora rose and barberry. Downed trees need to be removed and nuisance vegetation controlled. This will open up new area to be used for training. (FY 05)

- Sapper Island Stabilization and Rehabilitation. Sapper Island is a small, ½-acre, isolated island in Stilwell Lake. For several years this island has been used for summer Cadet engineer committee amphibious assault training. At this time Sapper Island is in need of soil rehabilitation and general rest from use to be able to properly recover from overuse. Plan is to remove old structures and debris, and seed and mulch unvegetated, damaged, and eroded areas. This rehabilitation effort will be needed on a regular basis as long as there is regular use of the island for training purposes. (FY 05)

- Maneuver trail erosion repair. This trail leads to a heavily used training site in Training Area M. The 200 meter long trail is steep (approximately 15% slope) and heavily eroded from vehicular traffic, water runoff and overuse. Most of the soil has been eroded from the trail. Gully formation is extensive. Trail edges have been heavily cut by traffic, and in many places only rock and boulders are present. Trail begins at WL 80017939 off Range Road 15. Trail maintenance, diversion ditches and water bars need to be emplaced. (FY 06)

- Sweeny Pit rehabilitation and reconfigure. This area is an old burrow pit that is no longer used for that

purpose. A wetland, which is adjacent to the old burrow pit, makes this a somewhat sensitive site. The plan includes regrading much of the approximately 5 acre area, which now consists of various sized mounds of debris and vegetation. Will then plant seed and mulch to re-vegetate and stabilize area. This will make the area available for use as a possible staging area or other training related activity. (FY 06)

- Range Road 6 Soil erosion control and trail closure. This trail is heavily eroded from water damage. Road is not used and the plan is to close it and allow it to recover to it's natural state. Block entrance to road. Regrade to channel water off road and eliminate erosion. Road begins at WL 83327727 and runs north toward Cranberry Pond. (FY 06)

- TA R Soil Erosion repair and rehabilitation - Lower Section. This area is no longer accessible by vehicle due to severe trail washout and subsequent gully formation. Plan to re-grade and install water erosion structures, such as waterbars, along the present trail to repair the present erosion and eliminate any further erosion of the soils. Black locust trees have taken over much of the open areas adjacent to the trail. Removal of this invasive vegetation will also me done by mechanical means as well as some herbicide application. Other invasive vegetation includes barberry and multiflora rose. This will open up new training area that is presently inaccessible and little used. (FY 07)

- Georgina Hill erosion control and repair. Maneuver trail is severely eroded from previous water damage. Install water bars, re-grade to eliminate channeling. Grade and re-seed upper section of trail to eliminate water erosion. Located between TA P/O. Trail begins at WL 76327689 and runs NW for approximately 300 meters. (FY 07)

- Maneuver trail soil stabilization and runoff control. Install waterbars and plant vegetation to eliminate further gully formation and soil erosion on steep (20%) trail. Trail is approximately 100 meters long. Add new culvert at bottom of slope to eliminate ponding and soil erosion. (FY 07)

- Calfex Damage – Live fire repair. Damaged occurred in Training Area D6 (WL 83628066) due to construction and use of the Live Fire range over the past years. Soil damage and gully formation is already present. Damage is close to sensitive wet areas. The need here is to repair the damage from the past activities stabilize sensitive areas. This will involve grading, seeding and mulching of the area approximately

150 meters long, extending up a slope of approximately 15%. It will also include removing deadfall to reduce forest fire risk. (FY 07)

- Soil stabilization at Land Nav site 3. Due to heavy use of this site, much of the groundcover has been removed from the main (classroom) area of this site. Soil stabilization is necessary. Topsoil, seed and mulch site and adjacent areas. Stabilize foot-trails around site with erosion control structures. (FY 07)

- When the exposure of soils is necessary to accomplish mission objectives whether for military training or for other activities, such as timber harvest, use soil conservation measures (e.g., check dams, wind breaks, diversions) to control erosion, sedimentation, and dust. To limit land maintenance expenditures and minimize environmental impacts, site physically intensive land-disturbing activities, when possible, on the least erodible lands (those requiring the least cover for erosion control). The potential erodibility of a site (as determined from existing soil types, slopes, and vegetative cover) and the location of adjacent wetlands, vernal pools, and other surface waters will be identified and considered in order to minimize impacts on these resources. (FY 03 - 07)

- Implement erosion and sediment controls where appropriate. Maintain protective vegetative covers over all compatible areas, especially on steep slopes. Other materials, such as gravel, fabrics, mulch, riprap, or other materials that are environmentally safe and compatible with the location, may be used, as appropriate, for control of erosion in problem areas. (FY 03 - 07)

- Monitor soil erosion on a regular basis, especially following damaging events such as heavy rains, rapid snow melt, high winds, or excess trafficking (training operations). Monitoring of potential erosion areas will allow early detection of problem areas. (FY 03 - 07)

- Continue to use the LRAM program in a proactive manner to repair soil erosion problems and to avoid future development of excessive erosion sites. (FY 03 - 07)

5.3.2 Other Management Alternatives Considered

Intensive management measures have been proposed for the soil resources on the USMA reservation. Other soil management alternatives that represented a program consisting of fewer, and less intensive, management

measures were considered, but rejected. The other management alternatives considered represented the minimum approach to achieving a soil resource management program that could comply with the guidelines established in Army Regulation (AR) 200-3. The management alternatives in this approach were aimed at controlling the level of erosion, soil loss, and disturbance that could potentially occur, rather than taking the steps necessary to prevent, to the maximum extent practicable, the likelihood of these events occurring.

Given the nature of the soils on the reservation and their vulnerability to erosion, this minimal approach to soil management has been rejected. The military mission requires continuous vegetative cover, and the ability to sustain this cover over the long term could be jeopardized by a minimal management approach and unexpected climatological events. The effort and resources necessary to implement this approach is a prudent investment toward ensuring the long-term sustainability of the soil resources.

5.4 WATER RESOURCES MANAGEMENT

The ecological and human health importance of maintaining healthy water bodies at USMA is reinforced by several federal and state laws/regulations. In addition, AR 200-1 and AR 200-3 also promote the importance of maintaining healthy water body systems on the installation.

The primary goal of water resources management at USMA is to protect the water bodies on the installation. The objectives defined for meeting this goal are:

- Identify and restore degraded aquatic habitats (see Section 5.5.1 for a more detailed description).
- Protect aquatic and riparian habitats (see Sections 5.5.1 and 5.5.2 for more detailed descriptions).
- Prevent degradation of water quality.

5.4.1 Management Measures

Inventorying and Monitoring Water Bodies. Developing a comprehensive water quality sampling/monitoring program is the most important management approach for the water resources at USMA. A comprehensive study

of surface water quality for USMA has not been conducted since the Adirondacks Lakes Survey in 1987 and limited water quality data have been collected since 1990. The water quality data that is available does not indicate the existence of any water quality problems and USMA is in compliance with all applicable laws and regulations regarding water quality. In addition, water quality problems would not be expected for several reasons—the waterbodies are located in forested ecosystems in the upper reaches of the watersheds, where the there is little human activity or disturbance to the headwaters that would result in water quality degradation. Indeed, the water quality of Lusk Reservoir, which receives its water from the Popolopen Brook watershed, and is a monitored source of drinking water, continues to be very good. Reservation wide, there is a general lack of problems with fish health, and the spawning populations of trout in Mineral Springs and Trout Brooks indicate near pristine water quality.

Maintaining a Forested Watershed. Maintaining a predominantly forested watershed will reduce the quantity of nonpoint source pollutants transported to surface water bodies. This is particularly important because most of the water supply for USMA is derived from the Popolopen Brook watershed, which is largely contained on the reservation (USMA, 1980b). There are no plans for deforestation at USMA other than the creation of scattered small upland openings coincident with selective timber harvest and reversion of some sections of Areas R and L back to old field habitat by removal of saplings and brush.

Maintaining Riparian Buffers. Vegetated riparian buffers serve many important functions in protecting water resources. By stabilizing the stream banks and shorelines with vegetation, erosion and sedimentation rates will be reduced. Increased sediment loads are associated with the physical destruction of habitat such as the smothering of bottom communities and spawning beds.

Vegetated riparian areas also stabilize water levels. For lotic systems, stable water levels and velocities result in reduced scouring of stream banks (i.e., reduced erosion), reduced pollutant transport, reduced turbidity, increased species diversity, and increased habitat for species. For lentic systems, stable water levels result in balanced thermal/mixing characteristics, reduced turbidity, and increased species diversity. High turbidity levels in water bodies often result in reduced prey capture rates, and the suspended solids associated with turbidity can be lethal to fish species by clogging their gills. In many cases, the vegetation also absorbs excess overland waterflow.

Riparian areas also help to moderate water temperatures for both lentic and lotic water bodies. Increased water

temperature can cause stress to sensitive cold water aquatic organisms, increased metal toxicity and hydrocarbon solubility, algal blooms, and an increase in nuisance plant populations in lentic water bodies. For lotic systems, moderate temperatures can be achieved primarily by creating riparian buffers that provide shade to the water body. It is difficult to manage water temperatures in lentic systems due to the large open water area associated with such systems. (Typically, artificial circulation is used to break down the thermal layers of a lake and to increase dissolved oxygen levels.)

The primary management measure for riparian buffers follows:

- Maintain 100-foot vegetative buffers with a sufficient number of canopy species around all water bodies where possible. (It may not be possible to establish a buffer area with canopy species around the drinking water reservoirs due to federal and state regulations, but grasses and other non-woody species that could be established can intercept overland water flow containing suspended sediments, nutrients, and pollutants.) Existing land use in several instances (highways, buildings, established training facilities, etc.) makes a vegetated buffer impractical. (FY 03 – 07)

Control Pollutant Inputs. Pollutants such as metals, organic contaminants, and chlorides adversely affect the health of water bodies. These pollutants stress fish and aquatic organisms in the water column and in bottom sediments and lead to bioaccumulation and related food chain events. These pollutants may also cause osmotic stress and ultimately lead to ground water pollution. Pollutants are difficult to treat once they have entered aquatic ecosystems, especially due to the bioaccumulation of pollutants by aquatic species. The most effective method of reducing pollutant levels in water bodies is to limit the use of these substances in the surrounding watershed, particularly in the riparian areas adjacent to the water bodies.

Bacterial inputs into water bodies (e.g., by septic tank leaks) can cause diseases of fish species and reduce the population size. High levels of bacteria can also affect human health. In 1976, septic tank leakage caused contamination in the Round Pond Recreation Area. Short-term E. coli contamination problems at Round Pond in recent years have been generally attributed to the presence of Canada goose feces. The NRB has responded with increased efforts to control the resident goose population.

Nutrient loading to water bodies, particularly of phosphorus, may accelerate natural eutrophication processes,

especially in shallow lakes. This "cultural" eutrophication may be the result of human activities upstream or elsewhere in the watershed (e.g., forestry, agriculture, construction). Excess nutrients that enter a water body may cause algal blooms, an increase in nuisance plant growth, and odors; disrupt species diversity; reduce dissolved oxygen levels below the standard associated with the trout designation of several of the water bodies; and cause health impacts at high concentrations in drinking water.

In 1997, a comprehensive evaluation of USMA golf course turf and pesticide management practices, along with soil and stream sediment sampling was conducted by the Army Center for Health Promotion and Preventive Medicine (USACHPPM, 1997). Pesticide residues were detected in samples collected from stormwater culverts and permanent streams draining the golf course, representing a historical introduction of these compounds into the sediment. There was no indication of significant downslope transport or migration of metals residues into surface water systems. Pesticide and metals residues detected in sediment samples collected next to Building No. 1227 are partially attributable to both past and present pesticide handling practices and serve to underscore the need to improve general housekeeping and to provide an adequately designed facility for staging pesticides or washing application equipment.

The chemical attributes of the water bodies at USMA are generally in good condition. General management measures to be implemented for controlling pollutant inputs are summarized below:

- Turf management chemicals for the USMA golf course will be applied *minimally* and in conformance with appropriate standards and will not be applied in riparian buffer areas. Currently, the most extensively used turf management chemical type is a nitrogen-based fertilizer. (FY 03 – 07)

- Minimize the potential for soil and water pollution by implementing an Integrated Pest Management approach in turf disease, insect, and weed control strategies. (FY 03 – 07)

- Onsite wastewater treatment systems will be operated, inspected, and maintained to prevent the discharge of pollutants to surface and ground waters and, to the extent practicable, reduce the discharge of pollutants into ground waters that are closely hydrologically connected to surface waters. (FY 03 – 07)

- Check dams can be used to trap sediments and reduce the transport capacity of a stream. Suspended sediments often carry attached pollutants to downstream habitat areas.

Control Nuisance Species. A normal distribution of aquatic species in water bodies is essential for maintaining overall aquatic ecosystem health and diversity. Large increases in one species tend to out compete other aquatic species in a water body. Large population increases are relatively common in algal species, particularly blue-green algae. Algal blooms are generally the result of high nutrient concentrations (especially phosphorus) and also of increased temperatures. Algal blooms usually occur during the summer months and have been reported in Popolopen and Stilwell Lakes. The best approach for controlling algal populations involves prevention, reducing nutrient inputs to water bodies, and controlling water temperatures (by establishing riparian buffer areas and by maintaining a primarily forested watershed). Once algal populations have begun to increase in a water body, algicides, artificial circulation, flocculation, and dilution/flushing are standard control techniques that may be tried.

The treatment of algal blooms to date has been limited to application of the algicide copper sulfate. Many studies exist comparing various lake management techniques for controlling algal blooms. In the 1990 *Lake and Reservoir Restoration Guidance Manual*, USEPA summarized the various techniques available for treating nuisance algal populations (see Table 5-1). This INRMP addresses only the techniques that may be implemented as part of the management measures summarized below. The first management strategy will scrutinize land uses surrounding Popolopen and Stilwell Lakes and identify likely upstream sources of point or nonpoint nutrient (e.g., phosphorus) loading. This information will provide a basis for development of future management measures. Possible management alternatives include:

- Application of algicides such as copper sulfate. Algicides are generally the first management strategy attempted to combat algal blooms. Application is simple and inexpensive, and results are usually immediate. Problems associated with algicides are dissolved oxygen depletion, toxicity to invertebrates such as zooplankton and unionid molluscs, blue-green algae tolerance, and the potential accumulation of copper in the sediments.

- Artificial circulation techniques. These techniques are moderately priced and are effective at reducing internal nitrogen, phosphorus, iron, and manganese cycling; increasing dissolved oxygen concentration; and changing the algal population from blue-green to green algae. Problems associated with artificial circulation are increased particulate nutrients, decreased clarity, and a temperature increase in the hypolimnion.

- Phosphorus inactivation. This is a technique to achieve long-term control of phosphorus release from lake sediments by adding as much aluminum sulfate (alum) as possible. This technique has been highly effective

in thermally stratified natural lakes, but is not well documented in reservoirs. Problems associated with phosphorus inactivation are potential toxicity to other aquatic species and increased clarity, which may allow weed infestations to spread in the water body. This technique is currently used in Lusk Reservoir.

Table 5-1
Comparison of Lake Restoration and Management Techniques for Control of Nuisance Algae

Treatment (1 application)	Short-Term Effect	Long-Term Effect	Cost	Chance of Negative Effects
Phosphorus Inactivation	E	E	G	L
Dredging	F	E	P	F
Dilution	G	G	F	L
Flushing	F	F	F	L
Artificial circulation	G	?	G	F
Hypolimnetic aeration	F	?	G	F
Sediment oxidation	G	E	F	?
Algicides	G	P	G	H
Food chain manipulation	?	?	E	?
Rough fish removal	G	P	E	?
Hypolimnetic withdrawal	G	G	G	F

Note: E = Excellent; G = Good; F = Fair; P = Poor; H = High; L = Low; ? = unknown.

Source: USEPA, 1990.

- Dilution. This is a relatively low cost technique which reduces nutrient concentrations in the water body and has immediate results. Problems associated with dilution are the large quantities of low-nutrient water required for dilution and the need to conduct the technique continuously.

The presence and control of aquatic weeds in USMA water bodies is discussed in Section 5.5.1.

5.4.2 Other Management Alternatives Considered

Other management alternatives that have been considered as techniques for improving water quality, but which are no longer being considered, are described below.

Dredging. Dredging was considered to remove excess sediments and nuisance plant species in the water bodies affected by those conditions. Dredging is no longer being considered as a viable alternative due to the large expense associated with the technique. Dredging is not a long-term solution and would need to be repeated annually. In addition, this technique can cause increased turbidity and low dissolved oxygen values.

Water Level Drawdown. Water level drawdown was considered to stabilize water levels and also control nuisance invasive plants. This management technique is no longer being considered as viable since the technique has been reported to enhance the populations of certain exotic species and also may promote algal blooms. In addition, the technique must be repeated annually for several years. This technique was attempted on two occasions in the 1980s at Weyants Pond with minimal success.

Plant Pathogens. Introduction of plant pathogens was considered to target exotic species. This management technique is no longer considered viable since it has unknown effects. Non-target species might be adversely affected, thereby further disturbing the natural biodiversity of the area.

5.5 HABITAT MANAGEMENT

AR 200-3 requires Army habitat management efforts to be accomplished in a manner that conserves and enhances existing flora and fauna consistent with the Army goal to conserve, protect, and sustain biological diversity while supporting the accomplishment of the military mission. To achieve this, activities will be directed toward the maintenance of healthy ecosystems and restoration of degraded ecosystems. The regulation also states that primary consideration be given to the management of indigenous listed, proposed, and candidate species' habitats, as well as to other environmentally sensitive areas and areas of special concern.

5.5.1 Aquatic Habitat

The goal of aquatic habitat management at USMA is to maintain healthy aquatic ecosystems to provide pristine water quality and superior fisheries resources. Aquatic ecosystems are abundant at USMA, with over 30 surface waterbodies and over 300 wetland areas. These ecosystems serve a vital role in supporting the military mission, providing drinking water, and affording recreational opportunities at the installation. Habitat protection is the primary objective for maintaining healthy aquatic ecosystems and protecting the balance of physical, chemical, and biological characteristics within each water body.

General aquatic habitat management measures have been developed based on the goals and objectives for maintaining healthy aquatic ecosystems. These general management measures are primarily aimed at protecting aquatic habitats. Specific management measures will be developed based upon findings of ongoing aquatic habitat

assessment/evaluation. General management measures are listed below.

5.5.1.1 Management Measures

Conduct Aquatic Habitat Assessments. Biological potential is limited by the quality of the physical habitat, therefore, conducting comprehensive aquatic habitat assessments provides a very effective management approach for evaluating the quality of the water resources at USMA. Collection of aquatic habitat data has been intermittent in the past, but a more focused effort began in 1996 and 1997 under the Memorandum of Understanding (MOU) with USFWS. Aquatic habitat assessment is now a major aspect of the annual USFWS technical assistance visits to West Point. This information is expected to provide a basis for the development of future management measures based on the results.

Aquatic habitat assessment is defined as the evaluation of the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community. For streams, an encompassing approach to assessing structure of the habitat includes an evaluation of the variety and quality of the substrate, channel morphology, bank structure, and riparian vegetation. The rapid bioassessment protocols developed by USEPA for use in streams and rivers involves rating 10 parameters as optimal, suboptimal, marginal or poor. The specific individual parameters, and the criteria from which to evaluate these parameters, varies depending on whether the waterbody is a low gradient or a high gradient stream. Details on conducting rapid bioassessment protocols are described in the most recent version of *Rapid Bioassessment Protocols for Use in Streams and Rivers* (USEPA, 1997).

Maintain Species Diversity. Biodiversity is critical in protecting aquatic ecosystems. Biodiversity provides resilience to drastic changes in environmental conditions such as floods or forest fires. Maintaining species biodiversity for both the floral and faunal components of each water body at USMA will reduce the potential adverse effects of anthropogenic changes in the environment, such as pollution, habitat degradation, and the introduction of exotic species (WWF, 1994). Monitoring aquatic ecosystems and preventing, or acting to reverse, these adverse effects are the primary means of maintaining species diversity. Preservation of those natural systems, which are of exceptional biological value will assist in maintaining species diversity in the aquatic habitats. At USMA, these systems include wetlands, riparian areas, and the Special Natural Areas located near or adjacent to waterbodies.

Protect Aquatic Habitat. The area immediately surrounding a water body plays a vital role in habitat protection. The stability of shorelines and stream banks is important in preventing instream sediment loading and protecting vegetative cover, which serves as a pollutant filter. The adjacent riparian area (discussed further in Section 5.5.2) provides additional streambank stabilization and contributes large organic debris (critical for providing spawning habitat for fish species) to the water bodies. On a larger scale, but equally as important, the surrounding watershed protects surface water quality through nonpoint source pollutant removal and erosion and sediment control. Habitat protection will ultimately foster pristine water quality and stimulate sustainable populations of fish species.

One hundred-foot buffers have been established around water bodies to maintain streambank and shoreline vegetation, to reduce adverse impacts on water quality, and to protect aquatic habitat. Activities within buffer zones are limited to those which would cause little or no impact on water quality and aquatic habitats. Angling activities are permitted. The project proposal review process at USMA, which includes review by natural resources staff, helps insure that the integrity of buffer zones is maintained.

In addition, amphibious training exercises at USMA will be reviewed to minimize shoreline and streambank erosion and to correct and/or minimize unavoidable impacts on aquatic habitats.

A recently completed shoreline stabilization project involved work around the Engineer Training Site at Stilwell Lake. Stream bank stabilization projects are planned for Highland and Popolopen Brooks.

Control Invasive Species. Another example of large increases in populations occurs when non-native species are introduced into an ecosystem. These exotic species do not have established "predators" in the ecosystem and are able to reproduce virtually unchecked when growing conditions are favorable. Invasive aquatic plants are found in many USMA water bodies.

Techniques for removing exotic species are generally species-specific. Many studies have compared various lake management techniques for controlling nuisance aquatic weeds. In the 1990 *Lake and Reservoir Restoration Guidance Manual*, USEPA summarized the various techniques available for treating nuisance aquatic weed populations (see Table 5-2). This INRMP addresses only the techniques that may be implemented as part of the

management measures below.

Table 5-2
Comparison of Lake Restoration and Management Techniques for Controlling Nuisance Aquatic Weeds

Treatment (one application)	Short-term effect	Long-term effect	Cost	Chance of negative effects
Sediment Removal	E	E	P	F
Drawdown	G	F	E	F
Sediment Covers	E	F	P	L
Grass Carp	P	E	E	F
Insects	P	G	E	L
Harvesting	E	F	F	F
Herbicides	E	P	F	H

E = Excellent G = Good F = Fair P = Poor H = High L = Low

Source: USEPA, 1990.

Water Chestnut. Water Chestnut (*Trapa natans*) is a floating aquatic annual plant species that if left alone, forms colonies of rosettes growing so thickly that all plant life below them can die from lack of light. Water chestnut can rapidly create a monoculture in aquatic systems. In extremely thick infestations, the water below the chestnut becomes stagnant and devoid of fish and most other life. Chestnut is an annual, dying back every year. This leaves a large amount of rotting vegetation in the water column, and can be responsible for fall and winter fish-kills.

Water Chestnut has been detected in Upper and Lower Cragston Lakes, in Stilwell Lake, Mine Lake, Weyants Pond, Lusk Reservoir, and the Hudson River. It is only at Upper Cragston Lake where this plant has had serious environmental impacts at West Point. However, Mine Lake and Lusk Reservoir have expanding populations of this plant, in spite of control efforts.

Water chestnut has little direct impact upon training because ongoing control efforts have kept water chestnut populations low. In high densities, it can contribute to the eutrophication of drinking water, but this is not the case at West Point. It can adversely effect fish populations and fishing opportunities. Its spiny seeds are a danger to bare feet, and the long anchoring stems caused the death of three swimmers in Kingston, NY in the summer of

2001.

Control of water chestnut has a high probability of success, provided the infestation is discovered and dealt with early enough. It is an annual, and if prevented from setting seed before it dies, water chestnut does not return. Water chestnut does form a seed bank, with dormant seeds taking several years to germinate, so control efforts must be persistent. Therefore, NRB staff has been monitoring all West Point lakes, and pulling plants as they are found. While NRB has been able to control water chestnut in all waters on the reservation, we have been able to eliminate it from none. It continues to appear in new locations. The spread is slow, and new populations do not become a nuisance immediately

One successful campaign began in 1995. At that time, Upper Cragston Lake had such an infestation of this plant that there was no other emergent or submergent plant life in the pond. In the winter, these weeds would die back, and the oxygen demand for this mass of rotting vegetation probably greatly reduced the fish population. To remedy this, the installation pest management contractor physically removed all the water chestnut in the pond (40 tons). Now, the NRB staff devotes several days every summer to clearing, by hand, any newly emerged plants from the pond. This has been a very labor intensive operation, but the results have been dramatic. Lilly pads and spatterdock now grow where once there was only water chestnut. The fish population has rebounded, and water clarity has increased dramatically. Production of seed has been very low to non-existent at this site for several years, and though the water chestnut population is less every year, there are always new plants to remove each summer, a testament to the viability of the seed.

Control of seed-source is essential for long-term success. Introduction of water chestnut to new habitats occurs when seed floats to new locations, is carried in the breast feathers of waterfowl, or is dumped with other debris. The rosettes will produce seed even when separated from the roots, and may be transported on boat props or trailers. It is unlikely to travel in live-wells or bait-buckets. To combat this, water downstream from infested ponds/lakes will be checked periodically for new water chestnut populations, as will areas frequented by waterfowl, particularly Canada geese. Dumping of any debris, especially the results of any control efforts, will be placed well upland, away from any watercourse. Lastly, anglers, boaters, and West Point's recreational staff will be educated to the dangers of accidentally introducing any organism into new habitats, be it water chestnut, Eurasian water milfoil, or the contents of their bait-bucket.

Management measures for the control of water chestnut include:

- Mine Lake, Upper Cragston, Stilwell Lake, and Lusk Reservoir will be monitored and weeded annually, until no new plants are found in two consecutive years. (FY 03 – 07)

- Other West Point lakes and ponds will be monitored for water chestnut on a rotating schedule, checking at least two water bodies a year. (FY 03 – 07)

Eurasian Water Milfoil. At West Point, large milfoil (*Myriophyllum spicatum*) concentrations occur in Popolopen Lake, Mine Lake, Lake Stilwell, Lake Georgina, Cragston Lake, Wilkins Pond, and Weyants Pond. In 1998, Sonar (5% Fluridone) was applied to Weyants Pond to control milfoil, as well as other problem aquatics found there. While this application was effective in controlling the plants for a short while, a more long-term solution was needed. Accordingly, in 1998 the post biologist stocked 400 sterile, triploid grass carp, *Ctenopharyngodon idella* in Weyants pond. This required obtaining a permit from the New York State Department of Environmental Conservation and the construction and maintenance of a fish-proof fence on the Weyants Pond outlet to prevent the carp from escaping to other aquatic systems. Grass carp take time to show results, but there has been an obvious improvement thus far. A second stocking is expected in 2004.

Two potential bio-control agents are being evaluated by Cornell University. A European aquatic moth, *Acentria ephemerella* and a native weevil, *Euhrychiopsis lecontei* were discovered living in Cayuga Lake. Soon after, European milfoil mats disappeared with a corresponding increase in native aquatic plants. It is believed that the dramatic reduction in the lake's aquatic plant problem is linked to these two insects. Unfortunately, though both prefer Eurasian milfoil, neither of the insects is monophagous. This non-specificity makes either animal unlikely to be licensed for intentional introductions, but the natural spread of these organisms seems a possibility.

Management measures to control milfoil are as follows:

- Maintain current grass carp levels at Weyants Pond by restocking to replace mortality. (FY 03 – 07)

- Continue to monitor and repair the fish fence. (FY 03 – 07)

- Look for evidence of *Acentria ephemerella* or *Euhrychiopsis lecontei* in West Point waters. (FY 03 – 07)

5.5.1.2 Other Management Alternatives Considered

An additional management alternative that was considered as a technique for improving aquatic habitat quality, but is no longer being considered, is restricting access to the water bodies. Access restriction is no longer being considered as a viable management alternative due to its potential conflict with the primary objective of maintaining the military mission at USMA and the desire to provide water-based outdoor recreation.

5.5.2 Riparian Areas

The goal of riparian management at USMA is to protect water quality and fisheries resources. USMA is rich with surface water resources, all of which are surrounded by riparian areas of varying land uses, topography, and vegetative cover types. Riparian areas are critical for dissipating stream energy associated with high water flows, filtering sediment and pollutants, improving floodwater retention and ground water recharge, stabilizing stream banks and shorelines, providing habitat for instream and upland species, and supporting biodiversity (USEPA, 1993). The primary objective of riparian management at USMA is to maintain adequate riparian areas.

General riparian management measures have been developed based on the goals and objectives for protecting water quality and fisheries resources. These general management measures are primarily aimed at maintaining adequate riparian buffer areas.

5.5.2.1 Management Measures

Conducting Riparian Habitat Assessments. Conducting a comprehensive riparian habitat assessment is a very important management approach for the water resources at USMA. This assessment will be conducted in conjunction with the water resources monitoring program and the aquatic habitat assessment discussed in Sections 5.4 and 5.5.1. Currently, little information exists on the condition of the riparian habitats of USMA. Once collected, this information will provide a basis for development of future management measures.

Maintaining Adequate Riparian Buffers. For small (first- and second-order) streams, the riparian buffer will be

measured from the center of the stream and extend approximately 100 feet on either side of the water body. For large (third-order and higher) streams and rivers, the 100-foot riparian buffer will be measured from the streambank. Similar buffer areas will be maintained adjacent to lakes and ponds. The objective of the 100-foot buffer zone along streams and around lakes, ponds and wetlands is to avoid any activity or condition that might adversely affect the primary waterbody or wetland. A buffer does not mean that no activity is permitted, but rather that special care and consideration is given to protecting the quality of the resource.

The buffer zones are not marked on the ground and do not appear on the training map normally used by units and individuals using the reservation. However, the existence and significance of these areas will be emphasized in environmental awareness efforts, to include inclusion in a reservation-wide sensitive area map currently under development.

Restrictions against disruptive activities within buffer zones will be included in the USMA Range and Training Complex Regulation, and particular consideration will be given by NRB personnel when reviewing project proposals involving buffer zones. Formal and informal monitoring by Branch personnel will identify buffer zones sites in need of specific protection/rehabilitation measures.

Maintaining Species Diversity. Encourage diverse species composition in the riparian areas, particularly with respect to canopy species. Diverse woody canopy composition will more successfully survive stochastic environmental events, such as wind damage, and will also provide necessary streambank stability. Large organic debris (LOD) from the woody species also encourages instream species diversity by providing habitat. LOD is generally allowed to remain in stream channels to provide necessary instream aquatic habitat characteristics.

Controlling Nuisance Species. A normal distribution of aquatic and terrestrial species in and around water bodies is essential for maintaining overall aquatic ecosystem health and diversity at USMA. Large increases in one species tend to out compete other species in a particular area. Nuisance beaver populations have been reported at several water bodies at USMA (Beaver Pond, Cranberry Pond, Long Pond, Wilkins Pond, and the wetlands in Range 3A). Beaver dams in these areas have altered water levels in the water bodies and in some cases might have affected water quality. Techniques used at USMA for managing nuisance beaver include trapping programs and the installation of water flow devices that allow water to pass through a beaver dam.

Originally an ornamental, Japanese knotweed (*Polygonum cuspidatum*) is now a serious pest around stream corridors and roadsides. Knotweed is a tall perennial that resembles bamboo with large heart-shaped leaves. It has a massive starchy culm, a fleshy root, from which it can extract reserves of energy to devote to growth. It is the culm that makes knotweed so hard to eradicate. If it is cut, knotweed rapidly re-sprouts. If poisoned, it lives off its stores until it can sprout again. Like phragmites, knotweed can spout from any part of itself. It is unclear if knotweed can reproduce through seed, as male plants appear to be rare in America. At West Point, the biggest vector leading to new infestations is probably through the dumping of landscaping waste. Knotweed will grow, poorly, under light shade where it can be residual for years, but does best in high light environments.

Infestations of note are the old homestead at Cranberry Pond, the stream between Popolopen and Mine lakes, the Range 4 transfer station, and on the main post (especially around Crow's Nest Brook). Altogether, we believe that there is no more than three acres of knotweed at West Point. While not immediately a major threat, knotweed can be very hard to control if left alone.

Knotweed can contribute to flooding problems, especially when the dead stems, fall into streams and block culverts or small channels. In thick stands, it can be a fire hazard. Recreational fishing opportunities can be greatly reduced in the streams where this grows, as the stems tend to be very thick at streamside.

Knotweed has the potential to rapidly spread itself to new environments, and once established, to create monocultures. Thus, it negatively affects the diversity of native plants where it is found. It may provide cover for small animals, and can be used for nesting. It is not a high quality forage, but has been used by beavers in the construction of dams.

Management measures for the control of Japanese Knotweed (*Polygonum cuspidatum*) include:

- Continue to monitor and map knotweed populations. (FY 03 – 07)

- Continue work at the Cranberry Pond site. This will help determine the feasibility of controlling other populations. (FY 03 – 07)

- Attempt to control the Mine Lake population. (FY 03 – 07)

- Offer assistance to land maintenance for on-post control. (FY 03 – 07)

Protecting Riparian Habitat. The area immediately surrounding a water body plays a vital role in protecting water quality and aquatic habitat. Activities will be limited to those that would cause little or no impact on water quality and aquatic habitats within riparian buffer zones.

A summary of the management measures for protecting riparian habitat is provided below.

- Range Road 2 Stream Protection. The concern at this particular stream crossing is the temporary nature of the culvert placement, the angle of the culvert placement, and the potential for rock and gravel to continue to get washed into the stream. The recommendation is to place a more permanent, long-term fix for this stream crossing. Recommend placing two 24" culverts, or a single larger culvert, at the crossing with Gabion headwalls and Cable Concrete crossing surface over the culverts. Fill Cable Concrete with stone for crossing. (FY03)

- Sandhurst Stream Crossing site stabilization. This site is located on Highland Brook at WL844813. This site is used during the Sandhurst Competition each year as a water crossing exercise. Use of this site over the past 2 to 3 years has caused damage to the stream banks and surrounding areas. Stabilize the Highland Brook stream banks using a "bio-log" made of natural material, such as straw or coconut fiber. Hardening and stabilization of upper banks on both sides of the stream will be required to prevent soil loss. Seed and mulching of the slope and upper bare areas to stabilize the soil and prevent its subsequent loss into the stream. (FY 03)

- Popolopen Ford Restoration. This site was previously used as a crossing site for access to the southern training areas (Gate 68). Because the stream is classified as Class A, vehicles are no longer permitted to use this as a crossing point. This area will be closed to vehicle access. The plan is to restore the crossing site to a more natural condition. The adjacent parking and access area will be removed and rehabilitated by disking and seeding. Located off Mine Torne Road on Popolopen Creek below Stilwell dam. (FY 04)

- Sapper Island Stabilization and Rehabilitation. Sapper Island is a small, 1/2 acre, isolated island in Stilwell Lake. For several years this island has been used for summer Cadet engineer committee amphibious assault

training. At this time Sapper Island is in need of soil rehabilitation and general rest from use to be able to properly recover from overuse. Plan is to remove old structures and debris, and seed and mulch unvegetated and damaged and eroded areas. This rehabilitation effort will be needed on a regular basis as long as there is regular use of the island for training purposes. (FY 05)

- Conduct riparian habitat assessments to identify and prioritize potential stream restoration sites. (FY 03–07)

- Maintain predominantly forested watershed cover and limited population density on the reservation to reduce the quantity of nonpoint source pollution transported to the surface water bodies. (FY 03 – 07)

- Establish vegetative buffers with a sufficient number of canopy species around all water bodies. Buffers of 100 feet will be maintained to reduce adverse impacts on water quality and to protect aquatic habitat. Wider buffers will be established in areas with trout fisheries and with steep slopes. (FY 03 – 07)

- Encourage diverse species composition in riparian areas, particularly canopy species; woody canopy species will more successfully survive stochastic environmental events and will provide necessary stream bank stabilization. When timber harvest occurs within a riparian buffer, it will be on a very selective basis, and only when it is expected to enhance the riparian buffer. (FY 03 – 07)

- Allow LOD to remain in stream channels when practical. (FY 03 – 07)

- Limit activities within the riparian buffer zones to those which would cause little or no impact on water quality and aquatic habitats; timber harvesting and soil-disturbing activities will not occur within riparian buffer areas. (FY 03 – 07)

- Plan recreational development and amphibious training exercises to minimize shoreline and stream bank erosion and to correct and/or minimize unavoidable impacts. (FY 03 – 07)

- Limit pesticide and fertilizer use in riparian buffers. (FY 03 – 07)

- Stream crossings will be located, designed, constructed, and maintained to provide maximum erosion protection; to have the least adverse effects on wildlife, aquatic life, and their habitats; and to maintain hydrologic processes and water quality. Any crossings will have the necessary state and federal permits prior to construction. (FY 03 – 07)

- Avoid constructing recreational structures (e.g., beaches, docks) in riparian areas with vital aquatic habitat. Structures will not disturb river or lake beds or restrict water movement near the shoreline. Alternatives such as cantilever, floating, or post-supported structures; dry beaches (built above the high water mark); and swimming platforms will be considered. Also, consider building beaches with coarse or pea-sized gravel instead of sand (USEPA, 1993). (FY 03 – 07)

5.5.2.2 Other Management Alternatives Considered

Additional management alternatives that were considered as techniques for protecting riparian areas, but are no longer being considered, are described below.

Restricting Access. Restricting access to the riparian areas at USMA was considered to protect the integrity of these areas. This alternative is no longer being considered because training restrictions in these areas would impede training under realistic conditions. Environmental awareness training should prevent or minimize the potential impacts associated with light infantry training.

Removing LOD. Removal of LOD found in the water bodies was considered as a method for controlling fluctuations in water levels and maintaining the existing conditions of the area. Removal of LOD is not generally being considered as a viable alternative because LOD is beneficial to providing fish spawning habitat, but potentially damaging LOD will be taken into consideration.

Relocation of Beavers. Relocation of nuisance beavers to remote areas of the installation was considered to restore natural water levels and natural conditions of the area. This relocation program is no longer being considered as a viable alternative because the technique has not proven successful. Beavers eventually migrate back to the water bodies they were inhabiting.

5.5.3 Wetlands and Vernal Pools

Wetlands and vernal pools are of critical importance to the protection and maintenance of living resources, since they provide essential breeding, spawning, nesting, and wintering habitats for many fish and wildlife species. Wetlands also enhance the quality of surface waters by impeding erosive forces of moving water and trapping waterborne sediment and associated pollutants, maintaining baseflow to surface waters through the gradual release of stored flood waters and groundwater, and providing a natural means of flood control and storm damage protection through the absorption and storage of water during high-runoff periods.

DoD natural resources policy states that wetlands will be protected. All activities that affect wetlands require an environmental analysis in accordance with AR 200-1, AR 200-2, and applicable federal and state laws and regulations. USACE permits are required under Section 10 of the Rivers and Harbors Act of 1899 prior to commencing any work or building any structures in a navigable water of the U.S. Also, USACE permits are required under Section 404 of the Clean Water Act for the discharge of dredge or fill material into waters of the U.S., including wetlands. The regulations established at Title 33 of the *Code of Federal Regulations* (CFR) Parts 320-330, prescribe the statutory authorities and general and special policies and procedures applicable to the review of applications for USACE permits. Before commencing any new work in a waters of the United States, a district engineer must be contacted and a permit obtained, as appropriate (HQDA, 1995b).

Executive Order 11990 requires that federal agencies minimize any significant action that contributes to the loss or degradation of wetlands and that action be initiated to enhance their natural value. Department of the Army policy is to avoid adverse impacts on existing aquatic resources and offset those adverse impacts that are unavoidable. Additionally, the Army will strive to achieve a goal of no net loss of values and functions to existing wetlands, and permit no overall net loss of wetlands on Army-controlled lands. The Department of the Army will also take a progressive approach toward protecting existing wetlands, rehabilitating degraded wetlands, restoring former wetlands, and creating wetlands in an effort to increase the quality and quantity of the Nation's wetland resources (HQDA, 1995b). As a signatory member of the North American Waterfowl Management Plan Cooperative Agreement with USFWS, the Secretary of the Army reflects the importance of participating in the international effort to restore declining waterfowl populations. The plan provides the framework for a waterfowl conservation and management effort by describing population and habitat goals and suggesting recommendations that will resolve problems of international concern. Army water resources projects are making important contributions to

this effort.

The New York State Freshwater Wetlands Protection Act applies to wetlands of 12.4 acres or greater in size. Wetlands of less than 12.4 acres are also protected if it is determined that they are of unusual local importance. Activities adjacent to wetlands of 12.4 acres or greater are also regulated if they could impact the wetland and are not more than 100 feet from its boundary. A buffer of greater than 100 feet can be required if it is determined to be necessary to protect the wetland. Although Army policy protects wetlands of less than 12.4 acres, there are no specific buffer requirements. At USMA, there is a 100-foot buffer zone established around all wetlands and vernal pools. That buffer zone does not appear on generally distributed maps, but upon project proposal review any activities proposed within these zones are limited (see Section 5.5.2.1 for more detail).

The main goal of the West Point wetland and vernal pool management approach is to continue to implement a program that is consistent with DoD natural resources policy. A wetland management policy with the objective of maintaining no net loss of wetland habitat will be continued on USMA. Activities occurring both in or adjacent to wetlands or vernal pools that would result in negative impacts on the habitats will be avoided, when possible, in a manner consistent with mission objectives. Where impacts on wetlands or vernal pools are not avoidable, mitigation of the impacts will be implemented. In a manner consistent with Executive Order 11990, wetland management objectives at USMA will take a progressive approach toward protecting existing wetlands, rehabilitating degraded wetlands, and (if applicable) restoring former wetlands.

An inventory of wetlands occurring on West Point and Constitution Island was completed by the USACE in 1993 and by West Point natural resources management staff between 1994 and 1996. The inventory includes location, USFWS wetland class, and acreage for all wetlands known to occur on West Point and Constitution Island. Descriptive narratives including the wetland setting and hydrology source, a depiction of the vegetative makeup, apparent or potential habitat value, and a table of dominant species per stratum were prepared for the 146 wetlands identified in the 1993 survey. As of 1996, 300 wetlands had been inventoried on West Point. (See discussion under Wetlands in Section 3.10.) The completion of the inventory of wetlands on West Point makes it possible to identify and evaluate the condition and potential trends of wetlands and to implement a management program consistent with DoD, federal, and state policies.

Wetlands located within the impact/danger zone have also been inventoried, but no characterization, other than boundary estimations, has been conducted due to limited access in the area. These wetlands have never been

monitored to determine whether contamination associated with runoff from the impact zone is occurring. The actual impact area is in the southern section of the zone on the northwestern slope of Cranberry Mountain, downstream of most of the wetlands that occur in the area. Some wetlands that occur along Zint's Brook are within an area that would most likely be affected by runoff from the impact zone. Management objectives include determining whether wetlands within the impact/danger zone are being contaminated by runoff. Management goals include investigation of mitigation measures, if applicable.

Ninety-nine vernal pools had been identified and approximately located on West Point. (See discussion under Vernal Pools in Section 3.11.) Vernal pools occur within most of the training areas. Because vernal pools are temporary bodies of water, they do not support fish populations. Several species of wildlife, including some that have evolved breeding strategies that are intolerant of fish predation on their eggs and larvae, are totally dependent on vernal pools for their survival. Many of these species also use the areas immediately surrounding the pools outside the breeding season. Management objectives to protect vernal pools will involve continuation of current monitoring efforts to determine characteristics and trends in vernal pool habitats. Monitoring information will be used to develop specific management strategies. Limiting activities that occur in areas immediately adjacent to vernal pools is an objective of vernal pool management on USMA.

5.5.3.1 Management Measures

Many of the wetlands on USMA are limited in habitat value by size, land use, or negative adjacent values (railroads, roads, impact zones, etc.). Preventing or minimizing disturbance of habitat between small individual wetlands will help maintain their functional values. Larger, more diverse wetlands, or wetlands containing significant scrub shrub acreage (rare at USMA) would benefit from limiting exercises and development at or adjacent to the sites. Increasing understory species diversity by controlling invasive understory species having limited habitat value, such as Japanese barberry and phragmites, could also increase wildlife use and diversity in and adjacent to wetland habitats at USMA (USACE, 1993).

Control Invasive Species. *Phragmites australis*, or common reed, is a model invasive. It is a warm season, perennial grass often seen in wetlands and other damp places. It is very aggressive, often colonizes disturbed lands to form monocultures, and has the ability to invade intact wetland ecosystems where it's height and habit allow it to shade out other wetland plants, opening space for more phragmites. Phragmites is highly resistant to

physical control, and cannot be permanently destroyed by fire, mowing, or discing. It can withstand periodic flooding, drying, freezing, a degree of salinity and can thrive in the most polluted environments.
Phragmites is often found in West Point wetlands, but is not always invasive in these habitats. It's estimated that common reed covers 32 acres of wetland, but this estimate is likely to change as the plant spreads and the NRB becomes aware of more plant locations. It is most problematic at Cranberry Pond, Camp Buckner, the Morgan Farm landfill, Range 11, Beaver Pond (B area), Round Pond, the Snake Pit, Beaver's Ponds (D5 Area), the RR21/22 wetland, and Range 4.

Phragmites impact on training is mostly due to the cost of control. On range 11, phragmites has to be constantly mowed along shooting lanes, increasing maintenance costs. It has also proved to be a useful building material to the resident beaver population and has contributed to flooding problems on that range. At Round Pond, phragmites has established itself along the northern shore, and limits access to the pond and recreation suitability. Thick phragmites stands are prone to high intensity fires and may be a hazard near training sites and structures.

Phragmites control has been attempted with every method of weed control available. Most meet with some success, but few are 100 percent reliable. As with all invasives, prevention is preferable. Soil disturbance must be kept to a minimum in and around wetlands. Transport of reed parts should be eliminated, so yard waste cannot be dumped near wetland areas. Water regimes that favor phragmites should be avoided. If a wetland is periodically flooded, high water should be maintained as long as possible to drown rhizomes. Erosion of banks that create shallow flats near shore allow phragmites colonization, so native riparian vegetation should not be removed, if possible.

Cutting and fire have been used elsewhere as management tools, but neither destroy the plant. Both work the same way by removing the upper parts, and rely on careful timing of the action so that the majority of the plant's resources are in the part cut away. Cutting should be attempted in May/June, just as the plant has reached its maximum size. Cut stems can, and do, root in under the right conditions, so all cut material should be removed from the site and disposed of in a safe place. Follow-up is essential, as underground rhizomes will continue to send up spouts for a long time after the initial cutting.

Black plastic mats, anchored over cut stems, has been very effective in destroying both aboveground and belowground parts of phragmites. This technique has the added advantage of being pesticide-free. Unfortunately,

it is difficult to implement over a broad area, and kills everything under the mat.

Systemic herbicides that are translocated to the roots and rhizomes are a better bet for control. Again, timing is important. Treatment should be attempted in late summer as the plants are "tasseling", that is, going to seed. Spray should be directed to the upper third of the plants to avoid unintentionally harming desirable plants at ground level. For more targeted applications, plants can be cut and the stem injected with glyphosate, or herbicide can be 'painted' on individual plants. Note that Roundup is not approved for use in wetlands, so Rodeo or a similarly approved aquatic herbicide is needed where pesticide might contact water.

Whatever control method is used, follow up will always be necessary. In 1993, NRB staff attempted to control the invasion of phragmites on the Cranberry pond bog mats with the cut/injection method. The treatment appeared to work very well for a time, but there was no follow-up done to eradicate residual plants that survived the treatment. Currently, the phragmites is up to, if not greater than, pre-treatment levels.

A potential control problem is that recent research has discovered that there are at least twelve haplotypes, genetic 'races', of *Phragmites australis*, and that only one, haplotype 'M' is invasive (Saltonstall 2002, cited in Pray, 2002). Haplotype 'M' is a native of Eurasia, and it is possible that today's invasion can be traced to a single introduction in Massachusetts in the 1800's. All the others appear to be native and genetically isolated. If this does indeed prove to be true, then the native phragmites may be a separate sub-species, if not its own species. Given that native phragmites is only known from a very few locations in the U.S., it may one day be considered an endangered species. If this is so, then passive control efforts, like a bio-control agent, may be precluded, and a more intensive, targeted approach will always be needed.

Management measures that will be implemented for the control of phragmites include the following:

- Continue to monitor and map existing populations. In the fall of 2002, USMA's ITAM program will create one-meter resolution digital aerial photographs that will be useful in more accurately depicting phragmites extents. New phragmites maps will be created by January 2003. (FY 03)

- Cranberry Pond Bog Mat. Plants in and around the floating bog mats should be treated with the cut/injection method in June/July 2003. Off the mats, or on heavily infested parts of the mats, herbicide spray treatment,

or black plastic might be used. (FY 03)

- Camp Buckner. Control will only involve herbicide spraying. This will require a repeated application in the fall of 2004, and the spring of 2005. (FY 04 – 05)

Wetland Management. USMA will implement (or continue to implement) the following wetland conservation provisions:

- Maintain 100-foot buffers around wetlands. Where it is determined that a wetland has, or could have, significant habitat value, or where current activities adjacent to a wetland are causing noticeable adverse impacts on the habitat, buffers of greater than 100 feet are considered. Activities within buffers zones are limited to those that would cause little or no impact on or disturbance to the wetland. In cases where established activities already occur within buffers and cannot be reasonably changed, those wetlands are subject to increased monitoring. (FY 03 – 07)

- Continue to develop the wetland inventory database by compiling information on wetland characteristics, as it is collected, into a format similar to that of the *West Point Wetland Inventory, Summer 1993* prepared by USACE (USACE, 1993) for the 154 wetlands not characterized in the 1993 study (Appendix F). (FY 03 – 07)

- Maintain and update GIS database and coverages for wetlands. (FY 03 – 07)

- Continue to restore degraded wetlands or to mitigate impacts on the habitats when requirements are identified and resources are available. (FY 03 – 07)

- Restore wetland functions at abandoned known-distance rifle range by improving water flow regime and controlling invasive species (FY 05).

- Pursue water quality management procedures that protect wetlands from excessive nonpoint source (NPS) runoff. (FY 03 – 07)

- Vehicle use on roads and firebreaks that currently traverse wet areas will be redirected or crossings will be

designed to minimize impacts on the habitats. (FY 03 – 07)

- Continue to encourage project managers to coordinate early with the Environmental Division to determine adverse impacts on wetlands. (FY 03 – 07)

- Plan development and training to avoid wetland impacts to the maximum extent possible and mitigate unavoidable impacts on wetland functions. (FY 03 – 07)

- Review operations and maintenance programs that potentially affect wetlands, and develop procedures and guidelines to avoid the loss of wetland functions. (FY 03 – 07)

- Evaluate general vegetative characteristics of wetlands to determine where potential future control of invasive species could result in measurable habitat value enhancement. (FY 03 – 07)

Vernal Pool Management. Vernal pools are important habitat for several wildlife species and proper management is necessary for their protection. Vernal pool management will include the following:

- Establish buffers around inventoried vernal pool habitats. One hundred-foot buffers are generally maintained. Activities within buffers zones will be limited to those that would cause little or no impact on or disturbance to the vernal pool, especially during wet periods. (FY 03 – 07)

- Continue to monitor selected vernal pools. (FY 03 – 07)

5.5.3.2 Other Management Alternatives Considered

The comprehensive management measures described above provide the maximum amount of protection for wetlands and vernal pools without impeding the military mission. Other management alternatives that were considered, but rejected, were less comprehensive and, therefore, offered less protection for these sensitive and federally-protected ecosystems. This less intensive management alternative did not include establishing buffer zones, continued development of the wetlands database, identification and characterization of vernal pools, updating GIS databases and coverages, or evaluating water quality. This less intensive alternative offered the level of protection necessary to maintain the wetlands and vernal pools at their current status, but did not offer ways to

improve and enhance their ecological integrity and protect the biological communities inhabiting them. For example, establishing buffer zones will ensure adequate long-term protection by decreasing the likelihood of future adverse impacts. These buffers zones have been mapped on a GIS for this INRMP, and these maps can be provided to the trainers to minimize impacts resulting from training exercises. In addition, increasing the amount of information that is known about the wetlands and vernal pools at USMA will provide the necessary data to properly monitor the systems. Increasing the database will allow the natural resources managers to track the success of the management practices and to adapt future management practices as needed. The more comprehensive management measures will ensure the long-term ecological viability of these sensitive ecosystems.

A more intensive management alternative was also considered. This alternative restricted all activity in and around the wetlands and vernal pools. Given the number of wetlands and vernal pools on the reservation, this alternative was considered to be too restrictive and incompatible with the mission and, therefore, was dismissed.

5.5.4 Terrestrial Habitat

The primary goals of terrestrial habitat management at West Point are to maintain long-term desirable military training conditions, to manipulate habitats for the benefit of wildlife and flora, and to maintain or improve the biodiversity of wildlife and flora occurring on the reservation. These goals must, and can, be achieved without adversely impacting the military mission. Although recreational hunting is the second most common land use on the reservation, the ecosystem management approach serves to improve the diversity of wildlife, rather than the prevalence of particular species of game. The following section describes terrestrial habitat management practices to be implemented at West Point, the wildlife species that are intended to benefit from the practices, and management measures for the next five years.

5.5.4.1 Management Measures

Rehabilitate Unused and Degraded Areas to Natural Conditions. There are a number of locations on the reservation that at one time were active training sites, but are no longer intensively used, in part because previous use was of sufficient duration and intensity to degrade the habitat. Rehabilitating these sites will not only stabilize the site and reduce the potential for further degradation from erosion, but will enhance the habitat in the immediate area, improve the overall diversity in the region, and restore the area to suitability for training. The sites that have

been identified and scheduled for rehabilitation under the LRAM program are described in Sections 4.2.2 (Table 4-1) and 5.3.1.

Maintaining Edge and Open Areas. Edge occurs wherever two different plant communities or successional stages within plant communities meet. In these transitional zones (known as ecotones), species common to either of the major plant communities may be found, as well as other species that are a product of the ecotone itself.

Wildlife richness in edges is typically higher than in surrounding areas as a result of the increased plant and habitat diversity. The richness of edge habitat for wildlife, though, is determined partially by the degree of contrast between the plant communities forming the edge. The greater the contrast, the more likely the adjoining habitats will have different structures and support a wider variety of wildlife species. Many bird species are attracted to edge habitat because of the greater structural diversity found there, while some big game species' preference for edge probably is due to the close association of cover and foraging areas.

At West Point, much of the reservation is composed of mature hardwood forest that permits little direct sunlight to reach the forest floor. The understory in these areas is sparse and mostly limited to shade-tolerant species. While some wildlife species prefer these areas of large, uninterrupted mature forest (e.g., pileated woodpecker, yellow-throated vireo, cerulean warbler), many others require a variety of successional stages.

To break up the forest canopy, increase edge habitat, and encourage use by a more diverse assemblage of floral and faunal species, small forest openings have been created throughout the reservation. Since 1979, wildlife contracts (Sikes Act funding) and annual timber harvests have been used to create more than fifty one- to two-acre, irregularly shaped openings on the reservation. The current practice during timber harvests is to clear one acre for every 40 acres harvested to improve wildlife habitat (e.g., wild turkey, ruffed grouse, woodcock, white-tailed deer, mice) and to enhance the diversity of birds and butterflies,. Given that 100 to 150 acres of timber are harvested annually, the number of acres cleared each year might range between two to four. Since high deer densities have prevented tree regeneration in most created openings, grasses and ferns are the dominant vegetation. Indeed, areas such as these are attractive to deer and have the potential to offer food supplies sufficient to increase the deer population. Excessive deer populations inhibit forest regeneration, which in turn limits the cover necessary to support the military mission. Therefore, the creation and maintenance of open and edge areas poses a potential conflict to the objectives sought by deer and forest management. However, since the

deer population has been declining, as a result of increased hunting pressure (see Section 5.8.1.2 for further details), it has been determined that the increased diversity of habitat and wildlife can be achieved without a significant increase in the deer population, and continued adverse impacts on forest regeneration.

To maintain or create open areas and edges, the control of woody growth (i.e., species not readily browsed by deer such as Japanese barberry) is often required. Methods used to remove woody growth include brush clearing, mowing, herbicide, and possibly, prescribed burning.

Brush is cleared in sections or rows. Cleared brush is typically piled in old fields to provide resting and escape cover for wildlife. The uneven topography and numerous rock outcrops on the reservation limit mowing primarily to the old field successional areas in Training Areas R and L.

Where mechanical manipulation is impractical or impossible, prescribed burning may be used, although factors including terrain and accessibility make this alternative difficult and there are currently no specific plans for burning. In addition to clearing woody growth, burning also has been found to benefit aspen stands by encouraging growth of root suckers. Aspen is an important species to ruffed grouse (*Bonasa umbellus*), woodcock (*Scolopax minor*), and other passerine species. All prescribed burns will be closely coordinated with NYSDEC, the Range Control Office, and the USMA Fire Department.

Herbicide applications are occasionally used to prevent the regeneration of undesirable tree species, such as the black locust. Targeted herbicide applications are used to retard stump sprouting and prevent future growth.

Preservation of Snags and Trees with Natural Cavities. Dead and dying trees, called snags, and live trees with natural cavities are important habitat components for many wildlife species. Snags, with or without cavities, provide foraging, nesting, roosting, and perching sites; natural cavities in live trees provide den and resting sites (Table 5-3). It is often the case that the abundance of woodpeckers, raptors, passerines, and bats is directly related to the availability of snags and tree cavities in an area. At West Point, migrating osprey, overwintering bald eagles and other raptors have been documented using snags at Wilkins Pond and Stilwell Lake. Great blue herons have been observed resting on snags throughout the reservation.

Table 5-3
Some Uses of Snags by Selected Wildlife Species

Species	Use of Snag
Pileated woodpecker	Cavity nest sites, feeding substrate, singing or drumming (communication), location of courtship, overwintering sites, roosting, thermally regulated habitat.
Turkey vulture	Roosting, lookout posts, loafing sites.
Owls and raptors	Cavity nesting sites, plucking posts, overwintering sites, roosting, lookout posts, hunting and hawking perch, thermally regulated habitat.
Osprey	Nesting platforms, roosting, lookout posts, hunting and hawking perch, fledging sites, loafing sites.
Bald eagle	Nesting platforms, roosting, lookout posts, hunting and hawking perch, fledging sites, loafing sites.
Brown creeper	Feeding substrate, nesting under bark.
Bats	Overwintering sites, roosting, communal nesting or nursery colonies, thermally regulated habitat.
Raccoon and black bear	Overwintering sites, dwelling or dens.
Small mammals	Cavity nest sites, food cache or granary, overwintering sites, dwelling or dens, thermally regulated habitat.

Source: Neitro et al., 1985.

To preserve snags and natural cavities on West Point, the following management measures will be implemented:

- Retain all snags within 100 yards of lakes and ponds consistent with personal safety and the protection of facilities. (FY 03 – 07)

- Create new snags as part of the Timber Stand Improvement (TSI) program. (FY 03 – 07)

- Preserve and retain all snags, active den trees, active raptor nest trees, and most wolf trees during timber harvest operations. Wolf trees are large, spreading trees, unproductive from a timber management perspective, but likely to contain wildlife cavities. (FY 03 – 07)

- Remove snags and dead trees on the Main Post if they interfere with landscape objectives or if their presence endangers personnel, roadways, power lines, buildings, or training structures. Snags in woodlands adjacent

to housing areas will not be removed unless their removal is deemed necessary by the Forester, Agronomist, or Land Maintenance Officer. (FY 03 – 07)

Targeted species include raptors, owls, and wood ducks; other species to benefit include passerines (nesting), mammals (denning and roosting), and the black rat snake (nesting).

Nest Boxes. One management practice commonly used when snags are limited or nonexistent is the use of nest boxes. This practice provides artificial cavities for cavity-nesting animals and can be used to encourage use of a habitat by one or more species (e.g., American kestrels, eastern bluebirds, wood ducks). Some species of birds and mammals actually use nest boxes more frequently than natural cavities when boxes are available (McComb and Noble, 1981). Nest boxes, however, do not substitute for snags in all ways, since they do not provide habitat for the same kinds of insects and arthropods. Also, the construction and maintenance of nest boxes on a large scale is costly, labor-intensive and not practical at USMA due to the lack of available personnel necessary to construct and maintain them.

On West Point, nest boxes are designed for use by wood ducks and eastern bluebirds. Other species, however, also benefit from the presence of these boxes, including the tree swallow, screech owl, gray squirrel, flying squirrel, red squirrel, mice, raccoon, and chipmunk. Yearly maintenance records show nest box use by bluebirds is low, and wrens, mice, and flying squirrels are common residents. Boxes are located along the perimeter of open fields (as opposed to out in the fields) to prevent interference with military activities and grounds maintenance. A recent situation involved nest box use by mergansers. Several boxes were erected over lakes and ponds to attract wood ducks, and also attracted hooded mergansers. When the artificial nests were moved away from the open water to trees along the banks, wood duck usage of the nest boxes increased by approximately 25 percent.

The plan for the use of nest boxes consists of the following:

- Replace/repair wood duck nest boxes that have been damaged or lost and identify additional areas suitable for the placement of boxes. Install additional nest boxes when suitable areas are located. (FY 03 – 07)

- Annually inspect nest boxes for use and keep records of findings. Relocate boxes as appropriate to

encourage use by targeted species. (FY 03 – 07)

Dead and Downed Logs. Dead woody materials on the ground, especially large logs, can provide important habitat to many forest-dwelling species. Woodpeckers eat insects that inhabit logs, and numerous species of mammals (e.g., short-tailed shrew, northern flying squirrel, eastern chipmunk, deer mouse, and common red-backed vole) use logs as sites for reproduction, foraging, and cover. Several species of amphibians are also found in association with decaying logs on the forest floor.

Management measures for fallen logs are as follows:

- Maintain fallen logs on forest floor in all areas to provide foraging opportunities and cover for pileated woodpeckers and other wildlife species. There is no need to remove fallen logs and slash associated with selective timber harvests since the relatively small volume does not pose a significant fire hazard or obstacle to military training. In many cases, the slash serves to protect developing seedlings from deer browsing. (FY 03 – 07)

Tree and Shrub Planting. Trees and shrubs planted around the reservation provide additional habitat. Occasionally, local volunteer groups plant trees and shrubs provided by the NRB. Species planting locations are selected based on their value to wildlife.

Specific management measures for planting trees and shrubs include:

- Continue planting native trees and shrubs on West Point. (FY 03 – 07)

- Restrict all plantings of non-native ornamentals on the reservation and Constitution Island. (FY 03 – 07)

Maintaining and Improving Unique Trees and Forest Stands. Aspen stands provide habitat for ruffed grouse (*Bonasa umbellus*), though grouse use of aspen varies in relation to the age of the stand. On West Point aspen stands are small, between one and five acres, scattered, and 35-40 years old. Stem densities are approximately 400 trees per acre with a basal area of 140 (USMA, 1994a). Aspen stands with these characteristics can provide winter food resources for grouse. To improve stand conditions and provide breeding and roosting cover for

grouse, root sucker growth will be increased. From root suckers, new sprouts grow and have the potential to reach stem densities of up to 70,000 per acre. Small clearings cut within or beside aspen stands and prescribed burning both promote root sucker growth.

The fruit and buds of apple trees are used by numerous wildlife species, including white-tailed deer, black bear, pine voles, ruffed grouse, and various songbirds. Two small orchards near Lake Frederick and several smaller clusters exist on the reservation. In most cases, the trees are old, overgrown, shaded by other trees, and generally in poor condition. Fruit production is irregular.

Management measures for maintaining and improving unique trees and forest stands include:

- Provide high-quality grouse habitat by promoting aspen root sucker growth. (FY 03 – 07)

- Release, prune, and fertilize fruit trees in Area R. This will improve fruit production and tree vigor, and provide better quality habitat for wildlife. (FY 03 – 07)

- Fence wild fruit trees, if necessary, to prevent excessive deer browsing. (FY 03 – 07)

Control Invasive Species. Most of the terrestrial habitat on the West Point reservation is a functioning, mature forest. In general, trees are well spaced, the canopy is closed, and shrubs and vines do not prevent foot traffic. These areas support native animals and plants, and are ideal for training. However, there are large portions of West Point where training is impacted by invasive species. Non-native shrubs and vines limit the training that can be conducted in these areas. Invasive plants crowd out or smother the normal assortment of plants, and biodiversity is negatively affected. The invasive species that are most harmful to the ecosystem have been targeted and control efforts have been directed towards those areas that are either ecologically important or where invasive species impact training. The species that have been targeted and the control methods that will be implemented are described below.

Japanese Barberry (*Berberis thunbergii*). Barberry has probably been at West Point the better part of 150 years. Currently, it is estimated that barberry covers 800 acres of the installation. Particularly heavy infestations include Round Pond, Proctoria, Mineral Springs, Camp Shea, and Morgan Farm, but this is by no means an

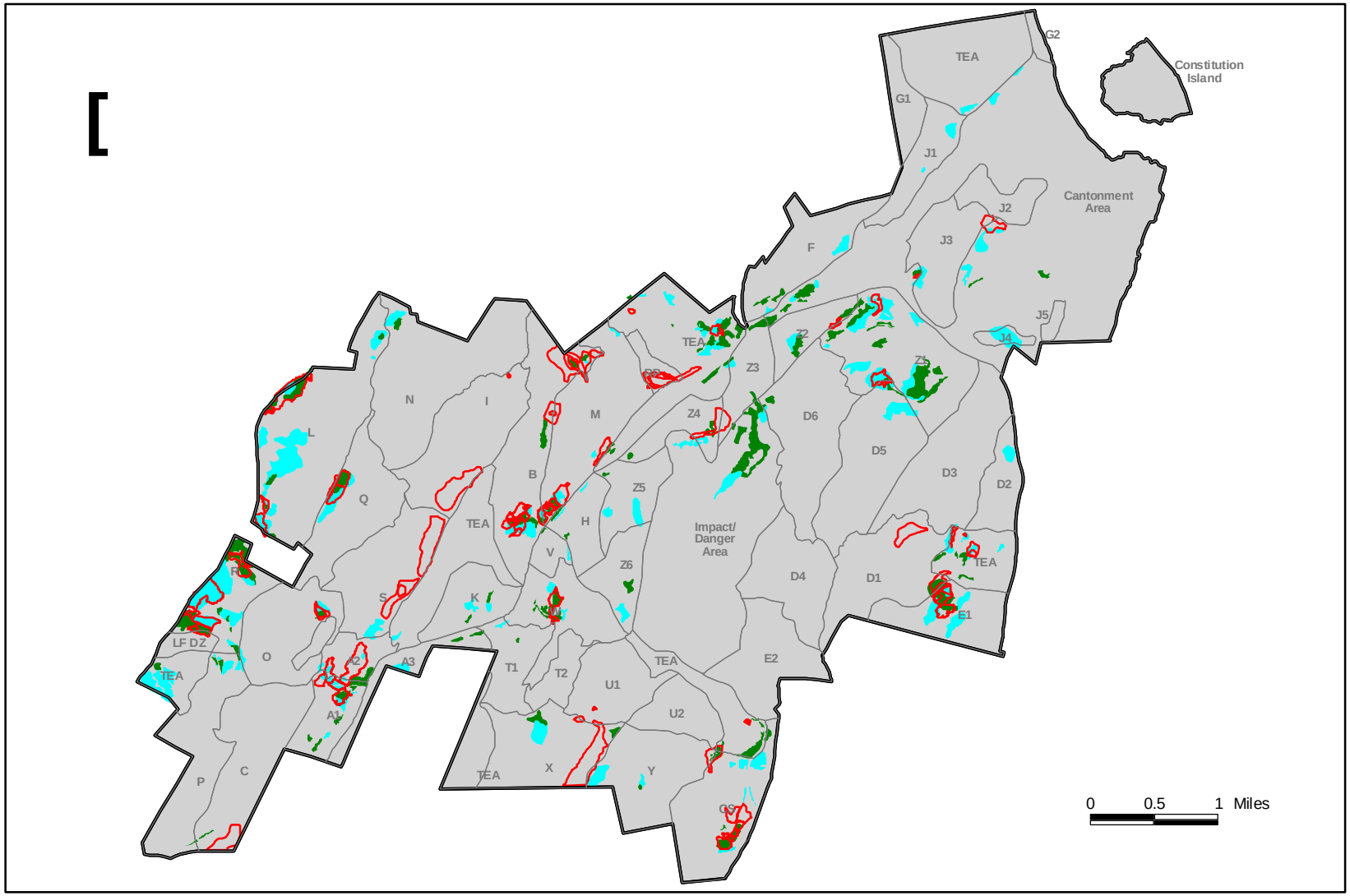
exhaustive list.

Non-chemical management techniques have been used with good results. Uprooting has been reported as an effective tool in barberry management, but is impractical for the large infestations generally seen at West Point. Nevertheless, this may prove to be a useful technique in post-spray follow-up. Small plants can be pulled by hand while larger ones could be leveraged with a commercial shrub puller. A small trial of simply cutting barberry stems failed to give significant control due to heavy re-sprouting and re-growth. Similar results were seen in a small prescribed fire trial.

For the last seven years, the NRB has been involved with an intensive barberry control effort. Large, densely affected areas of 2 to 20 acres or more are sprayed with a herbicide by a contractor using high pressure sprayers. Smaller areas, those areas of a lesser density, areas slated for timber harvest, or, increasingly, previously treated areas, are treated with backpack herbicide sprayers by the NRB staff. Treatment generally takes place in September/October when the sap is flowing into the roots. Following treatment, the NRB conducts an annual post-spray survey to gage the effectiveness of the spray, and to determine which areas may require further treatment. Currently 500 acres have been treated in this manner, and an improvement has been observed. Future efforts will be a continuation of this. Figure 5-1 shows the areas of West Point inhabited by barberry as shown in the 1998 aerial photograph series, and the areas treated with glyphosate between the years 1988 through 2001.

Management measures for the control of barberry include:

- Revise current maps of barberry extents using new, 2002 digital aerial photographs. (FY 03)\
- Identify and spray 50 acres of barberry annually by contract - providing adequate funding is available. (FY 03 – 07)
- Monitor the effectiveness of past treatments and new encroachments into these areas. (FY 03 – 07)
- Intensify efforts to re-treat past spray areas with NRB staff or by contract if necessary. (FY 03 – 07)
- Experiment with pesticide alternatives. (FY 03 – 07)



Barberry Coverage and Herbicide Treatment Areas

LEGEND

Estimated Japanese Barberry/Multiflora Rose Cover

- Heavy
- Light
- Herbicide Treatment Area
- Training Area

United States Military Academy
West Point, New York
Figure 5-1

- Continue current deer management efforts to reduce deer numbers, thus promoting native plant growth. (FY 03 – 07)

Multiflora Rose (*Rosa multiflora*). In thickets, multiflora rose, because of its stout thorns, may be more detrimental to training than barberry. An estimated 100 acres of West Point has at least some rose cover, with the largest populations in the Lake Frederick area, Range 2, and Engineer Point. At Lake Frederick and Engineer Point rose has prevented access to previously used training lands. These areas were sprayed with glyphosate in 2001.

This plant is treated the same as Japanese barberry, and since they often are found together, they are treated at the same time. Multiflora rose is highly susceptible to glyphosate, and if sprayed correctly, dies easily.

An alternate treatment is to treat the green canes in early winter or spring after leaf-off, thereby targeting the photosynthetic tissue still active in the canes, while not affecting dormant non-target vegetation. Spraying at this time will have the added benefit of increasing the window of opportunity for spraying from September/October, well into the winter.

Rose rosette disease (RRD) is a viral infection transmitted by endemic mites or through grafts. Its early symptoms include abnormal growth seen in new shoots and unusual coloration in leaves, flowers, and thorns. Affected plants may exhibit extra long, or spirally growing shoots, tipped with stunted clusters of leaves and flowers (similar to the damage seen in plants insufficiently treated with glyphosate). The presence of soft, red or pale green, thorns is diagnostic. Multiflora rose is highly susceptible to the virus, and dies within three months of contracting the disease. RRD is not considered a viable biocontrol agent because it can infect both native and commercially grown rose species, but its presence at West Point may make a rose control program unnecessary.

Management measures used to control Multiflora Rose include the following:

- Continue to target and treat rose infestations with both contractor and in-house spraying. (FY 03 – 07)

- Evaluate winter spraying. (FY 03 – 07)

- Purchase a propane torch to test high intensity burning. (FY 03)

- Monitor for rose rosette disease. (FY 03 – 07)

Purple Loosestrife (*Lythrum salicaria*). Loosestrife is only a limited problem at West Point with a approximately 25 acres being affected. Populations of note are Camp Buckner, and the wetland on the SW end of Long Pond. Loosestrife can block access through marshy areas, but this is not generally a problem for training. Around lakes and ponds, it can limit access to the shoreline, where it impacts fishing and can be expensive to control.

In 1995, NYSDEC, with assistance from Cornell's biological control unit, placed imported, monophagous insect herbivores, *Gallerucella pusilla* and *Hylobius versovitus* beetles, in the Buckner and the Long Pond wetlands. In 1999, and again in 2000, the NRB added to the population of *Gallerucella* beetles at the Buckner site. While there has been some work to evaluate the effectiveness of the introductions, results are inconclusive at this time.

Loosestrife can be eradicated using a variety of methods, including pulling, mowing, fire, herbicide, and flooding. Biocontrol may provide a long-term, passive means of control, provided the imported insects proliferate beyond the populations now known.

Management measures that will be implemented to control loosestrife include the following:

- Continue to monitor the progress of the insects. (FY 03 – 07)

- Add to the existing *Gallerucella* population. (FY 03 – 07)

Garlic Mustard (*Alliaria petiolata*). Aside from ecological damage, garlic mustard has no impact on training. At West Point, it is found along roadsides, hedgerows, and in any disturbed forest, but garlic mustard will readily invade undisturbed habitats. It does particularly well in areas previously treated with herbicide for barberry/rose control. An estimated 340 acres have been invaded by garlic at West Point, though little of this is a true monoculture.

So far, the best control practice appears to be either physical removal of adult plants before they set seed, or the application of a foliar herbicide late in the fall when most native plants are dormant. Any treatment will have to be

continued for at least five years, if not more, to deplete the seed bank.

With current methods, garlic mustard can never be eradicated from the woodlands it colonizes. Bio-control is currently being researched in Switzerland, and a selection of insect agents may be available within the next couple of years, following acceptance of the insects by the USDA. West Point will be one of the initial testing locations, and Cornell University has begun a garlic mustard monitoring program to monitor before and after effects of the introduced pests.

Management measures to control Garlic Mustard include:

- Continue involvement with Cornell in their bio-control program. (FY 03 – 07)

Oriental Bittersweet (*Celastrus orbiculatus*). Thick infestations of oriental bittersweet are found on Round Pond Road, on Engineer Point, Morgan Farm, Camp Shea, and around Eagle Valley Cemetery. Current estimates put bittersweet cover at 55 acres.

It appears that the best method for control is to cut the stems and treat them with full strength Garlon. Cutting is ineffective, and the New York Department of Environmental Protection states that Glyphostae does not kill bittersweet. Girdling with a propane torch in winter might be effective on this species, and this method will be tested.

In 2001, USMA cut all bittersweet stems in a small patch near the ITAM building. By June 2002, all of the cut stems had resprouted vigorously, some growing well over 15 feet. Follow up with chemical control is definitely needed. USMA is planning to continue to experiment with control of this species.

Management measures that will be implemented to control Oriental Bittersweet include:

- Follow up on initial control efforts. (FY 03 – 07)

- Experiment with Garlon as a more effective herbicide. (FY 03 – 07)

- Experiment with fire as an alternative control option. (FY 03 – 07)

Autumn Olive (*Elaegnus umbellate*). Sometime in the 1960's, autumn olive was introduced to West Point to improve wildlife habitat and forage. Olive was planted at two locations along Mine Torne Road, at the south end of Stilwell Lake, near Range 2, at Camp Natural Bridge, and in a few locations along Highland Brook. This plant has recently begun to spread from these plantings, and it is being discovered in new locations far removed from the initial plantings. Approximately 5 acres of West Point is inhabited by autumn olive, but this number is expected to increase in the future.

The best control is by chemical means. Girdling or cutting individual trees, then treating the wound with herbicide works best in small infestations. For very thick infestations, a foliar application of herbicide may be effective. Any action that removes the aboveground parts of the olive is sure to stimulate dormant olive seed in the ground so annual re-treatment is essential. Fire, girdling, or cutting alone do not appear to harm the plant, and cannot be a long-term solution. Small trees can be leveraged with a weed wrench, which can uproot trees to sapling size. Since this technique is pesticide free, it will be evaluated on this and other species.

In 2000, and again in 2001, the NRB staff attempted to cut back some of these plantings, and to remove nearby seedlings and sprouts. In 2002, staff members applied a foliar application of 2% Roundup to some escapees, and are currently awaiting results.

Management measures that will be implemented to control autumn olive include:

- Girdle and treat olive plantings in the woodlands of West Point. (FY 03 – 07)

- Apply pesticide to emerging seedlings and older escapees. (FY 03 – 07)

- Purchase a weed wrench to uproot small trees. (FY 03)

- Replace olive hedgerows with a non-invasive alternative (*Viburnm trilobum*, *Malus sp*, *Cornus sp*, or similar). (FY 03 – 07)

5.5.4.2 Other Management Alternatives Considered

A higher-intensity approach to terrestrial habitat management was considered where management techniques similar to those described above were implemented on a larger scale. Under this alternative, more forest openings would be created and a greater number of nest boxes would be erected. In the context of West Point's primary mission, this approach would not be feasible. In addition to the prohibitive cost of some labor-intensive management techniques (e.g., erecting and maintaining a large quantity of nest boxes), the use of other techniques (e.g., creation of numerous forest openings) would interfere with the objectives of the military mission by reducing the continuous forest cover required to provide realistic military training. In addition, increasing the number or size of forest openings might conflict with natural resource objectives for controlling the white-tailed deer population and ensuring adequate forest regeneration.

5.6 FOREST MANAGEMENT

Forest management involves exercising influence over the ecological processes of a forest in an effort to provide specific sustainable products and amenities from the forest while maintaining its long term health and vigor. The Army forest management program is required to support and enhance the immediate and long-term military mission and to meet natural resource stewardship requirements set forth in federal laws (AR 200-3). Army policy further stipulates that forest resources must be managed for multiple uses, using an ecosystem management approach to optimize the benefits to the installation's natural resources. Ecosystem management provides a framework for holistic management of the resource rather than focusing emphasis on a single aspect or activity such as commercial timber production or game species management.

The goal of forest management at USMA is to maintain ecosystem viability while maintaining the forest cover required for military training and providing for the production of commercial forest products. Using an ecosystem management approach, the natural resources program can provide for the production of timber while at the same time providing for the following:

- Biodiversity of species and habitat.
- Natural beauty.
- Outdoor recreation opportunities.
- Wildlife habitat, including habitat to support threatened and endangered species.

- Soil conservation, erosion control, and watershed protection.
- Air and water quality.
- Sustained viability and diversity of military training lands.

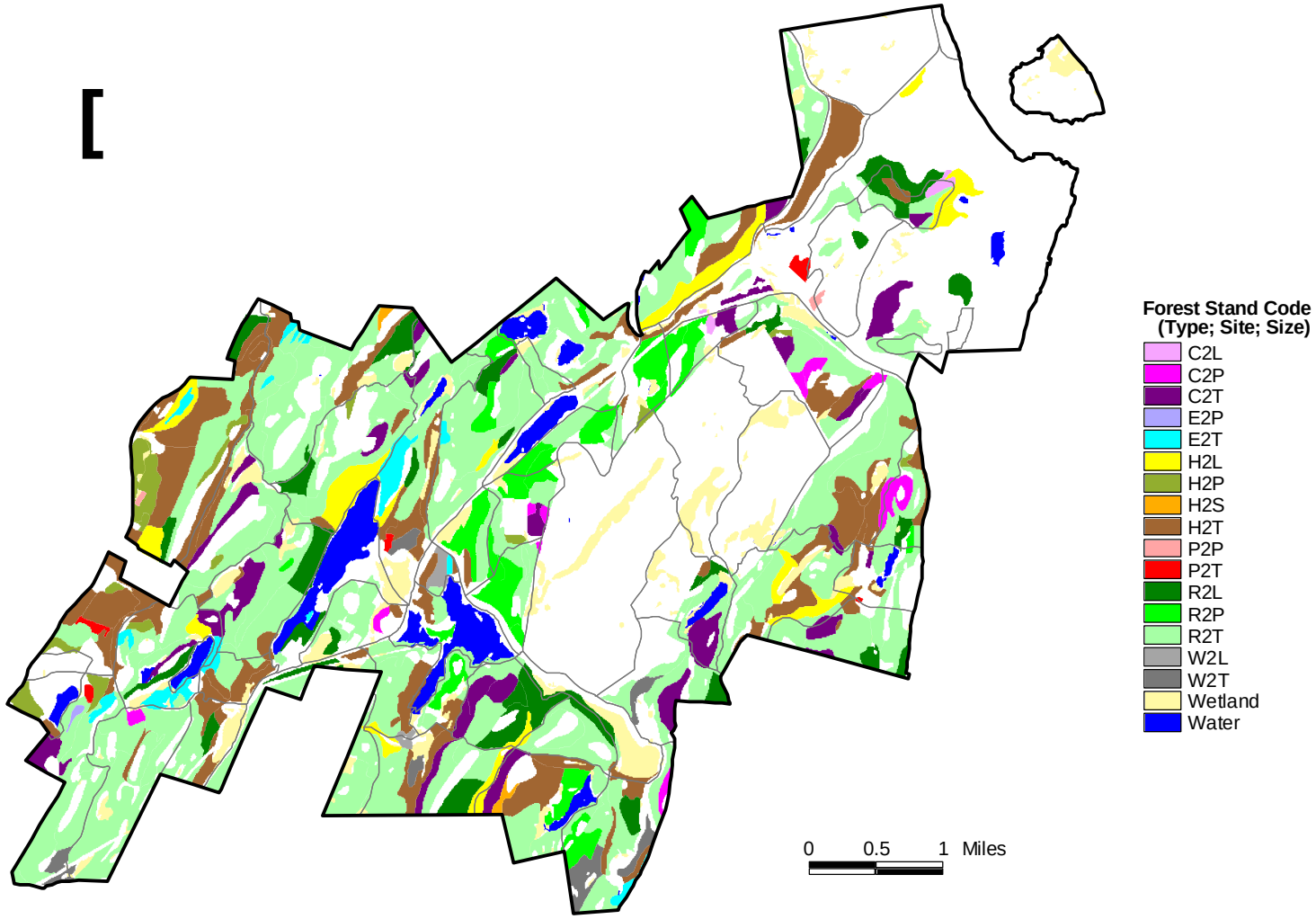
Forest management enhances the USMA military mission by providing for a healthy training area forest over the long term. Practices such as periodic timber harvest, stand improvement activities, encouragement and protection of regeneration, and protection against fire, insects and disease provide for sustainment of the forested environment desired for the conduct of military training. Conflict of forest management activities with the military mission is avoided by providing for review of management plans and activity schedules by the trainers.

The forest management program at USMA must also fully comply with all applicable federal laws, policies, and regulations pertaining to forest management. Federal laws, policies, and regulations that have the potential to impact forest management at USMA include AR 200-3, PL 86-797, Sikes Act, as amended (16 U.S.C. ' 670 a through o), 10 U.S.C. § 2665 (Sale of certain interest in land: logs), DoD Inst 7310.5 (Accounting for production and sale of lumber and timber products), Executive Order 11990 (Protection of Wetlands), and the ESA of 1973, as amended (16 U.S.C. §§ 1531 et seq.).

5.6.1 Management Measures

Managing complex forest ecosystems requires the flexibility to employ a variety of management practices that meet the desired vegetation conditions. No single set of prescriptions can be applied that will capture the dynamic nature of forest ecosystems. It should be noted that forest management is much more than the application of silvicultural treatments such as timber harvesting or stand improvements. The following section is divided into general categories related to forest management, with specific management guidelines included under each general category.

Forest Regulation Plan. To establish a formal framework for the conduct of forest management activities, a regulation plan is being developed. The basis for this plan is a timber stand map, which differentiates stands according to species composition, tree size and general site productivity (Figure 5-2). This map was derived from an ecological classification of USMA lands based on New York Natural Heritage Program ecological community definitions.



LEGEND - Forest Stand Code Classifications

Forest Type

C - Chestnut Oak
E - Eastern Hemlock
H - Hemlock/Hardwood Mix
P - Pine
R - Red Oak
W - White Oak

Forest Site (Ability to grow commercial sawtimber)

1 - High (No areas present)
2 - Moderate

Tree Size

L - Large Sawtimber
S - Small Sawtimber
P - Poles

Installation Boundary
Training Area Boundary

Sawtimber Cross Classification

United States Military Academy
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Figure 5-2

The results of individual stand examinations are providing the information for the regulation plan, which will identify current conditions and present prescriptions (management actions and timing) for stands. These prescriptions will provide for overall regulation of the forest based on the goals and specific guidelines for forest management presented in this INRMP.

In addition to identifying site-specific prescriptions, the regulation plan will provide a basis for timber harvest availability reports required by AR 200-3 and further document in one place the forest management program and its practices, thereby streamlining development of future management plans required by laws, regulations and policies.

Forest Inventory. Forest inventories are the foundation for the development of management and regulation plans. AR 200-3 requires forest stand inventories be conducted and kept current (at least every 10 years) to provide for sustained production of forest products. At USMA, the most recent forest inventory was conducted in October 1995 by Brooks Forestry and Resource Management Company (Brooks, 1996). This inventory gathered information for real estate reporting purposes and provided overall data for three broadly defined strata: pole timber, oak sawtimber and mixed sawtimber. Ongoing stand examination cruises are providing updated information to the 1996 inventory will not be required over the next five years of this INRMP.

In addition to gathering commercial timber data, the stand examinations collect information on ground cover, shrub layers, seedling regeneration, general stand environment, stand location relative to various habitats and specific wildlife parameters (snags and den trees). This information provides a view not only of the timber resource but also of the composition and structure of the stands as they relate to habitats of other plants and wildlife.

To identify how conditions change in response to management practices, information from the forest stand inventories will continue to be collected and integrated with other inventories, such as burned area location and coverage; timber harvest areas; TSI areas; riparian, wetland, and water resource buffer zones; stream corridors; ecological communities; wetlands; steep slopes and highly erodible soils; rare plants; threatened and endangered species; locations of cultural and archeological resources; and soil and water resources. A GIS database consisting of these data layers will be maintained and updated with each new inventory. Maps built from these data can be used to track temporal and spatial status and trends of the forest resources relative to other

ecologically or geologically sensitive resources.

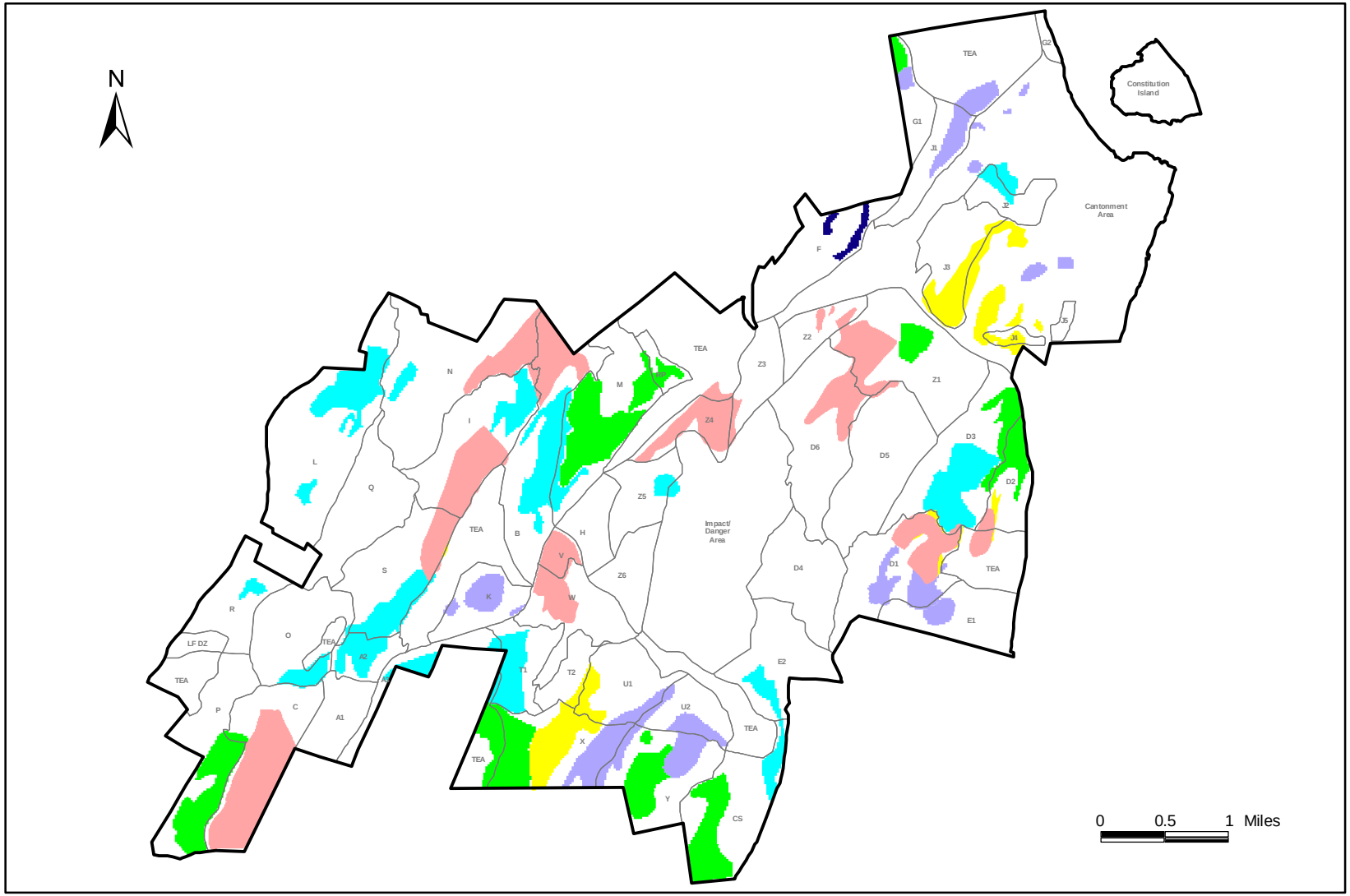
Timber Management and Harvest. There has been a timber harvesting program at USMA since the early 1950s when a salvage logging operation was conducted to remove trees blown down or otherwise damaged by hurricane winds. That event highlighted a need for active forest management to maintain the woodlands in a healthy condition to support the military training mission. Figure 5-3 shows areas on the reservation harvested since the inception of the program.

Several management guidelines have been established to direct timber harvest activities at USMA. These include the following:

- To meet the military training requirement of maintaining a generally continuous forest cover throughout the training areas, the forest is managed under the selection silviculture system. Trees, generally the oldest, removed in a harvest are selected by the forester so as to leave a stand with a broad range of age classes. Openings created by the individual tree removal provide for establishment of new seedlings. This system most closely mimics natural succession in the absence of fire. Harvests in any one stand will not generally occur more frequently than every twenty years.

- The selection system is designed for use in uneven-aged, or all-aged, stands where there is an existing range of age classes. Most of the oak-dominated stands at USMA are relatively even-aged, making application of the selection system difficult; gradual conversion to an uneven-aged condition will be a very long process. The conversion will mean a decline in the preponderance of moderately shade tolerant oak species in favor of more tolerant species such as sugar maple, beech and hemlock. The species conversion will result in a gradual change in wildlife values and the slower growing species may represent an overall decline in timber value. Maintenance of an oak component, important for wildlife, may require selection harvest of small groups rather than individual trees in some cases.

- Stand condition is the primary consideration in the selection of harvest areas. Evidence of declining vigor and damage from abiotic (such as wind or fire) or biotic (such as insects and fungi) factors may signal the need for harvest. Such factors frequently coincide with increasing age, and the rotation age (age at which the oldest trees are harvested) is set at 120 years. This may be adjusted as stands approach harvest age: it may be too long on poorer sites and may be extended on sites with higher productive capacity. The variability of site conditions even within designated stands makes it difficult to establish a firm rotation target. Few locations on USMA support healthy stands over 130 years of age, but this may change as



LEGEND

Year Harvested

- 1955-1959
- 1960-1969
- 1970-1979
- 1980-1989
- 1990-1996
- 1997-2002
- Installation Boundary
- Training Area Boundary

Timber Harvest Areas

United States Military Academy
West Point, New York
Figure 5-3

stands now develop under management. Changing species mix as conversion to uneven-aged conditions occur may also affect rotation age.

- The timber product objective is high quality hardwood sawlogs. There is virtually no other significant market in the region. The existing species mix makes this objective reasonable, and the associated long rotation is compatible with other ecosystem management objectives of the natural resources program.

- Timber harvest occurs only on the approximately 8,000 acres (some areas are undergoing reevaluation as part of the ongoing inventory project) of the reservation occurring outside of danger and other exclusion areas and designated as site quality two or better. No commercial timber management activity occurs on the remaining 8,000 acres.

- Timber harvests over the 5-year duration of this INRMP will not exceed 250,000 board feet per year and may occur throughout the reservation except in no-harvest areas as designated in this plan, and Special Natural Areas. This figure is consistent in scope with past harvest levels on the reservation. Individual harvest projects are subject to annual coordination with military training officials through Range Control.

- Timber harvest does not routinely occur in riparian buffers and in the buffers around large wetlands. There are instances, however, where harvest of specific trees can enhance wetland or wildlife values, such as removing competition from rare plants or from trees of particular value to wildlife. Cutting in buffers around small wetlands (under three acres) and streams takes into account specific circumstances. Harvest does not generally occur in wetlands.

- In general, an attempt will be made to retain representation of all existing ecological communities. This will be difficult and perhaps impractical given natural successional trends and will be attempted only when chances of success are good. A diversity of communities is the goal, but the nature and mix of the communities 50 to 100 years or more in the future needs further consideration.

- Timber harvesters are required to follow the Timber Harvest Guidelines for New York published by NYSDEC. Required stream crossing permits are obtained from NYSDEC.

- Logging operations are timed to avoid periods of excessively wet soil conditions to protect soils and to prevent erosion and possible sedimentation of streams. Diversion ditches are constructed on skid trails and forwarder roads to prevent erosion.

- All snags, fallen trees, active den trees, active raptor nests and most wolf trees are retained in harvest areas. Occasionally trees are ring girdled to create snags. Marking for harvest favors the retention of soft-wooded species such as ash, basswood and tulip poplar as potential cavity trees.

- For every 40 acres of timber harvest, a clearcut upland opening is created as part of the logging operation to enhance habitat and species diversity.

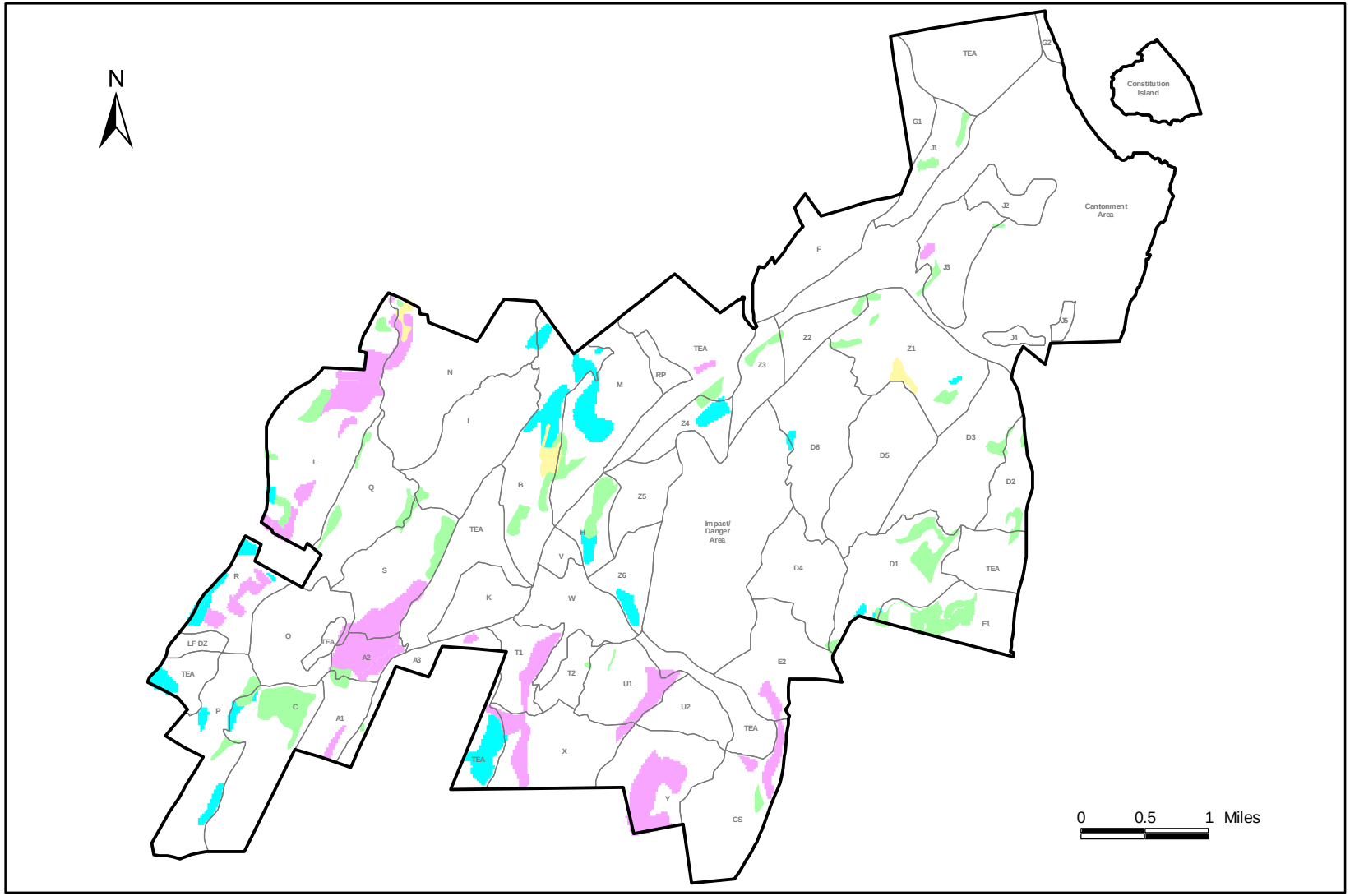
Timber Stand Improvement (TSI). TSI is a form of intermediate stand treatment that generally does not involve the harvest of commercially valuable material. The lack of regional markets for trees under 14 inches in diameter means there is little commercial potential for TSI operations. TSI is employed when conditions of developing stands do not meet forest management objectives. It is used primarily to improve the timber quality of selected trees by removing other trees or vegetation, which provide competition for light, nutrients and moisture. Under ecosystem management, however, TSI concentrates not just on promoting timber value but also on enhancing wildlife values and species diversity.

Between 1976 and 2002, over 1,350 acres were subject to TSI (Figure 5-4). The program will continue, generally on less than 100 acres per year. Specific management guidelines for the TSI program include:

- Emphasize recently logged areas and the more productive sites where developing small diameter stands are becoming overcrowded.

- Generally, favor oaks for their wildlife and timber value, but also give strong consideration to shade-tolerant species and species diversity.

- Conduct crop tree thinning to allow for competition among trees not selected for retention. Natural mortality over time will add value to wildlife and their habitat, and add to soil enrichment.



LEGEND

Year TSI Operations Conducted

- 1976 - 1979
- 1980 - 1989
- 1990 - 1999
- 2000 - 2002
- Installation Boundary
- Training Area Boundary

Timber Stand Improvement Areas

United States Military Academy
West Point, New York
Figure 5-4

- Generally, use non-chemical methods. Chemical (herbicide) methods may at times be necessary to minimize the structural damage to trees that are desired to be left standing dead for extended periods of time.

Forest Protection. It is necessary to maintain forest protection measures to prevent unacceptable damage and degradation of the resource resulting from insects and disease, animal damage, invasive species, and wildfire. Forest protection measures employed at USMA are listed below.

Insects and Disease:

- Conduct casual observations to identify timber stands infested with insects, such as gypsy moth and hemlock woolly adelgid, and disease.

- Use silvicultural treatments to promote stand and individual tree vigor and reduce susceptibility, and to promote species diversity.

- Continue the annual surveys conducted in cooperation with the USFS for gypsy moth control, including population monitoring, defoliation surveys, biological evaluations, trends, and projected damage. Cooperate with the USFS through the DoD Forest Pest Suppression Project when it appears a suppression project may be warranted. Any aerial suppression projects will require specific biological evaluation and environmental documentation. A USFS-funded pest suppression project in May 2002 successfully treated 650 acres of USMA training area with an aerially-applied biological insecticide to control gypsy moth.

- Conduct periodic surveys for hemlock woolly adelgid and continue participation in the University of Tennessee research project by protecting and monitoring the plantation site.

Animal Damage:

- Promote recreational hunting to control deer populations and reduce the impact on forest regeneration from excessive browsing.

- Monitor the impact of deer browsing on forest regeneration using regeneration surveys, as well as casual observations.

- Continue periodic monitoring of deer exclosures (see discussion of exclosures in Section 5.8.1.2, Management of White-tailed Deer on the Reservation).

- Protect tree seedlings using tree shelters.

Invasive Species: (see Section 5.5.4 Terrestrial Habitat for management measures aimed at the control of invasive species.)

Wildfire:

- Monitor weather conditions at the permanent fire weather monitoring site.

- Assist West Point Fires Department with determining and informing military trainers of potential fire danger for prescribed modifications of training activity.

- Conduct training for fire prevention and reporting for the military trainers.

- Suppress wildfires as they occur.

- Continue field sampling program to measure fuel loading, update associated GIS datalayers, and use the field data and other geographic information to evaluate relative fire risk.

Firewood Program. Related to the forest management program is a program of sales of small volumes of forest products, primarily for firewood. Under this program, permits are sold to USMA personnel and the general public for the gathering of dead and down wood along designated firebreaks and training area roads. Program participation has declined to less than ten participants in recent years, and the future of the program is being reevaluated. There is no significant forest management benefit from the program.

5.6.2 Other Management Alternatives Considered

Even-aged forest management would be silviculturally appropriate over much of the West Point forest, but the required clearcut or shelterwood methods would conflict with the training requirement to maintain a forest canopy. A more intensive approach to forest management was considered where uneven-aged management techniques would be used on a more extensive basis than proposed above. Larger sections of the forested areas would be harvested using group selection cuts to favor the growth of shade-intolerant species such as oaks, which have higher wildlife and timber values. In the context of West Point's primary mission, this approach would not be feasible. The military mission requires continuous cover for training and this management technique would create more open areas than are desirable. In addition, although the deer population is at or nearing a manageable level, creating more open and edge areas than what has been proposed has the potential to attract more deer, create a larger food source, and potentially increase the size of the herd. The level of browsing would again become excessive and forest regeneration would be inhibited.

5.7 SPECIAL NATURAL AREAS PROTECTION AND MANAGEMENT

DoD Instruction Number 4715.3 (Environmental Conservation Program, May 3, 1996) specifies that "areas on DoD installations that contain natural resources that warrant special conservations efforts . . . may be designated as special natural areas." It further states that "the natural resources management plan for the installation shall address special management provisions necessary for the protection of each area." Special natural areas include botanical areas, ecological reserve areas, geological areas, natural resources areas, riparian areas, scenic areas, zoological areas, "watchable wildlife" areas, and traditional cultural places having officially recognized special qualities or attributes.

USMA has identified 12 sites that are to be specially managed because of their ecological or geological significance, unique geological structure, and/or aesthetic and educational value (Figure 3-6). These areas are generally not of exceptional significance on a national or state basis, but are unique at West Point and/or in the region, and therefore warrant special consideration. USMA intends for these areas to remain part of designated training areas, but by their designation as special natural areas, to make additional efforts to minimize the potential for impacts to occur as a result of training exercises or any other activity. Any proposed changes to training activities in these areas will be reviewed by the NRB to determine if protection can be accomplished without loss

of mission effectiveness.

5.7.1 Management Measures

General Management. To minimize disturbance within these areas, no timber harvest or TSI activities will occur unless required to maintain or restore suitability for training, such as salvage logging following a severe blowdown event or insect/disease outbreak. Wherever possible without adversely affecting the training mission, high impact training activities, such as construction of field fortifications, excavation of foxholes, and bivouac or other troop concentrations, will be avoided. The natural areas are mapped and maintained as a GIS database layer to facilitate planning and analysis of protection measures. Hunting and fishing will be permitted in the natural areas. Wildfires will generally be suppressed and efforts made to control invasive plant populations.

Protection of Endangered, Threatened, and Rare Species. Several special natural areas are known to contain endangered, threatened, and/or rare species, including Constitution Island, Popolopen Brook wetland, the Bull Pond shoreline, and the timber rattlesnake den area. Constitution Island has been identified as an important winter perch site for the federally threatened bald eagle (see Section 5.10.1.1) and also has been found to support numerous rare plant species. No nesting activity has yet been observed on the island, though the potential does exist given the availability of suitable habitat. Since the island is used primarily for recreational purposes, disturbance to sensitive resources as the result of training is a not an issue. Also, since recreation on the island is limited in the winter months, there is little chance of adverse impacts on overwintering eagles. Restricting use of the island during this time is not a necessary management measure. To provide the potential for bald eagle nesting on the island, however, USMA may restrict use of certain portions of the island that contain suitable nesting habitat (e.g., large coniferous trees, close proximity to water) during the breeding season. Bald eagles require isolation from human disturbances to reproduce successfully.

For any location where rare plants are known to occur, fencing or posting signs around plants or populations will be done only when absolutely necessary to avoid adverse impacts, so as not to invite vandalism. The locations of rare species, and their buffers, will be mapped and training avoided in areas around individuals or populations. Access to areas on Constitution Island where rare plants occur are restricted. Rare plant management at USMA is described in more detail in Section 5.10.1.8.

To protect the state-threatened timber rattlesnake (*Crotalus horridus*), located in the timber rattlesnake den area,

all training maneuvers and hunting activity in this area will continue to be prohibited pending findings of the on-going timber rattlesnake study. Additional signs indicating the presence of vital habitat and its associated restrictions will be posted.

Control of Invasive Plant Species. Though mostly exotic-free, some of the designated areas support populations of invasive plants that are out competing native communities. These species are interfering with native tree regeneration, reducing the biological diversity of the area and the habitat quality for wildlife. Invasive species will be controlled as described in Section 5.5.4.1 (*Terrestrial Habitat, Management Measures*).

Monitoring. All special natural areas will be monitored periodically for changes in unique ecological or geological attributes.

These site-specific management measures are summarized in Table 5-4.

5.7.2 Other Management Alternatives Considered

The absolute restriction of all personnel from each of the 12 special natural areas was considered as a management alternative. However, this approach conflicts with the primary goal of USMA to provide a quality training experience. The duel goals of protecting these areas and using almost all portions of the reservation for training are not mutually exclusive. They both can be accomplished if done so in an adaptive management context. As long as the monitoring of these areas is made to be a priority and ecological conditions are assessed on a periodic basis, then resource management techniques or training activities can be modified on an as-needed basis.

It is important to note, however, that training activities in the timber rattlesnake den area will continue to be completely restricted until such time that the timber rattlesnake population has recovered.

Table 5-4
Summary of Site-Specific Management Measures

Special Natural Area	Management Measures
Constitution Island	Protection of bald eagle habitat and rare plants; control of invasives; monitoring.
Bear Swamp/Bull Hill	Protection of state-rare plants; monitoring
Burke Mountain	Protection of state-threatened plants; monitoring
Popolopen Brook Wetland	Protection of state-endangered plants; monitoring.
Popolopen Brook Gorge	Protection of state-threatened plants; monitoring.
Timber Rattlesnake Den Area	Protection of state-threatened species and critical habitat; monitoring.
Bull Pond Shoreline/ Hardwood Cove	Protection of state-endangered plants; monitoring.
Natural Bridge	Monitoring
Mineral Springs Falls Area	Monitoring
Cascade Ridge	Protection of state-endangered plants; monitoring
Johnson Meadows Woodland	Ecological characterization; monitoring.
Mineral Springs Brook	Monitoring
Cat Hollow	Monitoring
Crows Nest	Protection of state-endangered plants; monitoring

5.8 WILDLIFE MANAGEMENT

5.8.1 Big Game Species

The main goal of big-game management at West Point is to maintain and control populations compatible with the range they occupy, land management objectives, and the military mission of the installation and to provide quality recreational opportunities.

Big game species on the reservation include black bear (*Ursus americanus*) and white-tailed deer (*Odocoileus virginianus*). While black bear are not directly managed on West Point (though bear hunting is permitted), white-

tailed deer are intensely managed on both the reservation and Main Post. The reason for intense deer management stems from the fact that in past years West Point has supported excessively high densities of deer. Severe browsing throughout the reservation has been observed, resulting in the elimination of ground cover in many areas and reduced tree regeneration. Also, several problems with deer in the cantonment area have been reported, such as damage to landscaped and garden areas and deer-vehicle collisions.

The main objectives for black bear management are to monitor bear activities on the reservation to determine if active management is, or will be, necessary and to ensure that bears do not become a nuisance to USMA personnel and members of surrounding communities. For white-tailed deer, specific management objectives include maintaining a population that does not damage native and ornamental vegetation or cause conflict with humans, which at this time translates into decreasing total population size on both the reservation and Main Post, and providing a safe, high-quality hunting experience for the West Point community and guest hunters in designated portions of the reservation. Another deer management objective includes developing and implementing a more proactive outreach program to educate the public about ways to discourage deer foraging on the Main Post.

5.8.1.1 Management Measures for Black Bear

The management of black bears on West Point is in accordance with New York State laws and regulations pertaining to bear management and hunting. Since 1990, sightings of black bear at West Point have steadily increased due to a burgeoning bear population in New Jersey where hunting black bears is prohibited. New Jersey adult black bears move out in search of new territories, bringing them into Orange County, including the West Point reservation.

The number of black bears whose home range overlaps West Point property is unknown, but estimated by NRB to be six. Black bear cubs have been born and reared on the West Point reservation five times since 1992 (bears give birth every other year), and with a regular influx from the south, black bears will continue to be seen. New York State's bear hunting laws and seasons are designed to reduce and/or prevent the taking of adult female (sow) black bears and cubs. It is illegal to knowingly shoot a cub or shoot a bear that is with a group of bears. Black bears are not social animals and the only time two or more bears would be together in a natural situation is a sow bear with her cubs.

In 2001, there was a sizeable increase in bear sightings at USMA, including several sightings by USMA hunters during the open bear hunting season dates. USMA hunters took three bears in 2001 – one during the early special archery season and two during the regular ("firearms") season. On 2 November, 2001, a 210 lb. (dressed weight) male black bear was taken with a bow and arrow in Hunting Area T1. This is the first bear ever taken with archery equipment at West Point. On 25 November, 2001, a 154 lb. (dressed weight) male black bear was taken in Hunting Area H/Z6. On 9 December 2001, a 190 lb. (dressed weight) male black bear was taken from Hunting Area C.

USMA hunters have now taken four black bears since bear hunting was first authorized in Unit 3P in 1991. All have been young adult males and their removal will have no impact on the health of the black bear population in the Hudson Highlands ecoregion – other than to reduce the chances of negative bear-human interactions.

Hunting is not allowed on the 50,000 acres of Harriman and Bear Mountain State Parks immediately south of West Point (in effect, a bear sanctuary). Bear hunting is also not permitted on the 4,000-acre Black Rock Forest adjacent to West Point's northern boundary. With these three "no-bear-hunting areas" plus a yearly influx from New Jersey, it was deemed improper to also make West Point a "bear sanctuary." Black bears have large home ranges (25 to 60 square miles for males, six to 25 square miles for females) and, if USMA was to be made a "bear sanctuary," West Point bears would quickly become a nuisance to surrounding communities, including the West Point community. In addition, West Point personnel would be denied a valid recreational opportunity.

As bears are rarely a nuisance on the reservation, a formal management plan to regulate population size is not necessary at this time. It would be beneficial, however, to maintain a monitoring program that documents any actual den sites (dens are not re-used by black bears in the Northeast year after year) and tracks bear activities. Sighting information (e.g., location, time of day, number of individuals, approximate age of individuals) will be maintained in a GIS database and regularly examined to determine "hot spots" of activity. This information will then be provided to Range Control to avoid potential conflicts between training activities and black bears.

5.8.1.2 Management of White-tailed Deer on the Reservation

The primary means of managing white-tailed deer on the West Point reservation is through implementation of a regulated hunting program. Harvest limits are calculated each year to adjust the population size and structure to maintain a deer population that is not stressed by or stressing its environment and one that does not cause conflict with other USMA management program and military objectives. For example, a deer population that is too large (i.e., not existing within the carrying capacity of the reservation) is likely to overbrowse and damage understory vegetation, which can adversely impact small game habitat and forest regeneration. It is important to note that forest regeneration is important not only for ecosystem viability, but also to support the military mission.

Other techniques for managing deer, such as exclosures and trap and transfer, have been investigated.

Determining Appropriate Harvest Limits. In maintaining a deer population that does not conflict with other natural resource management programs or the military mission, West Point managers have determined that regulated hunting is the most effective (cost and otherwise) method. To control deer population growth by setting appropriate harvest limits, the size and physical condition of the population must be known. This information is especially important for harvest programs that emphasize management for specific sex and age ratios (Brothers and Ray, 1982), and several sources are used on the installation.

A winter mortality survey is conducted in late March or early April on east and south facing aspects on the reservation. Additionally, all mortalities found between 15 January and 15 April are examined by either USMA or Black Rock Forest natural resource managers to sample conception and/or birthing dates (useful in determining adult sex ratios) and physical condition of deer on the Reservation. An additional benefit of wintering censusing includes the monitoring of other wildlife populations such as coyote, fox, otter, mink, squirrel, grouse, and turkey.

To determine the physical condition of the deer population, biological data collected during the hunting season are compared by age class and sex to data collected in previous years. The biological data collected during the deer season includes: dressed weight (all internal organs removed), antler beam diameter (measured one inch above the burr), number of antler points, sex, and age. An annual comparison of average dressed weights and antler beam diameters (males only) by age class and sex provides insight into the physical condition of the deer population (Beemer, 2001b).

Yearling males are the best sex/age class to gauge the physical condition of the population, under most circumstances. The yearling buck frequency (percentage of 1½ year-old deer in the antlered buck harvest) was 50% in 2001 (52 % in 2000). This indicates that a significant portion of the male fawn population was lost during the 2000-01 winter. Normally, the yearling buck percentage is closer to 55%. Because the total number and percentage of older bucks in the harvest did not increase considerably, one can rule out that a majority of hunters were passing up younger bucks in order to shoot older bucks.

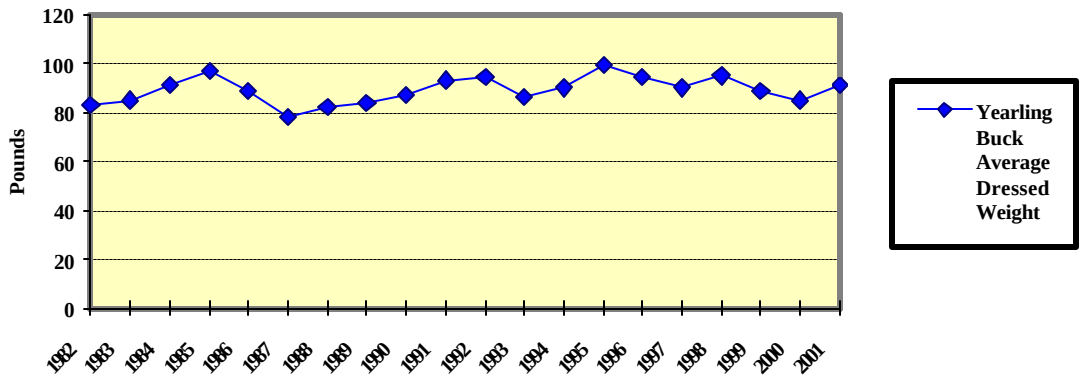
The average yearling male antler beam diameter (YABD) is another indicator of the physical condition of the herd. The 2001 YABD of 16.6 mm was 1.1 mm larger than the 2000 season figure and indicates that the general health of the West Point deer population is good (Figure 5-5) (Beemer, 2001b). The yearling buck average dressed weight (YADW) increased in 2001. This was the result of decreased deer numbers on most of the reservation in 2001 plus a good acorn crop following two years of poor acorn crops.

YABD can also be used to calculate the fawn-birthing rate for female deer the following spring. The 2001 YABD predicts a 2002 female reproductive rate of 1.2 fawns born/ bred yearling doe and 1.7 fawns born/bred older, adult doe. The YABD predicts that one doe fawn in six would be expected to give birth to a fawn in 2002. Checking yearling does harvested in past seasons has not confirmed predicted fecundity rates for does bred as fawns based on YABD.

Dr. Aaron Moen, a noted deer-population-dynamics researcher, has found that many year-old does (those bred as fawns) may not successfully raise their newborn fawns to weaning. The primary cause of summer fawn mortality is poor milk production by the doe, leading to starvation for the fawn and/or increased fawn susceptibility to predation. Coyote predation can be a significant factor to fawn-survival rates during the spring and summer months.

Based on 21 seasons of YABDs, this season's predicted reproductive rate is about the average expected for the Reservation (Beemer, 2001b). The actual recruitment into the year 2002 pre-hunt population will depend on the survival of fawns through the 2001-02 winter months and the survival of newborn fawns through the 2002 summer.

Figure 5-5. Yearling Buck Average Dressed Weight: 1982-2001



Another method used to determine the intensity of West Point deer harvests is the calculation of a winter range carrying capacity. The target capacity is usually one where the deer population survives into spring with the least mortality due to harsh winter conditions. To measure carrying capacity, a dynamic concept that is difficult to assess accurately, the amount and quality of available forage existing on the range must be determined. In the Hudson Highlands ecozone, the carrying capacity is directly correlated to mast crop production, which varies each year. The determination of available forage yields the subsistence carrying capacity and indicate the maximum number of deer the range will support. At West Point, land management objectives require the desired population level to exist below the subsistence carrying capacity, currently set at 600 deer. Future reservation carrying capacity determinations will be made using the computer program, DEER CAMP (Computer Assisted Management Program).

In addition to determining a biological carrying capacity for deer on the reservation, a "cultural" carrying capacity is determined for deer on the Main Post. This figure is purely subjective and reflects the level at which human users of West Point desire the deer population. Included in the calculation are the following elements: residents that just enjoy seeing deer, deer hunters who want to see many deer during the hunting season, deer hunters who want to see high quality deer during the hunting season, residents who don't want their gardens or yard plantings damaged by deer, safety personnel who would like to minimize deer-vehicle collisions and who are concerned with Lyme disease transmission, and trainers who do not want a park-like atmosphere for training activities.

West Point and the Black Rock Forest work cooperatively with NYSDEC to determine permit levels for Wildlife Management Unit (WMU) 3P. Permit levels are determined after selection of the desired adult female harvest

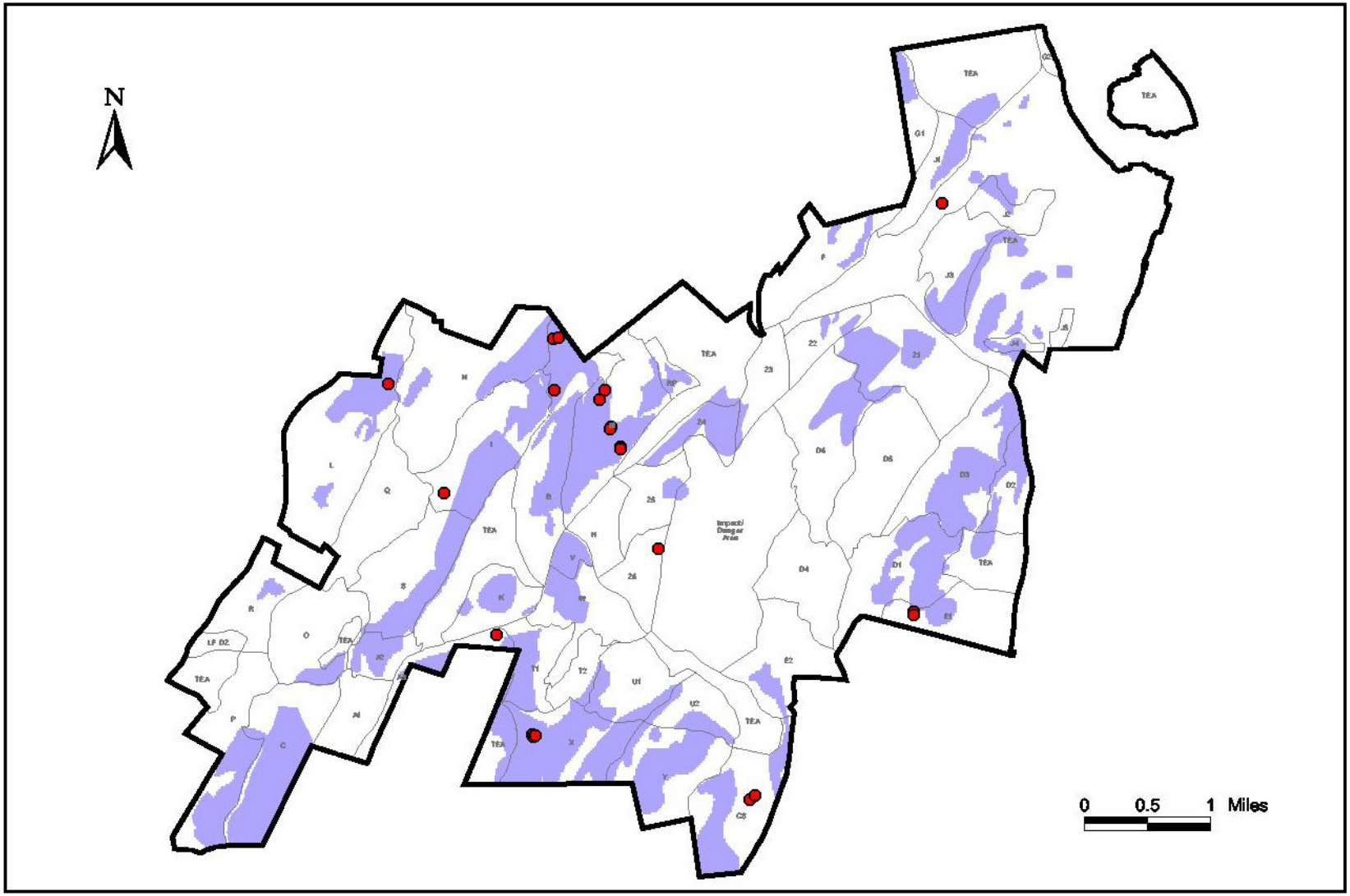
level—a rate that either allows the herd to grow, decreases its size, or stabilizes it at its current level. These rates can be influenced by a number of factors, such as winter mortality detected after the deer season, birthing rates and fawn mortality, deer usage of neighboring properties, and forage conditions of the previous autumn coupled with predicted mast production. Winter severity is another factor, since, even with a good mast production, a particularly harsh winter can substantially reduce the yearling age-class of the following autumn. Key indicators of a deer herd below the West Point biological range carrying capacity are YMDWs of 90 pounds or more, YABDs of greater than 16.5 mm, fawn harvest sex ratios of 1:1 (males to females) or ones favoring females, and fawn dressed weights of 55 pounds or more.

Exclosures. While the deer population at West Point has been reduced over recent years, forest regeneration continues to be impeded by the browsing of seedlings by deer. The lack of regeneration, both of trees and other flora, has a direct effect on ecosystem viability and could eventually limit opportunities for training.

To assess the impacts of deer browsing on forest regeneration, small fenced exclosures have been established throughout the reservation (Figure 5-6). The exclosures, generally, 150 square feet in size but ranging up to 10,000 square feet, are located in a variety of forest conditions and typically have a control plot associated with them. They were intended primarily as visual demonstration areas, but in many plots, information on size, numbers, and species of seedlings has been recorded for the past several years. At most sites, there is now a dramatic contrast between test and control plots. Compared to those within the exclosures, seedlings in the control plots (unfenced) are typically few and stunted. Also in the control plots, the decline of seedlings has been rapid. For example, data from Plot 84 A demonstrates the contrast that occurs between the number of seedlings growing inside the exclosures as compared to outside of the exclosures (Table 5-5). There is a marked decline in the number of northern red oak seedlings in the control plot (unprotected) over time and the growth of the existing seedlings is severely impeded. These data illustrate the destructive impact that overgrazing by deer has on forest regeneration.

5.8.1.3 Management of White-tailed Deer on Constitution Island

Due to the relatively small population and lack of interference with other natural resource management programs, deer (as well as other game species) are protected from hunting on Constitution Island. To prevent



LEGEND

- Deer Exclosure
- Timber Harvest Area

Deer Exclosure Locations

United States Military Academy
West Point, New York
Figure 5-6

Table 5-5
Deer Exclosure Data: Plot 84A - Northern Red Oak

	Inside Exclosure		Outside Exclosure (unprotected)	
Survey Date	**Number**	**Height (inches)**	**Number**	**Height (inches)**
06/13/84	500		388	
07/12/84	Too dense to count		700	
08/10/84	70 percent of that noted on 07/12/84		756	
07/29/86	121		178	
05/19/87	320		110	
06/03/88	146	27	183	4
06/16/89	241	3	64	4
08/20/91	135	4	56	4
07/13/92	220	46	42	6
06/27/94	106	38	19	7

illegal hunting, military police patrols are coordinated with the local New York State Environmental Conservation Officer and Constitution Marsh Sanctuary manager. No trespassing signs are posted along the railroad track boundary and are annually inspected for replacement by the NRB. The presence of a resident manager on the island is believed to further discourage illegal hunting.

The size and condition of the island's deer population will be monitored by the NRB, as well as its effects on rare plant species and vegetative communities. Should adverse impacts be detected, the implementation of deer herd reduction methods will be considered.

5.8.1.4 Management of White-tailed Deer on the Main Post

***Harvesting*.** Since the late 1970s, concerns have been raised by the West Point community and command levels regarding the high density of deer frequenting the Main Post. Browsing of ornamental shrubs, deer-vehicle collisions, and the threat of Lyme disease necessitated the implementation of increased efforts in past years to reduce the population. Deer repellents, live trapping and relocation, and shooting deer under a Damage Control Permit (issued by NYSDEC) were attempted to reduce problems associated with too many deer. No method was effective, and one, in the case of the permit harvesting, was also socially unacceptable.

Bowhunting in Hunting Area J3 has been occurring since the 1970's (Figure 4-2). Few deer were taken from this area until the 1980's. In 1980, all of Areas J2 & J3 was opened to bowhunting for all military personnel and civilian employees assigned to USMA. In 1982, other Main Post areas were opened to bowhunting (G2, J4, J5, and J6) and J3 was opened for shotgun deer hunting (six hunters afield maximum). Areas J2, J3, J4 and J5 have since had their boundaries reduced due to development projects on the Academy and Area J6 was eliminated due to non-use (Beemer, 2001b). Boundaries and access points to the J areas are marked. The West Point community is alerted to the presence of the hunting areas through notices in The Pointer View, the Post Bulletin, e-mail bulletin boards, community mayor briefings, and on Channel 8 TV & WKDT radio.

Controlled hunting, especially with firearms, can be a safe and effective, low-cost method of reducing deer numbers on the Main Post. However, bowhunters are often reluctant to shoot a doe early in the archery season for fear of missing out on an antlered buck. And, bowhunters, on average need to spend twice as much time afield as gun hunters in order to successfully take a deer. A minimum number of adult doe deer need to be removed each year in order to reduce a deer population.

In 1999, New York State implemented a new program called Deer Management Assistance Permits (DMAPs) that could alleviate hunters' concerns. Landowners (the Academy in this case) can apply for a block of permits valid for taking antlerless deer only and then distribute them to hunters that are willing to use them in areas a landowner needs deer taken from.

The USMA Natural Resources Branch applied for and received 30 DMAPs in 2001, the third consecutive year the Branch has done so (Beemer, 2001b). The Natural Resources Branch mandated their use strictly in the Main Post hunting areas. The permits were issued Monday to Friday at the Branch office on a first-come/first-serve basis following a standard operating procedure (SOP). An added benefit to these permits is that personnel that arrive

after the application deadline for WMU 3P permits could still have an opportunity to take an antlerless deer.

USMA deer hunters have been enthusiastic in their participation. The resulting harvest in the Main Post Areas from the use of DMAPs has increased noticeably from the 1980s and early 1990s (range: 0-14 deer). Twenty-six deer were harvested from the Main Post Areas in 2001, 16 males and ten females. Eleven deer were tagged with DMAPs. DMAP-tagged deer in the harvest has ranged in number from 11 to 19 since 1999. New York State regulations only allow an individual hunter to fill up to two DMAPs. Several USMA hunters stated that they were willing to take even more deer with DMAPs if so permitted.

In the briefing sent to the Community Mayors each year regarding the deer hunting on the Main Post, it was suggested that the mayors develop a list of area residents that would accept packages of venison from deer taken by hunters, or, an entire deer. It was further suggested that two or more residents could each contribute towards having a deer butchered and sharing the venison.

A program called *Hunters Helping The Hungry* allows hunters to donate a portion of or an entire deer to soup kitchens, homeless shelters and food pantries. The deer would be professionally butchered by participating butchers and distributed to the charitable organizations by volunteers. Several USMA hunters took advantage of this program in 2001.

This donation program is important. A recently completed survey of West Point deer hunters shows that most deer hunters can only use the meat from 2½ deer at most and no hunter is willing to shoot deer just to kill the animals (Enck and Brown, 2001).

The Main Post hunting areas are very popular with West Point personnel, providing 472 man-days (1 area-signout = 1 man-day) of hunting recreation in 2001. The J2/J3 Bow Area continues to be the most popular bowhunting area on USMA during the special archery season with 182 sign-outs, 325% more than the second-most popular area – J4 with 56 sign-outs. (Note: Hunting Areas J2 and J3 are combined as one area during the special archery season and treated separately during the Regular Season). Hunting Area J3 is often one of the ten most heavily used areas during the Regular Firearms Season (and was the most heavily-used in 2000), despite rifles not being permitted there. In 2002, the Garrison Commander authorized access to Area J3 for hunting deer during the special muzzleloader season and increasing the size of Areas J2 and J5.

Habitat Manipulation. Habitat manipulation techniques can provide another means of controlling pest deer in urban areas. Two such methods include planting species that are resistant to foraging and using deer repellents. Research on deer preference of ornamentals has shown that deer do not like to eat lilac, boxwood, jasmine, china berry tree, hercules club, century plant, persimmon, sea buckthorn, holly, smoke tree, butterfly bush, black locust, pepper tree, wax myrtle, narcissus, daffodil, jonquil, aloe, columbine, clematis, iris, larkspar, foxglove, and English ivy (Rue, 1978). Additional studies of damage to nurseries in Connecticut showed that deer rarely attack American holly, dogwood, pine, cedar, fir, shadbush, lily of the valley, golden-bells, dog hobble, magnolia, snowball viburnum, mock orange, bridal wreath, weeping birch, hemlock, and mountain laurel; they moderately browse rhododendrons, red cedar, Exbury hybrid azaleas, white birch, and juniper. Some deer resistant plants are, however, unacceptable for planting at USMA because they escape cultivation, and are invasive in native habitats.

DHPW uses a variety browse-resistant ornamental plant species for landscaping the Main Post (see Table 5-6). It is important to consider, however, that the use of resistant plants will be effective only in the absence of intensive feeding pressures or high deer densities. Provided with this information, homeowners can make their yards less desirable to deer by growing ornamental species that are poisonous or otherwise unpalatable to them.

Table 5-6
Browse-resistant Ornamental Plants Used on the Main Post

Paperbark Maple *Acer griseum*	Emerald Mound Honeysuckle *Lonicera xylosteum*	Fritshciane Spirea *Spiraea fritschiana*
October Glory *Acer rubrum*	Adams, Bobwhite and Japanese Crabapple (*Maius spp*.)	Improved-red Spirea *Spiraea x bumaida*
Downy Shadblow *Amelanchier canadensis*	Dawn Redwood *Matasequoia glyptostrobodies*	Vanhoutte Spirea *Spiraea vanhouttei*
River Birch *Betula nigra*	Northern Bayberry *Myrica pensylvanica*	Blackhaw *Viburnum prunifolium*
Wintegreen Boxwood *Buxus var. koreana*	Persian Parrotia *Parrotia persica*	Erie viburnum *Viburnum dilatatum*
Redbud *Cercis canadensis*	Norway Spruce *Picea excelsa*	Shesta Doublefile viburnum *Viburnum tomentosum*
Sweetfern *Comptonia peregrina*	Serbian Spruce *Picea omorika*	Red Prince Weigela *Weigela florida*
Smoketree *Cotinus coggygria*	Eastern White Pine *Pinus strobus*	Japanese Zelkova *Zelkova serrata*
Cockspur Hawthorn *Crataegus cruz-galli*	Douglas Fir *Pseudotsuga taxifolia*	Bosnian Pine *Pinus heldreichii*
Pink Deutzia	Natchez Mockorange	Dwarf Korean Lilac

Table 5-6
Browse-resistant Ornamental Plants Used on the Main Post

Deutzia scabra	*Philadelphus natchez*	*Syringa meyeri*
Japanese Kerria *Kerria japonica*	Fragrant Sumac *Rhus aromatica*	
E. Larch *Larix decidua*	Dwarf Garland Spirea *Spiraea x arguta*	

Source: Jones, R. 1997.

Deer repellents have been used on West Point to control deer browsing, but some types have resulted in limited success. The repellent currently in use is the Plant Pro-Tec Unit®, a formulation consisting primarily of garlic oil and chili pepper. The Plant Pro-Tec Units® are clipped to individual plants, placed in the soil adjacent to a plant, and/or clipped to fences around areas. The garlic odor is evident for six to eight months, and aversive conditioning (associating the site of the device with garlic odor) may keep the deer away for some time after the garlic odor is gone. Similar to the use of resistant plantings, this method of control is effective only without intense feeding pressure—starving deer have been known to ignore all repellents (Swihart and Conover, 1990).

Lyme Disease Monitoring Program. Lyme disease is a human health concern in many parts of the northeastern United States. Its primary vector is the black-legged tick (*Ixodes scapularis*). At West Point, where humans exist in relatively close contact with deer, the tick is closely monitored on an annual basis for changes in population size and infection rate. The black-legged tick (***Ixodes scapularis***) [formerly called the deer tick, ***I. dammini***] is the primary vector of Lyme disease in the region. Since 1985 the Natural Resources Branch has cooperated in a Lyme disease monitoring program with Fordham University's Vector Ecology Laboratory. According to a protocol provided by the Laboratory, ectoparasites are collected from a sample of deer brought to the West Point Deer Check Station during the Regular "firearms" Season. The Preventive Medicine Office of MEDDAC at USMA has the primary responsibility for check station tick collections. Twelve years of data are summarized in Table 5-7 (Beemer, 2001b).

In 2001, the Army Center for Health Promotion and Preventive Medicine (CHPPM) also had personnel present at the West Point Deer Check Station to collect blood samples and ectoparasites from deer carcasses. This was a follow-up to the survey they had conducted in 1998. The biological samples were tested for the Lyme disease spirochete and also for human granular erhlichiosis, another emerging tick-borne illness of concern.

Table 5-7
Tick Collection Results at West Point

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
# of Deer Checked	119	100	166	60	29	27	30	35	47	34	30	30
# of Deer with I. scapularis	67	18	52	18	18	19	23	22	40	27	28	20
# of I. scapularis found	466	74	253	44	137	67	107	218	564	377	193	321

Results of the 1998 CHPPM sampling showed that 34 percent of the black ticks analyzed were infective with the Lyme disease spirochete, and 24 percent of the ticks were infective with the erhlichiosis pathogen.

5.8.1.5 Management Measures for White-tailed Deer

- The desired annual hunter harvest is a target of 200–250 deer, dependent on recruitment and winter survival rates. About 75–100 deer taken by hunters should be adult does. If this harvest level is achieved, the natural environment on the West Point reservation (the training areas) should continue to improve while maintaining healthy individual deer in the integrated management of West Point's natural resources. This should result in the continued improvement in the body size of deer harvested and in the quality of antlers on bucks taken.

- Deer hunting opportunities at West Point should be, at a minimum, maintained at the 2000 season level. It would continue to provide a quality, recreational opportunity of significant importance for the members of the West Point community. It will also insure that adult female deer harvest targets are likely to be met.

- The NRB will apply for Deer Management Assistance Permits from New York State each year to help alleviate the deer problems on the Main Post. The NRB will work with the USMA Safety Office and the DCFA Community Recreation Division to identify new areas on the Main Post where bowhunters might be able to safely take additional antlerless deer.

- Consider allowing general public hunters an opportunity to pre-season scout before the Regular Big-Game season starts. Familiarity with an area increases a hunter's chance at success. However, bow hunting or small-game hunting before the Regular Season will not be allowed.

5.8.1.6 Other Management Alternatives Considered

Restricting Bear Hunting. A complete restriction of black bear hunting on the reservation was initially considered as a management alternative. However, given the sanctuary afforded black bears in New Jersey and in Harriman and Bear Mountain State Parks, it would be inappropriate for USMA to create another sanctuary that could be a potential source of nuisance for surrounding communities. Also, the low number of bears taken by USMA hunters (less than one bear annually) would likely be replaced by individuals from the south looking to establish territories of their own.

Deer Movement Study. A study of deer movement on the reservation could be conducted to identify intensively used areas and travel corridors used by deer to access the built-up portions of the Main Post. The information collected could aid in determining locations for deer deflection fences and roadway lighting.

Immunocontraceptive Injections. Research is being conducted on the efficacy of using immunocontraceptive injections to control deer population growth. So far, this technique is recognized as being both costly and time-consuming and believed to be potentially useful only in urban areas. It is also not expected to reduce population sizes, only to stabilize them at existing levels. While it may not be the most desirable method of controlling population growth, the use of deer contraceptives could have some future value for managing deer on the Main Post at West Point once the population size is stabilized. It is an alternative to consider as more becomes known about its effectiveness and practical value.

Trap and Transfer. To reduce deer population size, this management technique, which involves the use of trapping, netting, and/or immobilization to capture and relocate deer, has been, and could potentially continue to be, employed on West Point. With this technique, deer are typically attracted to live traps using food bait, captured, and then moved to another area. Trapping is most successful in the winter when natural foods are relatively scarce. This management tool is not often used to control free-ranging herds due to its high cost and a lack of sites capable of absorbing the relocated deer. Also, deer have been shown to be susceptible to traumatic injury during handling, including stress-related heart failure, resulting in low survival rates in many instances. The use of tranquilizers to reduce stress during capture and handling was also considered, however, difficulties estimating the weight of an individual increases the risk of an overdose.

West Point attempted a trap-and-transfer program from 1987 to 1989, with almost complete failure. Every deer that was transferred off the Main Post, with the exception of two that were killed in deer-vehicle collisions, returned to the cantonment area within a short time period. Capture mortality was high and the project proved both cost and time consuming.

Since the 1987-1989 program, West Point has been unable to finds sites willing or capable of absorbing relocated deer. Given the trauma to the deer and the likelihood of high mortality rates, the failure of the previous attempt, the lack of relocation sites off of the property, and the high costs, this alternative has been rejected.

Increasing Deer Predator Population and Sharpshooting. Two other management alternatives considered, but rejected upon further evaluation, were increasing the population of coyotes on the reservation as natural deer predators (rejected because the West Point coyote population is increasing and expected to reach a relatively "natural" dynamic range) and arranging another sharpshooting event on the Main Post as a means to quickly and easily remove excess does (rejected due to expectation of severe adverse reaction by the public).

5.8.2 Small Game Species

The goals of the small game species management program are to maintain viable populations of small game (i.e., waterfowl, turkey, ruffed grouse, gray squirrel, rabbit, woodcock) and provide recreational opportunities. A specific objective to achieve these goals is continuing to create and maintain a diversity of habitats on the reservation, many of which would be suitable to several species of small game.

5.8.2.1 Management Measures

Forest clearings of one to two acres in size are created throughout the reservation to increase habitat diversity and availability for small game species. The greater diversity of terrestrial habitats on West Point benefits not only small game species, but also some nongame species (e.g., songbirds, butterflies) whose presence contributes to a more species-rich and "healthy" matrix of communities.

In addition to creating forest openings, other habitat manipulation methods will be employed to provide suitable small game habitat. Some of these methods include increasing the number of snags in forested areas (Section

5.5.4.1), maintaining healthy aspen stands for grouse (Section 5.5.4.1), and constructing and maintaining nest boxes near open water habitats for cavity nesting waterfowl, such as wood ducks. Reducing the deer population would also benefit small game, since deer browsing has severely limited ground cover in many areas, resulting in less brood and breeding cover and feeding opportunities for many species.

The wood duck nest box program has been highly successful at West Point. As a result of the program, the population of wood ducks has increased on the reservation, as well as the number of nesting hooded mergansers which occasionally make use of the boxes. Squirrels also are known to use the nest boxes.

Less labor-intensive management activities undertaken as part of the range maintenance program, such as brush clearing and mowing, also provide habitat to small game species. Open areas in Training Areas R and L are maintained by brush cutting and mowing approximately every three years on an alternating basis (i.e., alternating between which training area that is cut). The actual frequency of the maintenance is dependent on the amount of regrowth by woody vegetation and by invasive species, particularly black locust. The potential benefits of conducting a spring (April) burn are currently being evaluated. Maintenance of the open areas in Training Areas R and L improves the insect populations that are necessary to provide young turkey poults with the abundant supply of insects that are required for hearty growth. Maintaining open areas also provides habitat suitable for rabbits. Maintenance of firing ranges at USMA also provides open habitat suitable for small-game species such as cottontails, ring-necked pheasants, wild turkeys and northern bobwhites.

Limited numbers (100 – 200) of ring-necked pheasants (*Phasianus colchicus*) are released each fall in suitable habitat to provide additional hunting opportunities. This Asian species was first naturalized in the U.S. in the 1800s and was common in Orange County, New York as recently as the 1960s. Winter survival of released ring-necked pheasants has been noted at West Point, so the chance of this species reproducing is possible. The ring-necked pheasant is a popular species for bird watchers and is preyed upon by native wildlife such as great horned owls, red-tailed hawks, coyotes and raccoons. Northern bobwhites (*Colinus virginianus*), a native New York species, are also being considered for release. However, a current state season bag limit of 10 birds renders stocking impractical at this time. New York State is considering dropping the season bag limit. If that occurs, then USMA would likely stock some bobwhites each year, as well. Bobwhites are less expensive than pheasants. Plus, many military personnel stationed at USMA come from southern states where quail hunting is a family tradition. Therefore, the release of northern bobwhites would have a positive effect on the morale of many USMA

personnel. Funds for the purchase of pheasants and quail comes from the sale of USMA hunting and combination hunt/fish permits.

5.8.2.2 Other Management Alternatives Considered

A more intensive approach to small game management was considered in which more and larger forest clearings were created. This approach was rejected based on its projected conflicts with the big game species management program and military mission. The clearing of relatively large forested areas (greater than two acres) throughout West Point to provide habitat for small game species would likely cause a significant increase in white-tailed deer on the reservation, a population whose growth could not be controlled under the current hunting regime. The clearing of large areas would also potentially conflict with the military mission of USMA, which requires the presence of continuous forest cover.

5.8.3 Furbearers

The goals of furbearer management on West Point are to reduce or eliminate nuisance populations in a manner consistent with land use and training objectives and ensure that healthy populations continue to exist so that they are appreciated for their aesthetic and ecological values. Recreational fur trapping is permitted when it is consistent with these goals. Furbearer species on West Point include the beaver, raccoon, opossum, skunk, mink, coyote, gray fox, red fox, fisher, bobcat, muskrat, and river otter. A nuisance individual or species is generally defined as one that causes unacceptable damage to a natural or man-made element, such as disruption of a hydrologic regime, destruction of vegetation, or flooding of a road, range, or training area.

5.8.3.1 Management Measures

On West Point, nuisance furbearers are removed through trapping. In lieu of an on-going recreational trapping program, when excessive damage is identified on the reservation, West Point managers allow trappers to take the nuisance individuals. Five trapping zones have been established on the reservation (Figure 4-2) with harvest limits set for each zone based on an evaluation of the populations conducted during aerial and ground surveys. Annual beaver harvest quotas are determined on a colony-by-colony basis; for otter, if the population size permits, only one individual is allowed to be harvested at any beaver trapping location. The trapping of other furbearers is

assessed on a case-by-case basis, whereby animals are removed if they present a nuisance problem. Only one bobcat may be taken by a person either hunting or trapping and no fisher may be taken. Nuisance raccoons on the Main Post, for example, have been trapped and removed in the recent past.

The trapping of nuisance individuals on an as-needed basis will be continued. Benefits of this program include preventing or minimizing damage to natural and man-made resources in a cost-effective manner and providing recreational opportunities, although the program typically involves only one or two persons annually. Recreational trapping for coyotes, gray fox, red fox, opossum, skunk, mink, river otter and bobcat is permitted while an individual is trapping for nuisance beaver, muskrats and raccoons. These species' populations are generally abundant except for bobcats and river otters, whose harvest is limited as mentioned previously.

Also, aerial and ground surveys will be conducted annually to count active beaver colonies. Where active beaver lodges are present, flow control devices can be installed as an alternative or supplement to trapping to reduce flooding of the surrounding area.

Although no formal survey is planned, informal monitoring will be conducted to document the extent of the presence of fisher on the WPMR.

5.8.3.2 Other Management Alternatives Considered

Habitat manipulation is another means of deterring nuisance species from certain areas. Beaver, for example, can sometimes be deterred from a site by planting vegetation that is unpalatable or otherwise undesirable to them (oftentimes these are non-native species). This management measure would not be practical on West Point, since it could potentially alter the vegetative composition of several areas to an undesirable state, especially if exotic species were planted.

5.8.4 Nongame Species

The primary goal of this program is to maintain nongame populations at levels compatible with land use objectives while promoting the existence, importance, and benefits of nongame species.

The basis of managing a rich assemblage of nongame wildlife is to provide an array of habitats that are structurally and biologically diverse. These habitat types on West Point include wetlands, vernal pools, riparian areas, open water systems, grasslands, shrublands, woodlands, forests, and talus slopes. In managing for a diversity of habitats and diversity within those habitats, the potential exists for numerous nongame species to be found on West Point.

In accordance with Executive Order 13186, Federal agencies, to paraphrase, are required to the extent practical, to initiate measures to conserve migratory birds and to minimize the intentional and/or unintentional take of migratory birds during/through agency actions. USMA properties are used by over 100 species of breeding migratory birds and are the winter residence of, or visited by, another 140 species. The sound natural resources management practices employed by USMA ensure the continued health of those migratory species on the USMA properties and their habitats. Further, the training activities that occur at USMA are unlikely to result in the intentional or unintentional take of any migratory bird species.

5.8.4.1 Management Measures

Habitat Management Techniques. Numerous techniques for managing nongame species habitat have previously been discussed in the habitat management sections of this document. As part of the Forest Management program, individual trees of high wildlife value (e.g., wolf trees, snags, trees with a high mast production), as well as trees in important wildlife habitats, such as riparian areas and wintering sites will be maintained (Section 5.6.1). Aquatic and riparian habitat management measures to improve habitat conditions for aquatic communities include establishing buffers around water bodies, maintaining healthy communities of riparian and shoreline vegetation, and stabilizing eroding shorelines (Sections 5.5.1 and 5.5.2). Managing and protecting wetlands on West Point will further benefit nongame species by ensuring the existence of these high-habitat-potential ecosystems. Management measures to be implemented for wetlands include establishing buffers around inventoried wetlands, continuing to develop the wetlands inventory database, planning training activities to avoid impacts to wetlands, and minimizing and repairing any unavoidable impacts (Section 5.5.3). Vernal pool management measures that will provide habitat to a specialized group of nongame species include the continuation of vernal pool identification and classification efforts and the establishment of buffer zones around known vernal pools.

Terrestrial habitat management measures that will benefit nongame species (as well as game species in many instances) include maintaining and/or creating edge and open areas, preserving snags and trees with natural

cavities, erecting and maintaining nest boxes, maintaining dead woody materials on the forest floor, planting native trees and shrubs that could be used as habitat, and maintaining and improving unique trees and forest stands. Turtle egg-laying sites will be monitored for possible degradation and increased predation.

One potential conflict between nongame species management and other program objectives might result from the creation and/or maintenance of edge and open areas. As stated earlier, this technique provides additional resources for deer, which can then result in population increases beyond a desirable limit. The need for continuous forest cover to support the military mission likely would not conflict with the aforementioned management measures, since the forest openings created are small and few in number relative to the entire reservation. In addition, the maintenance of the firing ranges provide open, grassland habitat that is limited at USMA but benefits many uncommon species.

Control of Invasive Plants. One threat to nongame species habitat on West Point is the widespread presence of invasive plant species. Three particularly ubiquitous invasives include Japanese barberry, tree-of-heaven (*Ailanthus altissima*), and phragmites. In many portions of the forest understory, Japanese barberry has out competed and displaced many of the native herbaceous plants. It exists in dense thickets, limiting the growth of most other understory species and substantially reducing habitat diversity. Management measures aimed at controlling invasives are provided in detail in Section 5.5 (*Habitat Management*).

MAPS Program. Nongame species monitoring efforts on West Point include participation in the Mapping Avian Productivity and Survivorship (MAPS) program, a cooperative effort among public and private organizations to provide long-term data on the productivity, survivorship, and population sizes of target landbird species (e.g., neotropical migrants). Inventories and monitoring are conducted through mist netting, banding, and point counts during the breeding season. In addition to contributing data to large-scale regional analysis, participation in the MAPS program offers West Point the opportunity to monitor its own population of nongame bird species. This monitoring effort will continue on West Point, possibly in conjunction with Black Rock Forest.

Other Surveying and Monitoring Efforts. To date, USMA has conducted surveys for odonates, butterflies, moths, molluscs, crayfish, and bats. One other survey to conduct on USMA lands is for raptors, as habitat conditions are favorable on both the reservation and Constitution Island. Several state-listed raptors have already been identified at West Point (Section 3.17).

5.8.4.2 Other Management Alternatives Considered

A more intensive approach to nongame species management was considered where management techniques similar to those described above were implemented on a larger scale. Under this alternative, more forest openings would be created, more nest boxes would be erected, the complete eradication of invasive species would be attempted, and a full-scale effort to plant native species would be undertaken. In the context of West Point's primary mission, this approach would not be feasible. In addition to its prohibitive cost, it is likely that some of the management techniques would interfere with the military mission by reducing the continuous forest cover required to provide realistic military training.(e.g., creation of numerous forest openings). Increasing the number or size of forest openings would also conflict with natural resource objectives for controlling the white-tailed deer population and ensuring adequate forest regeneration. Also, the military mission would likely inhibit the use of nest boxes by bluebirds and interfere with full-scale planting of native species in the training areas.

A highly-intensive, costly approach to management would not be necessary to maintain habitat on West Point suitable for a diverse assemblage of nongame species.

5.9 FISHERIES MANAGEMENT

Per AR 200-3, the fisheries management program on Army installations must provide for the management of the fish populations and their habitats consistent with accepted scientific principles, in compliance with the ESA and other applicable laws and regulations. The program will emphasize the maintenance and restoration of habitat favorable to the production of indigenous fish, particularly federally listed species protected under the ESA. In addition, the fisheries are to be managed to conserve both game and nongame species.

The goal of fisheries management at USMA is to provide quality recreational fishing opportunities for West Point anglers, while maintaining a balanced and diverse aquatic ecosystem. The best long-term approach, as well as the most efficient use of resources for achieving this goal, is to establish and maintain the biological integrity of the water bodies. Biological integrity is the ability to support and maintain "a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat of the region" (Karr and Dudley, 1981; Karr et al., 1986). The inability of water bodies to provide sustainable populations is often the result of habitat degradation, poor water quality, and overfishing.

Habitat protection and the availability of suitable habitat is essential for productive fisheries and the successful management of the fisheries (USEPA, 1993). The condition of the surrounding watershed has a significant role in determining the quality of the water and the physical habitat. The implementation of watershed management practices improves and protects the quality of the water resource, and, therefore, must be incorporated into the fisheries management program.

Inventorying and Monitoring. Inventorying and monitoring procedures are essential for collecting the data necessary to establish baseline conditions, and for measuring the performance and effectiveness of management measures already in place. The inventorying and monitoring procedures listed below evaluate the environmental parameters indicative of ecological integrity and include the integrity of the biological communities found in the water body; instream and riparian habitat quality, water quality, and an assessment of the overall condition of the watershed. Measures are also provided for determining the level of fishing pressure.

Implementing these measures will achieve the goal initially stated: to provide quality recreational fishing opportunities for West Point anglers by maintaining sustainable populations of fish by preventing or correcting habitat degradation, poor water quality, and overfishing.

Stocking and Transplants. The primary purpose of stocking is to provide fishing opportunities for species that are unable to sustain their populations through natural reproduction. The strategy applied at West Point is actually a combination of two individual strategies known as (1) put, grow and take and (2) put-and-take. The put, grow, and take strategy stocks fish of subharvestable size, anticipating that these fish will grow to harvestable size and survive in the water body for an extended period of time. The put-and-take strategy stocks fish of harvestable size in water bodies with significant fishing pressure where the fish are not expected to grow significantly before being caught, or in water bodies that will support the fish for only a limited period of time because of environmental conditions. An example of this latter situation occurs when trout are stocked during the summer or spring in a water body where they die during the summer because temperatures exceed their tolerance levels.

The combination of strategies involves stocking fish eight to nine inches in size, as well as trophy-sized individuals weighing at least 1.5 pounds. This meets the objective by providing large fish each year, while supplementing the current population to improve the long-term availability of larger-sized fish. Also, some of the brooks have suitable habitat for trout, but may not currently have a population of trout inhabiting the stream. Stocking in these

streams serves a two-fold purpose: (1) it provides stream trout fishing opportunities and (2) it provides the fish necessary to establish a naturally reproducing population.

The management measures in this INRMP are consistent with policies of the USFWS, which has placed a higher priority on habitat restoration aimed at creating ecosystems capable of producing self-sustainable populations of fish than on stocking. Long-term increases in fishing quality at relatively low costs are achieved more effectively by implementing habitat improvement and protection measures. Stocking is not cost effective unless the stocked fish have a reasonable chance of survival and suitable habitat is available.

The management approach outlined in this INRMP establishes a cost-effective management program by matching the management objectives with the uses that the natural condition of the water body can most readily support. Costs are controlled by enhancing or rehabilitating fish stocks by protecting and restoring habitat and water quality.

5.9.1 Management Measures

The fisheries management strategies for the streams, lakes, ponds, and reservoirs at USMA are designed to enhance the fishing opportunities for West Point anglers while promoting sustainable populations of the species most suitable for each water body. A primary component of the fisheries management program is monitoring. The monitoring methods used will be consistent among water body types (i.e., lakes/ponds and streams) and from year to year. This consistency allows the comparison of data among water bodies of a similar type, as well as the evaluation of temporal status and trends occurring for each water body. The inventorying and monitoring data will be evaluated frequently to ensure continued success of the program. Management measures that are not leading to the desired objective will be reevaluated to determine the corrective action needed to ensure success. Management measures that produce the desired results will be continued for as long as they are successful at meeting their objectives.

General Measures. General management measures have been developed for the overall fisheries management program. Some of these general measures are aimed at providing educational materials and increasing participation in the volunteer Angler Diary Program. Increased participation is this program is very important

because it generates quantitative data that are used to evaluate the fishing pressure and fish stocks in the various water bodies at West Point.

- Sample water bodies to inventory fish species present.
- Work with DCFA webmaster to enhance and update *An Angler's Guide to West Point Waters* found on the USMA website
- Maintain minimum size of 15 inches for bass on all waters except Wilkins Pond.
- Maintain the 18-inch minimum size, 1/day bag limit for walleye and the 12-inch minimum size, 5/day bag limit for channel catfish on all West Point waters.
- Maintain 3 fish bag limit for bass on all waters except Weyants Pond, Cranberry Pond, and Wilkins Pond.
- Maintain angler report boxes at all fishable waters.
- Continue limnological measurements (temp, DO, pH, conductivity, plankton samples) on all waters.
- Continue angler diary program on all West Point waters.
- Conduct habitat assessments on all perennial streams on the property.

Water Body-Specific Management Measures. In addition to the general management measures described above, management measures and inventorying and monitoring regimes required to meet the objectives for individual water bodies are provided below.

BULL POND

- Remove bass (largemouth and smallmouth) by electrofishing at least once per year to reduce competition with trout present.

- Continue stocking brown trout, brook trout, and trophy-size rainbow trout (14-16 inch) to provide recreational fishing opportunities. Emphasize brown trout to maximize holdover potential.

- Conduct population surveys every fourth or fifth year with gill nets, trap nets and electrofishing equipment to monitor fish population sizes and structure.

CRAGSTON LAKES

- Electrofish once every four-five years to assess the warmwater species population sizes and structures.

- Monitor the lakes for water chestnut and hand remove any plants found in lower Cragston. Continue efforts to remove water chestnut from the other three ponds.

- Assess lower Cragston for feasibility of chemical or mechanical control of Eurasian milfoil and other aquatic weeds.

- Conduct a biocontaminant assay of fish species to determine if leaching from the Cragston landfill is a problem.

CRANBERRY POND

- Electrofish once every four to five years to assess fish populations.

- Investigate improving the boat launch area for trailer boats.

- Maintain the one 15+-inch fish daily bag limit for bass.

- Survey ice fishermen to determine impacts on panfish and bass. If excessive, amend USMA Reg 215-5 to limit panfish harvests.

LAKE FREDERICK

- Electrofish once every 4-5 years to assess fish populations.

- Maintain 5 fish bag limit and 12-inch minimum size on channel catfish.

LAKE GEORGINA

- Continue investigations to determine why the dam continues to lose water. If a cause is found, determine corrective measures to take to raise the water level.

- Electrofish once to determine fish populations present.

LUSK RESERVOIR

- Continue stocking with 500 to 1,000 brook, brown, and rainbow trout each spring to provide angling opportunities. Shift emphasis to brown trout to increase holdovers.

- Continue to remove water chestnut plants as they are found.

MINE LAKE

- Electrofish to assess fish populations once every four to five years.

- If a large number of undersized bass are present, actively remove all fish under 12 inches in size to restructure the population.

- Investigate establishing a handicap fishing access point on the east shore.

POPOLOPEN LAKE

- Stock 1,000 walleye fingerlings every other year to provide a walleye angling opportunity. Maintain the one 18+ -inch fish daily bag limit for walleye.

- Investigate whether channel catfish are successfully spawning. If not, construct and place up to 12 artificial nesting boxes for channel catfish. Maintain the 5-fish bag limit and the 12-inch minimum size for channel catfish.

- Electrofish every four to five years to assess fish population structures and growth rates.

- Conduct a biocontaminant assay for copper sulfate in the substrate and in several fish species.

ROUND POND

- Continue stocking brook, brown, and rainbow trout to provide angling opportunities. Shift emphasis to brown trout to increase holdover potential.

- Electrofish every fourth or fifth year to assess fish populations and growth rates.

- Remove some bass by electrofishing each year to reduce competition with trout.

STILWELL LAKE

- Stock 1,000 walleye fingerlings every other year to provide a walleye fishery.

- Electrofish every fourth year to assess fish population structure and supplement angler diary information.

- Supplement bass recruitment with fish removed from Weyants, Wilkins, Bull, and Round Ponds.

- Monitor for water chestnut and remove all plants found.

- Investigate whether channel catfish are successfully spawning.

WEYANTS POND

- Electrofish for two days every other year to remove all bass under 12 inches in length.

- Maintain one 15+-inch bass per day bag limit.

- Monitor the effects triploid grass carp are having in controlling aquatic vegetation. Stock a supplemental number of grass carp (5 carp/acre) five years following first introduction to replace those lost to mortality and to maintain control.

- Monitor for water chestnut and remove all plants found.

WILKINS POND

- Electrofish for two days every other year to remove all bass under 12 inches in size. Remove bass between 12 and 14 inches if stockpiling occurs.

- Treat small sections with aquatic herbicides to control weed problems in accordance with NYS regulations.

- Avoid during treatment those sections near the outlet where the NY-listed threatened bladderwort species (*Utricularia radiata*) has been documented.

- Promote the quality panfish opportunity in Wilkins Pond.

- Maintain the one 20+ -inch bass/year size limit/bag limit.

POPOLOPEN BROOK

- Continue to stock no more than 350 brown trout and rainbow trout to provide a stream trout fishing experience. Stock the majority of the fish in the section downstream of the Weyants Pond Road bridge.

- Electrofish once every five years to assess fish populations.

- Plant shrubs and willows above the large sedge wetland and below the ford to shade and cool the stream.

- Place fencing around some willows to discourage beavers.

- Place some fallen trees along the brook in the sedge meadow section to provide cover and shade. Add deflectors, boulders etc. to increase habitat where it is deficient.

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.

HIGHLAND BROOK

- Continue to stock 100-200 brown trout each spring to provide stream trout fishing opportunities.

- Electrofish once every five years to assess fish populations.

- Survey the stream each fall to locate potential spawning sites. Take appropriate actions to protect those areas from degradation by sedimentation.

- Place three stream deflectors (fallen trees or small boulders) in the flat, open, shallow section downstream of the Range Road 2A bridge and upstream of the deep section by the dam at Range Road 1.

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.
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- Evaluate methods to improve angler access to the brook.

CROWS NEST BROOK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.

- Electrofish once every five years to assess fish populations.

TROUT BROOK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.
- Electrofish once every five years to assess fish populations.
- Conduct a fish habitat assessment survey.

MINERAL SPRINGS BROOK

- Electrofish once every five years to assess fish populations.
- Identify the key spawning locations for the trout so that appropriate actions can be taken to protect those areas.
- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.
- Conduct a fish habitat assessment survey.

QUEENSBORO BROOK

- Stock 100 brown trout each spring to provide additional stream trout fishing opportunities.
- Electrofish once every seven years determine holdover success and assess fish populations.
- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.

DEEP HOLLOW BROOK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.
- Electrofish once every five years to assess fish populations.
- Conduct a fish habitat assessment survey.

CRAGSTON CREEK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.
- Electrofish once every five years to assess fish populations.
- Conduct a fish habitat assessment survey.

JOHNSON MEADOW BROOK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.
- Electrofish once every five years to assess fish populations.

BROOKS HOLLOW BROOK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.
- Electrofish once every five years to assess fish populations.

HEMLOCK BROOK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.

KINSLEY FARM BROOK

- Determine external elements that are eliminating fish populations and investigate methods to improve fish habitat.

CASCADE BROOK

- Electrofish once every seven years to assess fish populations.

SINCLAIR POND BROOK

- Electrofish once every seven years to assess fish populations.

LONG POND CREEK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.

- Electrofish once every seven years to assess fish populations.

CAT HOLLOW BROOK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.

- Electrofish once every seven years to assess fish populations.

CRANBERRY BROOK

- Place a thermograph in the brook once every five years and let it run from 1 May to 1 November to monitor stream temperatures.

- Electrofish once every seven years to assess fish populations.

- Conduct a fish habitat survey. Investigate possible methods for increasing/improving fish habitat.

5.9.2 Other Management Alternatives Considered

A more intensive (and traditional) approach to fisheries management, in which management techniques focused on more intensive manipulation of the food chain, gamefish stocks, and increased levels of stocking was considered. Under this alternative, more intensive efforts and resources would be expended toward increasing the biomass of a relatively few species of game fish through manipulations of the fish stocks and the food chain (e.g., continued proliferation of prey species that have the potential to adversely affect zooplankton populations). In addition, fish would be stocked in water bodies that would support the fish on a temporary (seasonal) basis only.

This traditional approach to fisheries management is more costly, and less effective in the long-term than the approach presented above. Habitat improvement and protection measures are far more effective than intensive stock manipulations and stocking, and they have a higher probability of producing long-term improvements in the quality of recreational fishing at relatively low costs. Also, stocking fish regardless of the suitability of the habitat, the potential for long-term survival, and the impact on other fish species or biological communities inhabiting the water body is costly both economically and ecologically. Although historically fish for stocking could be received from USFWS hatcheries at little or no cost, this is no longer true. The USFWS has drastically reduced its hatchery program in favor of habitat restoration and protection programs and is no longer producing the number of fish it produced in the past. Many of the fish required for stocking would need to be purchased from private hatcheries.

A highly intensive and costly approach to fisheries management would not be necessary to maintain quality recreational fishing opportunities at West Point.

5.10 ENDANGERED, THREATENED, AND RARE SPECIES MANAGEMENT

The management goals for sensitive species management on West Point is to identify, protect, and preserve endangered, threatened, and rare species on the reservation in accordance with applicable laws and regulations and Army policy on responsible stewardship.

The ESA requires all federal agencies to conserve listed species. Conservation, as defined by the ESA, means the use of all methods and procedures necessary to bring any listed species to the point where protections pursuant to the ESA are no longer necessary. Section 7(a)(2) of the ESA requires Federal agencies to consult with the USFWS and NOAA Fisheries to ensure that they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Section 7 also establishes the requirement for Federal agencies to confer with USFWS and NOAA Fisheries on actions that may similarly affect proposed species and/or critical habitat. USMA will continue to coordinate and consult with the USFWS and NOAA Fisheries on any proposed project that may affect a Federally-listed or proposed species, and/or critical habitat.

On September 28, 1994, the Acting, Assistant Secretary of the Army (Civil Works) signed a Multi-agency Memorandum of Understanding (MOU) on Implementing the ESA. The purpose of the MOU was to establish a general framework for greater cooperation and participation among the agencies exercising their responsibilities under the ESA. The MOU states that the departments will work together to achieve the common goals of: (1) conserving listed species; (2) using existing Federal authorities and programs to further the purposes of the ESA; and (3) improving the efficiency and effectiveness of interagency consultations conducted pursuant to Section 7(a) of the ESA. Each signatory agreed to: (1) use its authorities to further the purposes of the ESA by carrying out programs for the conservation of federally listed species, including implementing appropriate recovery actions that are identified in recovery plans; (2) identify opportunities to conserve federally listed species and the ecosystems upon which they depend within existing programs and authorities; (3) determine whether its respective planning processes effectively help conserve threatened or endangered species; (4) use existing programs, or establish a program, to evaluate and reward the performance of personnel who are responsible for planning or implementing programs to conserve or recover listed species or the ecosystems on which they depend.

Army policy on listed species includes the following elements: balancing mission requirements with endangered species protection, cooperating with regulatory agencies, and conserving biological diversity within the context of the military mission. As required by AR 200-3, the Army must ensure that it carries out mission requirements in harmony with requirements of the ESA. All Army land uses, including military training, testing, timber harvesting, recreation, and grazing, are subject to ESA requirements for the protection of listed species and critical habitat. In fulfilling its conservation responsibilities, the Army is required to work closely and cooperatively with the USFWS and National Marine Fisheries Service (NMFS), the two federal agencies responsible for enforcing the Act. Installations are encouraged to engage in informal consultation with USFWS and NMFS during the planning of projects or activities to ensure ESA compliance. In conserving biological diversity, installation commanders and Army natural resource managers are required to develop and implement policies and strategies to maintain viable populations of native plants and animals, maintain natural genetic variability within and among populations, maintain functioning representations of the full spectrum of ecosystems and biological communities, and integrate human activities with the conservation of biological diversity.

AR 200-3 requires installations to prepare Endangered Species Management Plans (ESMPs) for each listed and proposed species and critical habitat present on the installation, including areas used by tenant organizations. Installations requiring more that one ESMP (i.e., more than one listed or proposed species present) are permitted to prepare a combined ESMP provided the combined plans satisfy the substantive requirements detailed in AR 200-3, Chapter 11-5(b)(3 and 4). Installation ESMPs must prescribe area specific measures necessary to meet the installation's conservation goals for the subject species and critical habitats (HQDA, 1995b). In March, 1995, the U.S. Army Environmental Center published the *Manual for the Preparation of Installation Endangered Species Management Plans* to provide a standard and comprehensive format for preparing ESMPs.

Species that are candidates for federal listing or are state-listed as threatened, endangered, or of special concern are not protected under the ESA. Because candidate species may be listed in the future, installations are required to avoid taking actions that result in the need to list candidates as threatened or endangered and are encouraged to participate in conservation agreements with the USFWS. Although not required, installations are encouraged to develop ESMPs for candidate species (HQDA, 1995b). At a minimum, installations are required to document the distribution of candidate species on the installation and monitor their status. For state-listed species, installations are encouraged to cooperate with state authorities in efforts to conserve these species.

Rare plants in the state of New York have been designated as such by the NYNHP based on the number of individuals of a particular species that are estimated to occur within the state (see Table 3-18 for rarity ranking definitions). On West Point, since the NYNHP ranking itself does not mandate protection and the legal protection under New York law does not prohibit plant disturbance by property owners, the protection and management of rare plants is viewed by the Army as a matter of responsible stewardship.

5.10.1 Management Measures

Sensitive species on West Point and specific management measures for them are provided below.

5.10.1.1 Bald Eagle

The federally threatened bald eagle (*Haliaeetus leucocephalus*) is considered a winter resident in the lower Hudson River valley (New York State Museum, 1994). All bald eagles encountered on USMA properties are considered part of this overwintering population. Sightings of bald eagles roosting and perching have been recorded by NRB all months of the year, with the most sightings occurring on Constitution Island (Figure 3-7). Other sightings have been in the vicinity of the Popolopen Brook drainage. Since January 1992, the greatest number of bald eagles seen on USMA at one time was nine on Constitution Island and seven on Popolopen Lake (Beemer, 2002, personal comm.).

No eagle nesting has been observed on West Point nor in the lower Hudson River Valley. Bald eagles in southeastern New York are known to locate their nests in large coniferous trees, between 10 and 180 feet above the ground, near large water bodies that are undisturbed by human presence (Ehrlich et al., 1988). Bald eagles require isolation from humans during the breeding season in order to reproduce successfully. These conditions are more prevalent on Constitution Island than on the main reservation.

In January 1996, West Point initiated a joint-monitoring effort with NYSDEC's Endangered Species Unit to survey wintering bald eagles in the lower Hudson River valley and vicinity (McGowan and Nye, 1996). Specific objectives of the study are to document the distribution of eagles during the winter season (November to March), identify critical habitat areas, and document eagle use of the West Point reservation and vicinity. During the first three months of the survey, 96 bald eagle observations were made in the West Point section of the study area

(consisting of USMA and the immediately surrounding area). Constitution Island and the North Crows Nest site were identified to be important day-perch areas. Constitution Island was further identified to support a high bald eagle use—36 observations were made during 10 full-day and three half-day survey periods. There have been more than 700 bald eagle sightings since the survey began in 1996.

In response to the Biological Survey results mentioned above, West Point developed an endangered species management plan (ESMP) for bald eagles found on USMA property (Beemer, 2001c; see Appendix J). As a result of this study, West Point developed specific management actions in the plan include the following:

- From 1 December to 31 March, survey Constitution Island and likely areas of the WPMR for bald eagle day usage. The survey will be conducted once per week with the following information recorded: number of eagles seen; ages of eagles seen (adult vs. immature); location of sightings; and, activity eagles engaged in when sighted. Monitor identified and likely winter nighttime roosts for activity at least two days/week. Develop and execute contract to monitor the Crown Ridge roost for activity, dependent on contractor and funding availability.

- The USMA Caretaker assigned to Constitution Island will be notified of the location of the winter daytime perch trees so that maintenance activities do not disturb or harm them. The Caretaker will also be provided data sheets and be solicited for all bald eagle sightings on the island at all times of the year. Should it be found that bald eagles have commenced nesting on the island, all human activity within 200 meters of the nest site will be prohibited and USMA will initiate formal consultation with USFWS and NYSDEC to determine what other actions are necessary.

- Notices will be placed on the Post e-mail bulletin boards, in the *Post Bulletin* and in the Post newspaper *The Pointer View*, soliciting all eagle sightings by any member of the West Point community. Said notices will be placed in November and April.

- Memorandum will be sent to the Commander, 2nd Aviation Detachment NLT 15 November regarding restrictions on helicopter flights over WPMR and Constitution Island between 1 December and 31 March.

- Develop an information sheet or card for helicopter pilots in the 2nd Aviation Detachment so that they can properly identify bald eagles (both adults and subadults) from other birds of prey.

- Review all USMA construction projects and other proposed Federal activities at the USMA for potential impacts to bald eagles. If no adverse impacts, or only potentially beneficial impacts to bald eagles are likely to exist as a result of the project or activity, then initiate informal consultation with USFWS in accordance with Section 7 of ESA to clarify the USMA's position. If adverse impacts may exist should the USMA action be taken, then initiate formal consultation with USFWS in accordance with Section 7 of ESA. Should bald eagles be de-listed by the federal government, USMA will continue to coordinate with the USFWS with regards to the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

- Review, update and modify (if necessary) the ESMP each year based on information obtained from the monitoring program.

In addition to continuing the implementation of these management actions, large evergreen trees around Stilwell Lake are protected from harvest or other disturbance to allow for potential roosting and/or nesting activity.

If it is found that bald eagles have commenced nesting on the island, Section 7 formal consultation with the USFWS would be required to prevent any disturbance to the eagles. It is likely that all human activities within 200 meters (approximately 660 feet) of the nest site would be prohibited during the nesting season.

Study data from the 1996-2001 survey period are being compiled and analyzed. Findings of this monitoring effort will be used to protect habitat used by overwintering eagles from disturbances associated with training and other natural resource management activities, as well as to modify and finalize the draft management plan.

5.10.1.2 Golden Eagle, Peregrine Falcon, Least Bittern, Pied Billed Grebe

Four other bird species documented at USMA are listed as endangered or threatened by New York State – the golden eagle, peregrine falcon, least bittern and pied-billed grebe.

Golden Eagle. The golden eagle (*Aquila chrysaetos*) is a state-endangered visitor to West Point. Its habitat

includes open country, prairies, tundra, open coniferous forest, barren areas, and eastern deciduous mountain forests, and it nests 10 to 100 feet from the ground on cliffs and in trees (Ehrlich et al., 1988). Golden eagle sightings on West Point are usually one or two immature birds seen a couple of days each winter, with an adult bird seen only on rare occasions. Since this species has only been rarely sighted on USMA property, with no evidence of nesting activity, no management actions are proposed.

Peregrine Falcon. The peregrine falcon (*Falco peregrinus*), a state endangered species, is a historical resident of West Point, and suitable habitat, open wetlands near cliffs, still exists in the vicinity. Individuals birds have been observed by NRB staff soaring over the WPMR. In 1995, NYSDEC monitored an active peregrine falcon nest located on Breakneck Ridge, just 3 miles north of West Point. Nesting activity has also been observed on both Bear Mountain and Newburgh-Beacon Bridges. The Crows Nest area will be monitored annually for peregrine falcons.

Least Bittern. The least bittern (*Ixobrynchus exilis*), a state threatened species, has been observed in the marsh on the northeastern part of Constitution Island. This species is a breeding resident of the adjoining Constitution Marsh, where more favorable habitat is located. No breeding by least bitterns has been documented on Constitution Island by USMA to date, but the marsh will be monitored annually to document any least bittern activity.

Pied-billed Grebe. The pied-billed grebe (*Podilymbus podiceps*), a state threatened species, has been observed during summer months on some of USMA's lakes and pond including Mine Lake, Weyants Pond, Brooks Hollow Marsh and Cranberry Pond. No adult has been observed with nestlings nor have pairs of grebes been observed in late spring. Therefore, active breeding is not presumed at this point. Sites where grebes have been observed in the past will continue to be monitored each spring to see if breeding pairs are present or if successful nesting has occurred.

5.10.1.3 Indiana Bat

In 1993, eight or nine Indiana bats (*Myotis sodalis*), a federally endangered species, were observed by the post biologist at the rear (in a chamber) of Zints Mine, an abandoned iron ore mine located north of Deep Hollow (Gannon and Sherwin, 2001). In addition, a single Indiana bat was caught during a bat survey conducted on the

reservation between September 1999 and September 2000. Acoustic sampling of bat call sequences during the survey also suggest that this species might be more prevalent on the installation than is indicated by the netting results.

A survey for Indiana bats following USFWS protocols was conducted in 2002 at USMA by the New York Natural Heritage Program. Twenty sites on USMA were surveyed. No Indiana bats were caught during this effort. As a result, the Indiana bat is considered to be a visitor to USMA properties at this time. A follow-up survey at USMA for Indiana bats is planned for 2007 and will also include some additional survey sites in forest interiors away from stream corridors. Because Indiana bats were observed in Zints Mine on one occasion, USMA will install a bat gate over the Zints Mine opening to prevent human disturbance to any hibernating bats using the mine. USMA will coordinate the installation of the gate with USFWS and NYSDEC.

5.10.1.4 Timber Rattlesnake

The timber rattlesnake (*Crotalus horridus*) is classified as threatened by NYSDEC. It has a state ranking of S3, indicating 21 to 100 occurrences within New York State (New York State Museum, 1994). The rattlesnake's diet consists mostly of small mammals such as rodents and small rabbits. It inhabits heavily wooded terrain and hibernates in dens located on wooded or partially wooded rocky hillsides with southern exposure (Conant and Collins, 1991).

C. horridus is one of only two species of *Crotalus* found east of the Mississippi River. It is a locally common species of the timbered mountains of the east, though it has been completely extirpated in many areas where it once was numerous. Within or immediately adjacent to the peripheral boundary of West Point, five extant and one extirpated populations have been identified. In the fall of 1993, a 3-year telemetry study was initiated to determine occurrence, population sizes, age classes, home range parameters, and causes of attrition to the three extant populations (Stechert, 1995 and 1996). The field season for the final year of data collection ended in the fall of 1996. Dens of the extant populations are referred to in the study by their NYSDEC designation. Results of the study reveal moderate to significant degrees of reduction in population size to two dens. Den O-6 was heavily poached in the 1960s and early 1970s and has never fully recovered. It appears that the few remaining adult females in the population rely on males from Den O-32 (located 1 kilometer north of Den O-6) and Den O-5 (in adjacent Harriman State Park) for reproduction. Den O-32 supports a depleted, but still viable, colony of

rattlesnakes. At the time of study, four adult males and six gravid females were known to be reproducing in this population. Den O-31 appears to be the least affected by human-incurred mortality. Age classes are well represented in this population, and sex ratios approach 50:50. Age class distributions within the three populations are shown in Figure 5-7.

West Point is currently involved in a 10-year timber rattlesnake recovery (also known as population augmentation) effort in cooperation with the Palisades Interstate Park Commission. As part of this effort, gravid females are removed from their dens and placed in an incubator until their young are born. In late fall, just before hibernation occurs, the young snakes are moved to one of the dens containing a severely-depleted population. Objectives of the annual survey efforts of the augmentation program include 1) monitoring the survivorship and growth of introduced rattlesnakes released as neonates in 1995, 1996, and 1997; 2) identifying significant habitat (basking and foraging areas) used by these snakes and native individuals; 3) outlining the parameters of their summer range; and 4) safeguarding the apparently growing population from dens 0-6 and 0-32 against illegal collecting or killing (Stechert, 2001). Survey results strongly indicate that Deep Hollow is a genetic mixing area for adult male and female rattlesnakes from all three dens.

According to Stechert (1996), causes of attrition to West Point timber rattlesnake populations can be attributed to two primary sources. First is road mortality, which seems to be the greatest threat to rattlesnakes during their seasonal activities. Several reports of road-killed rattlesnakes are on record with the NRB. A secondary cause of attrition, and one that is poorly documented, is incidental mortality from hunters and military personnel in the southern quadrant of the reservation. In addition to snake viscera found in areas of known rattlesnake occurrence and known training activities, conversations with military personnel in 1994 and 1995 and reported sightings near Camp Natural Bridge, Bull Pond, and Lake Georgina support the notion that some military-induced mortality occurred prior to 1995 (Stechert, 1995, 1996). During summer cadet training in 2001, a cadet was observed killing a yellow adult rattlesnake on the west side of Deep Hollow, apparently east of, and between dens 0-32 and 0-6 (Stechert, 2001).

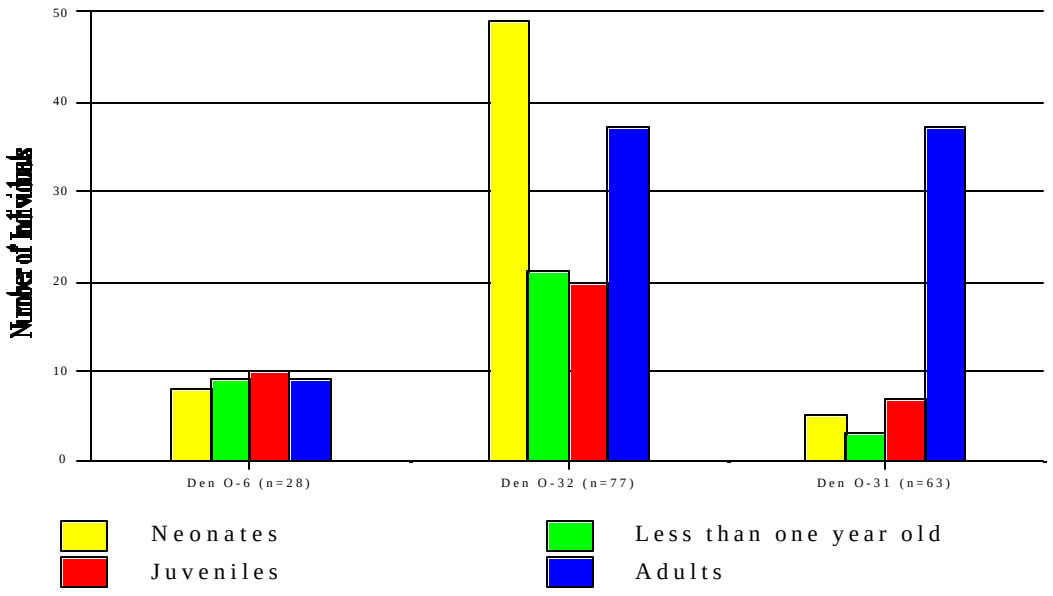


Figure 5-7. Age Class Distributions Within Three *Crotalus horridus* Populations: 1994–2001

Training maneuvers by visiting troops, as well as spring turkey and small game hunting, bring more people in close proximity to the rattlesnakes. In addition to being killed during human encounters, rattlesnakes are sensitive to disturbances and typically will not inhabit an area with high human activity.

In response to preliminary results of the study, the training area boundary was modified in 1994 to reduce the potential for disturbance to the rattlesnakes during critical life stages. Approximately 100 acres is marked off as a training exclusion area. To continue timber rattlesnake protection, all training activities in and around rattlesnake critical habitat, especially the areas designated as Training Exclusions Areas, will continue to be prohibited to prevent human-rattlesnake confrontations. Additional signs will be posted, if needed, indicating the presence of sensitive areas and a flyer distributed to the West Point community explaining the protected status and retiring nature of the species to help alleviate the potentially dangerous misconceptions held by many people. The closure of Range Road 14A will continue indefinitely.

Maintaining the existence of West Point's rattlesnake colonies will require military cooperation. Conversations with military personnel suggest that properly informed individuals exhibit more cautious interest and less irrational aggression toward the snakes (Stechert, 1996). To this end, it has been suggested that explanation of the ongoing

timber rattlesnake research be provided to troops in training and also that the troops and their commanding officers be asked to carefully observe and report any rattlesnakes they encounter.

5.10.1.5 Shortnose Sturgeon

A management plan for the federally endangered shortnose sturgeon (*Acipenser brevirostrum*) was developed for the section of the Hudson River adjacent to USMA (See Appendix K). As stated in the plan, all actions potentially involving dredging, filling, or other anthropogenic disturbance will be reviewed by NYSDEC and the NMFS and evaluated for potential effects to the sturgeon. The plan allows sturgeon researchers to access the Hudson River from USMA property.

5.10.1.6 State Species of Special Concern

There are 15 species listed as Special Concern by New York that are residents or breeders on West Point and Constitution Island. They include five reptile species (eastern wormsnake, spotted turtle, wood turtle, eastern box turtle, eastern hognose snake), two species of amphibians (Jefferson salamander and marbled salamander), one mammal species (small-footed myotis – *Myotis leibii*), and seven species of birds (Cooper's hawk, sharp-shinned hawk, red-shouldered hawk, American bittern, whip-poor-will, cerulean warbler, and golden-winged warbler).

Spotted turtles (*Clemmys guttata*) have been documented at 15 locations at USMA and are generally stable populations. Wood turtles are limited in the stream characteristics needed for winter hibernacula and so far only three locations have been identified that meet these criteria – Deep Hollow Brook, Popolopen Brook and Highland Brook. Eastern box turtles have been found at many locations on the reservation but important habitat components have not been identified as yet for this species. The eastern hognose snake and the eastern wormsnake tend to be secretive at USMA and any sightings will continue to be documented. Both salamander species are dependent on vernal pools and pools they are known to use will be closely monitored.

The small-footed myotis individuals were all lactating females captured in Special Natural Areas – Cat Hollow, Mineral Springs Brook, and Constitution Island. The protection afforded these areas will serve to protect this bat species.

The planned raptor survey will provide additional information on the status of Cooper's hawk, sharp-shinned hawk, red-shouldered hawk, and osprey at USMA. A nesting platform for ospreys was erected on Wilkins Pond in 1997, but has been shown no interest by any potential breeding birds. Cooper's hawks will continue to be surveyed as part of the *Birds in the Forested Landscapes* project (formerly Project Tanager).

Protecting wetlands will continue to provide suitable habitat for the American bittern and forest openings benefit whip-poor-wills on Long Mountain and in Deep Hollow. The golden-winged warbler survives near open wetlands at USMA (Popolopen Brook Marsh), but is facing potential "genetic swamping" from a sympatric species, the blue-winged warbler. Maintenance of open wetland and shrubby areas should continue to benefit this species.

The cerulean warbler is currently being reviewed by USFWS for possible listing under the ESA. The 1997-1998 survey conducted by the USGS Biological Survey confirmed four cerulean warbler nests with potential nesting at 16 other sites. The tall, mature forests on dry upland slopes at West Point are a habitat type different than the bottomland forests that support the greatest numbers of cerulean warblers in other parts of the country (Cornell Laboratory of Ornithology's Cerulean Warbler Atlas Project Report, 2000). USMA's forest management practice of selective cutting insures that sufficient super-canopy trees this species prefers for nesting will be maintained and the species should continue to thrive at USMA.

One potential threat to the cerulean warbler is the brown-headed cowbird (*Molothrus ater*), which acts as a nest parasite to many passerine species. A study was initiated in 1997 to survey the distribution and density of both the cerulean warbler and brown-headed cowbird populations (Dawson, 1998). Long-term monitoring of changes in both population will follow.

If monitoring data reveal any of these sensitive species to be in an imperiled state at West Point, a conservation and management plan will be developed. In the meantime, individuals' locations will be mapped and maintained as a GIS database. The maps will be provided to military trainers and other program managers so that disturbance to these species is minimized or avoided completely.

5.10.1.7 Rare Invertebrates

Invertebrate surveys of USMA identified the presence of several rare species (see Section 3.18). Locations will be mapped and maintained on a GIS database to aid in formulating habitat protection measures. Additional surveying and monitoring efforts will be conducted probably no more often than every five years to determine changes in population status. The database will be updated as additional surveys are conducted.

5.10.1.8 Rare Plants

The long-standing approach to protecting and managing rare species on a species-by-species basis has, in many instances, proven impractical and ineffective. More current methods involve management on the community or guild level and a focus on maintaining ecosystem functions as a means to protect species. On West Point, for example, most rare plants are dependent upon specific habitats for their survival, including grasslands and savannas, mature deciduous forests, wetlands, fire break margins, and talus slopes.

Barbour's 1994 survey of rare plants on USMA, discussed in Section 3.18, indicated the presence of 63 special status plant species, including 11 species with historical reportings (see Table 3-19). Some of these species, or groups of species, are believed to be restricted to specific habitats, as 10 species are found only in rich woodlands, 9 in ponds and streams, 7 in swamps or marshes, 3 in estuarine wetlands, 2 in burned areas, and 3 in "northern" woods (cool sites with some boreal species, such as the Bull Hill Grotto) (Barbour, 1996). Seventeen species were found in disturbed sites, revealing that rare plants are not always found in pristine habitats. Disturbed areas on the reservation containing rare plants included roadsides (Carey's smartweed, dwarf plantain), cut-and-fill areas (fragrant cyperus), openings (purple milkweed, racemed knotweed, wild flax), scraped roadbanks (yellow harlequin, dittany), mowed fields and lawns (slender crabgrass, bush's sedge, Georgia bulrush), a horse corral (pigmy starwort), and burned hilltops (cluster sedge, Standley's goosefoot, slender knotweed, yellow harlequin).

For plants in both disturbed and undisturbed terrestrial habitats, some general management strategies are followed. Rare species in these areas will be monitored periodically for changes in number, density, and ground coverage and for changes in ecological conditions. Data on plant locations will be maintained in a GIS database, which is updated to incorporate the latest monitoring information.

The 2002 West Point rare plant management plan (Deschenes, 2002a; Appendix H) provides management measures for each rare species occurrence. In addition to general monitoring and record keeping, the plan calls for a variety of management measures based on specific circumstances. These measures include checking proposed installation activities against rare plant locales, protecting vulnerable plants from fire, notifying certain site managers of the presence of rare plants, constructing passive barriers, maintaining habitat conditions, and transplanting and seed banking. The plan will be updated from periodic survey findings.

5.10.2 Other Management Alternatives Considered

Since protection of federally listed species is mandated by federal law and protection of state-listed and rare species is required by Army regulation, other management alternatives that would have afforded less protection to these species were not considered. Also, the absolute restriction of training operations in all areas supporting a rare or state-listed species was disregarded as a viable management alternative since support of the military mission is the primary function of USMA property. Rare and state-listed species can be well managed and protected by knowing exactly where they are (i.e., having current monitoring data) and planning training activities in space and time accordingly. For example, if a sensitive raptor is nesting in a particular area on the reservation, training can be limited there during the nesting season but allowed at other times of the year. If, in the following year, nesting is not occurring in the same location, training activities will not be restricted.

5.11 AGRICULTURAL/GRAZING OUTLEASES

There are no areas on USMA suitable for agriculture or grazing; therefore, agricultural and grazing outleases have never been granted. This status is not expected to change.

5.12 PEST MANAGEMENT

The following discussion is a brief overview of the USMA pest management program, which is described in full in the USMA Pest Management Plan (USMA, 1997). Table 5-8 lists the major target pests by group and order of importance. Pest management objectives at USMA include the control of potential disease vectors or

Table 5-8
Major Target Pests at USMA

Disease Vectors and Medically Important Arthropods	**Ornamental Plant and Turf Pests (cont.)**
American Dog Tick	Fall webworms
Black-legged Tick	Bagworms
Lone Star Tick	Scale insects
Mosquitoes	Fungal pests (Anthracnose) and diseases
Bees and Wasps	White grubs
Rats and Mice	Billbugs
Raccoons	Weevils
Skunks	**Undesirable Vegetation (see Section 5.5)**
Bats	Poison Ivy
Birds (Pigeons, Starlings, House sparrows, Nuisance Canada geese)	Dandelions
	Crabgrass
Real Property Pests (Structural/Wood Destroying)	**Vertebrate Pests**
Subterranean termites	Skunks
Carpenter ants	Woodchucks
Carpenter bees	Opossums
Powder post beetles	Raccoons
Stored Product Pests	Snakes
Saw-toothed grain beetles	Squirrels
Red flour beetles	Stray cats and dogs
Carpet beetles	Nuisance Canada geese
Dermestids	**Household and Nuisance Pests**
Rats and mice	Crawling insects (ants, cockroaches, crickets, ground beetles, earwigs, centipedes, millipedes, silverfish)
Pest birds	
Ornamental Plant and Turf Pests	Blackflies
Tent caterpillar	Filth flies
Gypsy moth	Fleas

Source: USMA, 1997.

animals of other medical importance, protection of real estate, control of undesirable or nuisance plants and animals (including insects), and prevention of damage to natural resources.

The USMA pest management program, operated by DHPW, practices IPM. This method of pest management involves four primary control strategies—mechanical and physical control (physical removal or exclusion of pests), cultural control (altering the environment to make it less suitable or attractive to the pest), biological control (use of other organisms that control the pest), and chemical control (use of pesticides).

5.12.1 Management Measures

Pest control strategies at West Point follow the principles of integrated pest management described above. These

principles are equally applicable to minor and common pest problems such as turfgrass weed control and to major and specialized problems such as the control of gypsy moths. The management measures for controlling pests at USMA are provided below.

Control of Potential Disease Vectors or Animals of Other Medical Importance. The control of potential disease vectors or animals of other medical importance is important for the protection of human life and well-being. Animals that carry diseases or can cause other medical problems are attracted to human dwellings in search of food and shelter or egg-laying sites, or they might be transported to human dwellings by people themselves or by other animals. Transmission of disease to humans is passive, and nondisease medical problems (e.g., bites and stings) are the result of an animal's need for food or self-protection.

Flies are attracted to human dwellings by odors in their search for food and organic materials on which to lay eggs. Cockroaches establish themselves in human dwellings in search of food and shelter. Fleas are transported to human dwellings by other animals and might establish themselves in carpeting or furniture if a continuing source of food (i.e., blood) is available. Birds might seek nesting sites in protected locations on the outside of buildings and occasionally in protected locations inside buildings, and their nests can harbor disease-carrying organisms. All of these types of animals, while they themselves are not harmful to humans, can potentially transmit diseases to humans. Their establishment in human dwellings or in close proximity to humans must, therefore, be prevented or controlled to the extent that the likelihood of disease transmission is very small.

Ticks attach themselves to humans when the latter pass through vegetation where the ticks are located. Human blood is a source of food to the ticks. Ticks that carry disease-causing organisms internally can pass the organisms directly to humans through their bites. Rodents and bats can carry diseases internally and pass them to humans through bites that might occur if the animals are disturbed or threatened. Rodent nests and rodent and bat feces can also harbor other disease-carrying organisms or disease vectors.

Bees and wasps that nest on or near human dwellings, a few spiders, and snakes will sting or bite humans when disturbed or threatened. Generally, these injuries are only painful and do not cause long-term problems, though some individuals might be sensitive to the stings of certain insects and the bites of poisonous snakes can be dangerous.

Pest management activities at USMA to control these animals are necessary to prevent the outbreak and spread of disease at the installation since disease can lower the well-being and morale of installation personnel and a serious outbreak would hinder accomplishment of the military mission at USMA. Management measures to control pest posing a potential threat to human health include:

- Ensure proper sanitation and housekeeping to remove the food sources of interior pests that are attracted to foodstuffs (e.g., cockroaches, ants, flies).
- Practice proper personal hygiene, wear proper clothing, and wear repellants to reduce or eliminate problems associated with sucking insects (ticks, mosquitoes).
- Remove the excrement of bats and birds from underneath their roosts to prevent the growth of harmful bacteria.
- Remove nests of birds that are located on buildings.
- Eliminate artificial breeding and larval habitat for flies and mosquitoes.
- Destroy the nests of bees and wasps whose locations present a hazard to people.
- Use tick control products on pets regularly to reduce their occurrence indoors and prior to applying tick control chemicals to carpets or upholstery.
- Apply insecticides for the control of ticks, mosquitoes, and ants for large infestations.

Protection of Real Estate. Protection of real estate from damage requires that animals (including insects) that seek refuge or other life necessities within human dwellings in a manner that causes damage to structures be controlled or prevented from entering the dwellings. Animals seek refuge inside human dwellings because the dwellings can provide warmth, protection from the elements, or materials or locations for nest building.

Many animals are attracted to human dwellings, but those that enter them and cause damage at USMA are not

numerous. They include termites, carpenter ants, rodents, and powder post beetles. Termites are the primary structural pest at USMA. The wooden structures at USMA provide termites with a source of food and shelter, and if uncontrolled, their infestations can cause serious damage to and weakening of wood-framed structures. Carpenter ants might also seek shelter within the wood of wood-framed structures at USMA, which can also damage and weaken them if the ants are not controlled. Powder post beetles have been occasional pests in wooden structures at USMA. Rodents (i.e., rats and mice) can cause damage to structures and fixtures within buildings at USMA in their search for food, nesting materials or sites, warmth, or shelter. They can gain entry through small openings, but often enlarge these openings to suit their needs. They also use materials found within human dwellings, such as insulation, for nesting material, and gnaw on loose or obstructive objects, such as electrical wiring or the outside corners of structures, in an effort to make their surroundings more suitable to themselves. The odors from their feces and urine can also be damaging to structures. Pest management at USMA must include control of these animals to prevent serious structural damage. Methods that can be used to prevent the destruction of the structures at USMA include:

- Prevent the entry of pests into buildings by closing holes, cracks, and crevices; replacing torn or missing window screens; and adjusting doors that do not close tightly.

- Keep the perimeters of buildings free of tall or dense vegetation.

- Apply tracking powder or other poisons to eliminate rodents that have established themselves in building interiors.

Control of Undesirable or Nuisance Plants and Animals (including insects). Animals that are nuisances when in human dwellings are controlled to make the dwellings more enjoyable to inhabit, but these animals generally do not pose any real threat to humans. Spiders; ants; earwigs; crickets; and stray bees, wasps, or hornets that gain entry to dwellings can be nuisances. Moths or beetles might create a nuisance if they establish themselves in stored food products, and some species can damage fabrics. Birds that nest on dwellings or that search for food in the materials of dwellings (i.e., woodpeckers) are sometimes a nuisance. Stray dogs and cats, nonpoisonous snakes, woodchucks, skunks, and raccoons can become nuisances if they become accustomed to the presence of humans or to finding food near human dwellings, cause damage to grounds around dwellings, or gain entrance to dwellings.

Some animals mostly constitute a nuisance but have the potential to cause other problems, such as structural damage or the spread of disease. These animals include cockroaches, flies, fleas, some ants, rodents, and bats. The problems associated with these animals are discussed elsewhere in this section.

Most animals that are no more than nuisances only need to be controlled when their presence is substantial enough that they affect morale or the comfort of dwellings, or they present a potential danger to installation personnel. Their presence might be seasonal, and they can generally be controlled on a case-by-case basis. A plan for their control is generally not necessary. AR 420-76 (*Pest Management*) prohibits installation personnel from conducting pest control operations for pests that constitute only a nuisance unless such control is included in a MACOM PMC-approved installation pest management plan.

Nuisance plants include undesirable weedy plants on grounds that are unsightly, herbaceous or woody plants in locations where they could lead to mechanical problems (e.g., near power lines), and plants in areas that need to be relatively free of vegetation for fire control purposes. Plants that exude irritating substances (e.g., poison ivy) are also nuisances where they occur in areas frequented by humans.

General management measures that will be used to control nuisance pests include:

- Capture individual large animals (e.g., woodchucks, skunks) for destruction.

- Actively discourage Canada geese from Round Pond, Lake Frederick, the West Point Golf Course and areas of the Main Post.

- Use snap traps and glue boards to trap rodents.

- Properly fertilize turf to encourage the growth and strength of desirable plants and to reduce the growth of weeds.

- Apply herbicides for the control of weeds and aquatic weeds when they interfere with other management objectives (e.g., fire suppression) or they are too numerous for mechanical control methods.

- Place pesticide baits along the paths of ants and cockroaches.

Prevention of Damage to Natural Resources. Prevention of damage to natural resources is an important objective of pest management at USMA. Fortunately, pest problems of this nature are not a major pest management concern at the installation. Natural resource damage can result from infestations of damaging insects or insect larvae, from overgrowths of vegetation where other natural resource management concerns demand their removal, and from invasions of exotic plant species that displace natural vegetation.

Insects that can damage natural resources at USMA include pests of ornamental plants and turf. Ornamental plants can be infested by the larval stages of insects that voraciously consume their foliage and construct nests in the foliage in a manner that can kill entire sections of the affected plant. Insects that cause this type of damage include the fall webworm (*Hyphantria cunea*) and the eastern tent caterpillar (*Malacosoma americanum*). Ornamental plants can also become infested with sucking insects, such as scale insects and aphids, that deprive the plants of strength to the point that they are weakened and might die. The larval stage of June beetles are white grubs that live in the soil and feed on the roots of grasses and other plants and can cause serious damage if they become abundant.

An insect of particular concern to the health of natural resources at USMA is the gypsy moth (*Lymantria dispar*), the larvae of which can affect, and has affected to a significant degree in the past, large areas of forest on the reservation. The physical presence of the gypsy moth in large numbers and the resulting defoliation cause a significant decrease in the realism of military training, and USMA has in past years conducted gypsy moth suppression activities in support of the military mission.

Section 5 of the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. § 2101) authorizes the Secretary of Agriculture to protect forests from insects and diseases. USFS has the delegated responsibility for carrying out the provisions of the Cooperative Forestry Assistance Act on forest lands in cooperation with federal land managing agencies. Under the Act, USFS provides technical assistance and funding to meet specific pest management project objectives:

- Provide foliage protection.
- Reduce specific insect and disease populations.

- Reduce risk of artificial spread to uninfested areas.
- Prevent tree mortality.

A Memorandum of Agreement between USDA and DoD, signed 11 December 1990, for the Conduct of Forest Insect and Disease Suppression on Lands Administered by DoD is in effect. USMA continues to have a longstanding partnership with USFS for cooperative assistance for gypsy moth management. Following a 1987 suppression effort (aerial spray of 600 acres), gypsy moth population levels remained low, apparently due in large part to the presence of the entomopathogenic fungus, *Entomophaga maimaiga*. In 2002, however, the potential of defoliation by a large gypsy moth population required a control effort. Based on information from a USFS Biological Evaluation, USMA contracted for the aerial spray of a biological insecticide over 652 acres of forested training land in a successful effort to prevent defoliation. The predominantly oak forests of USMA are very susceptible to damage by gypsy moth, so the insect continues to periodically pose a threat to the forest and the training mission. USFS continues to provide technical assistance, including population monitoring, surveys, biological evaluations, trends, and projected damage, for the control of gypsy moths.

Another insect of concern on the reservation is the hemlock woolly adelgid, an aphid-like insect that can form severe infestations on hemlock trees if left unchecked. Appearance of the insect and population increases in the early 1990s, leading to heavy hemlock mortality on the main post and some mortality on the reservation, have given way to fluctuating population levels in recent years. A USFS evaluation in 1998 concluded that the heavy presence of wooly adelgid in USMA eastern hemlock stands could not be significantly reduced by the introduction of a beetle that has shown promise for adelgid control in some situations. Monitoring for this insect will continue.

Aquatic plants can become a problem in the lakes and ponds on the West Point property. The problem associated with aquatic plants is generally one of overgrowth such that use of the lakes or ponds is hindered, and control on a case-by-case basis is appropriate. An exotic aquatic plant native to Eurasia, water chestnut (*Trapa natans*), has established a large population in Upper Cragston Lake and small populations in several other lakes on the reservation. (Refer to Section 5.5.1 for detailed discussion of aquatic weeds.)

Exotic species of plants are not a major problem at USMA, but are significant enough (and increasing) that management actions are required. Invasive plant species that occur on the reservation include purple loosestrife (*Lythrum salicaria*), a native of Eurasia, Japanese barberry (*Berberis thunbergii*), Ailanthus (*Ailanthus altissima*),

and Japanese stilt grass (*Microstegium vimineum*). Purple loosestrife now occurs in 47 states in the US, tolerates a wide range of environmental conditions, and produces large quantities of seeds. Its occurrence on reservation wetlands is increasing. Disturbance of the plant often favors its spread through seed distribution and stem and root segment propagation (USDOI, 1997).

Japanese barberry is a native to Japan and is used as an ornamental shrub. It is thorny and can form dense thickets, which can interfere with training operations on the reservation. Because of its thorns, it is not readily browsed by deer, so it can out compete native species that are browsed back by deer. It propagates itself by seed and by means of extensive rhizome systems. Ailanthus, commonly referred to as tree-of-heaven, is an Asian deciduous tree that spreads by underground and seed propagation. It grows very rapidly and once established can be extremely difficult to eradicate. Japanese stilt grass is common along range roads throughout the reservation. (Refer to Sections 5.5.2, 5.5.3, and 5.5.4 for detailed discussions on invasive species in riparian, wetlands, and terrestrial habitats, respectively.)

Management measures for the control of pests at USMA include the following:

- Per AR 200-5 (*Pest Management*), only DoD trained and certified personnel are to apply pesticides, unless pest management is conducted under contract by persons trained and certified by an USEPA-approved program.

- Pest management operations will be planned and conducted to minimize or eliminate adverse environmental effects.

- Applications of pesticides by air will be conducted per AR 200-5. Any aerial spray operation will require completion of a formal biological assessment and will require completion of an EA under NEPA.

- Conduct regular (weekly, monthly, annual) inspections to assess the need for pest control measures. Inspect vegetation for signs of infestation, buildings for points of entry, and buildings and grounds for conditions that promote pest occurrence. Conduct special surveys for the presence and spread of invasive exotic species.

5.12.2 Other Management Alternatives Considered

Two other management alternatives for pest management were considered: (1) less intensive management, and (2) more intensive management. The pest management measures currently in use at USMA, and as described in the IPM Plan are relatively moderate in intensity. Lowering that intensity further would not provide sufficient control of invasive species (e.g., Japanese barberry) and destructive insects (e.g., gypsy moths, hemlock woolly adelgid), which would create a potential for those species to adversely impact the condition of the training lands. More intensive pest management measures would result in increased usage of pesticides. This would be counter to the Army's goal of reducing pesticide usage. More intensive pest management measures would be more expensive and would be beyond the requirements to adequately protect health and property. Therefore, a more intensive management approach was dismissed.

5.13 FIRE MANAGEMENT

Wildfire prevention and control is a matter of concern for military training and natural resources management at USMA. Wildfires have several undesirable aspects: they interfere with ongoing training activities, they may make training areas unsuitable for training over the short- or long-term, they produce smoke which contributes to air pollution and brings complaints from neighbors, they have direct and indirect impacts on habitats and species and they lead to soil erosion when the vegetative cover is sufficiently destroyed, as occasionally occurs on the thin-soiled ridgetops at USMA. There are positive aspects to wildfire from an ecological standpoint (see below), but they are normally outweighed by the negative aspects at USMA, so the general policy is to suppress wildfires when they occur. Wildfire prevention and control involves reducing the frequency of wildfires and suppressing and containing the spread of wildfires that do occur.

The USMA Engineer, through the USMA Fire Chief, is responsible for wildfire prevention and control procedures. Primarily, fire control strategies and actual fire suppression are conducted by the Fire and Emergency Services Division (FESD); however, a mutual aid agreement with Orange County provides for assistance between FESD and nearby local community fire departments when needed. In addition, local fire departments in Highland Falls and elsewhere provide standby capacity for fire fighting, if necessary. The NRB is responsible for implementing a fire danger monitoring system, providing advice and assistance in suppression, determining potential threats to protected species and habitats during actual fire events, and mapping wildfires for inclusion in the GIS.

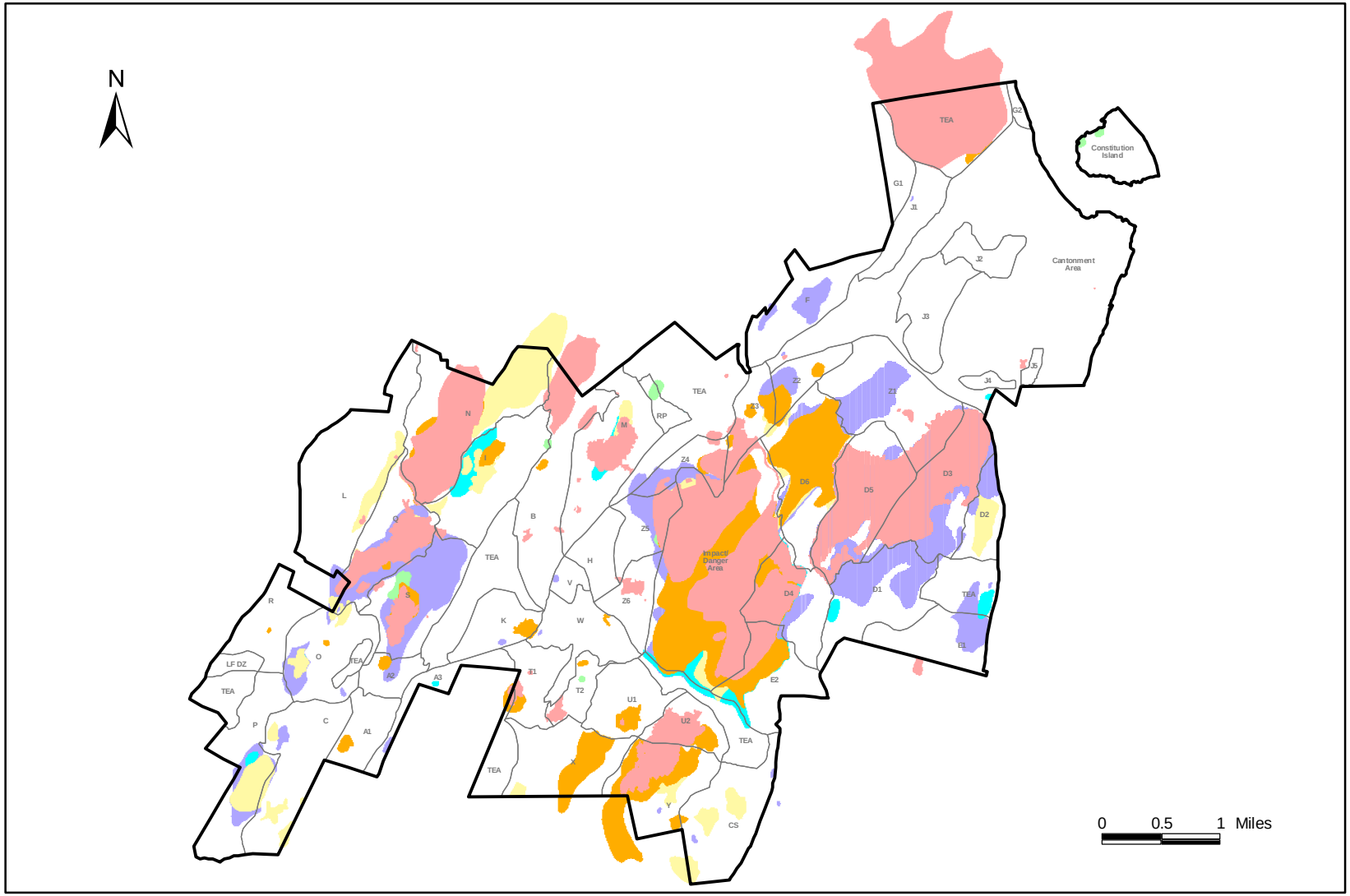
From an ecological perspective, wildfire is beneficial to many wildlife species because it encourages new vegetation growth and enhances habitat diversity. Fires are also necessary for some plant species to regenerate, including the pitch pine, which is located on the reservation. In addition, some of the rare plants at West Point appear to be depend on recently burned areas for their survival. Burning is known to benefit aspen stands, an important species to ruffed grouse (*Bonasa umbellus*) and various passerine species, by encouraging the growth of root suckers. Areas that have been burned from forest fires since 1950, are shown in Figure 5-8.

In 2000, the Center for Ecological Management of Military Lands (Colorado State University), conducted a study of the fuel inventory and relative risk of wildfire on the reservation (CEMML, 2000). The study provided an initial assessment of the size, type, location and amount of fuels that are found throughout the reservation, and identified areas that have high risk of burning in the immediate future. A field sampling program measured in situ fuel loading and a GIS analysis was then performed, using the field data and other geographic information to assess relative fire risk. Figure 5-9 illustrates the distribution of relative risk of fire on the reservation.

5.13.1 Management Measures

Virtually all wildfires at West Point are accidental and occur from the use of pyrotechnics during training activities. The complete prevention of wildfires is impossible without significantly restricting the military mission during the fire season (normally from May through October). However, there are a number of measures that can be taken to minimize the number, the extent and the effects of wildfires. These measures include monitoring fire danger conditions, implementing fire reporting procedures, fire-related training restrictions, firebreak maintenance, controlled burning, and establishing fire suppression procedures. These management measures are discussed in the following sections.

Fire-Related Training Restrictions. The USMA Engineer has recommended restrictions on the use of certain munitions and pyrotechnic device for wildfire prevention. These restrictions have been incorporated into the Range Regulation and will be imposed according to existing fire danger conditions (see Table 5-9 for these



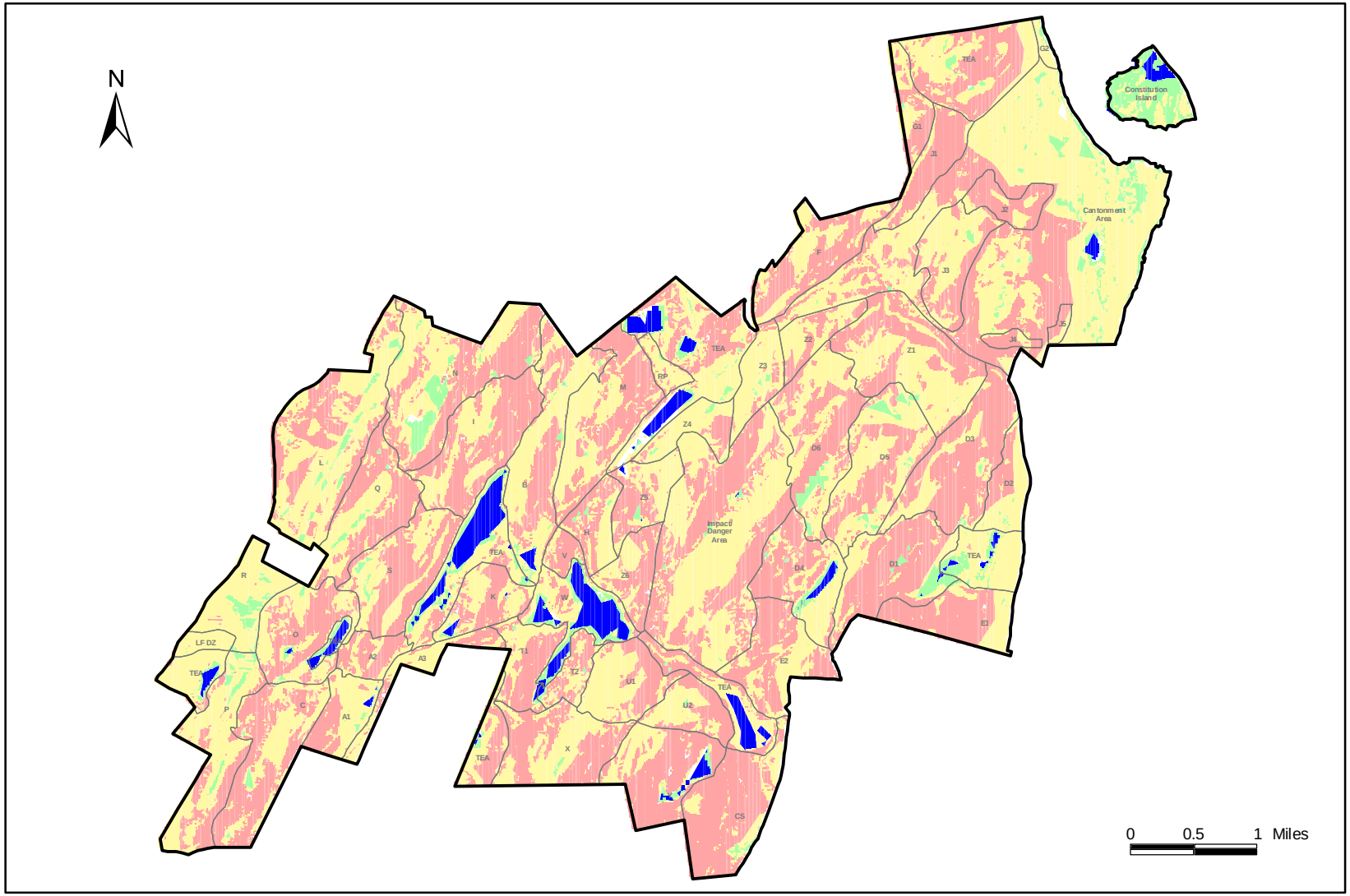
LEGEND

Year of Fire

- 1951-1959
- 1960-1969
- 1970-1979
- 1980-1989
- 1990-1995
- 1997-2002
- Installation Boundary
- Training Area Boundary

Forest Fires

United States Military Academy
West Point, New York
Figure 5-8



LEGEND

Degree of Risk

- High
- Medium
- Low
- Water
- Installation Boundary
- Training Area Boundary

Potential Forest Fire Risk

United States Military Academy
West Point, New York
Figure 5-9

Table 5-9
Pyrotechnic Fire Hazard Use Restrictions

Action	Green	Blue	Yellow	Orange**	Red**
No restrictions	•	•	•		
No parachute flares or star clusters			❍	•	•
No ground flares			❍	•	•
No smoke pots*			❍	•	•
No smoke grenades			❍	•	•
No demolition			❍	•	•

• = Indicates applicable restrictions, if any
❍ = Use permitted but exercise caution when using
* = These pyrotechnics can be used during all burn index categories except red if they are ignited and extinguished in a controlled burn pit.
** = Ranges are limited to ball ammo only under burn index categories orange and red.

restrictions). The USMA Engineer and Range Control have developed suitable restrictions to be imposed during the hunting seasons.

Firebreaks. The unimproved roads on the reservation that serve as firebreaks will be maintained annually to preserve their effectiveness. Large areas without firebreaks, and areas particularly prone to wildfires, will be evaluated to determine the need for establishing new firebreaks, and if necessary, the location of those firebreaks. Unnecessary firebreaks and those particularly prone to erosion will be considered for closure.

Fuel Load Sampling and Monitoring Program. A fuel load sampling program was initiated during the 2000 study by CEMML and further data collection efforts will increase the accuracy of the prediction map. The CEMML study indicated that the next step towards mitigating wildfires is to manage the fuels that are present and to develop a comprehensive fuels management program that will benefit training and protect the public.

Controlled Burning. Reducing the fuel load through controlled burning helps to prevent fires from starting, decreases the intensity of fires that do get started, and helps to inhibit the spread of wildfires. The Natural

Resources Office, in conjunction with FESD, will determine areas particularly susceptible to summer wildfires (including areas adjacent to where pyrotechnics are used) and evaluate the need for controlled burning. Potential negative effects of controlled burning, particularly damage to forest regeneration, will be evaluated in any consideration of burning. Controlled burning has not been used at USMA in recent years, largely due to the adverse effects on air quality and community relations, and significant controlled burning is unlikely in the future.

Wildfire Suppression. As mentioned previously, nearly all of the fires at West Point result from the use of pyrotechnics during training. Weather conditions will be monitored continuously at the permanent fire weather monitoring site during the fire season (i.e., May through September) and Range Control will be notified of fire danger conditions so the necessary training restrictions can be imposed. Woodland fires that threaten life or property will be extinguished as quickly as possible. The person(s) that first notice the fire will attempt to control and extinguish it, however, if this is not feasible, the fire will be contained to the extent possible and FESD will be notified immediately. Personnel out on the training areas will be adequately trained in fire prevention and reporting procedures.

5.13.2 Other Management Alternatives Considered

Fire management measures proposed for the USMA reservation are those minimally required for effective fire management. Other management alternatives that require more or less aggressive fire management were considered, but rejected. Because accidental fires result from the use of pytrotechnics during training, the more intensive alternative would involve increasing the restrictions on the use of pyrotechnics or eliminating their use altogether. This management strategy would place an unacceptable level of restriction on training activities and the military mission, therefore, it was rejected. The less intensive alternative would allow wildfires to burn unabated. Although this alternative may have ecological benefits, unchecked wildfires may also have negative ecological effects, and may potentially destroy much of the vegetation that provides the natural conditions necessary for realistic military training. Unchecked wildfires could potentially leave large tracts of training areas unsuitable for training. In addition, the threat these fires could pose to the surrounding communities, and the adverse effects of smoke, would be unacceptable, therefore, this alternative was also rejected.

The management strategy that will be implemented is appropriate for a number of reasons: (1) it provides a reasonable amount of protection by restricting pyrotechnics in accordance to environmental conditions and the

probability of accidental fires occurring during their use, (2) when accidental fires do occur, they are suppressed as rapidly as possible to protect the natural resources necessary for realistic military training, and (3) the management strategy complies with USMA Regulation 385-11, Range and Training Complex Regulation.

5.14 CANTONMENT AREA MANAGEMENT

As mentioned in Section 1.1, the scope of this INRMP focuses primarily on the military reservation because its purpose is to insure the sustainability of the desired military training area conditions necessary to support the mission. The cantonment area consists of 2,520 acres of developed land on the Main Post where the academic, residential, administrative, supply and storage, medical and support facilities are located. Only limited, low-intensity military field training normally occurs in the cantonment area.

Management of the natural elements of the cantonment area is conducted by DHPW and consists of grounds maintenance, urban plant management, deer management, turf management, and tree and shrub management. Annual management plans for urban plants, turf, and trees and shrubs are developed by EMD and completed by outside contractors.

Standards for the design of the communities on the Main Post are described in the *United States Military Academy Installation Design Guide.* These standards have been established to provide a "visually cohesive, attractive installation" with an "attractive well designed environment" (Design Collaborative, Inc. et al., n.d.). The guide also includes restrictions on building materials and architecture, transportation (roadways, bicycle paths, and pedestrian walkways), lighting, landscaping, parks, playgrounds, and playing fields, signage, fences, access, maintenance, and utilities (Design Collaborative, Inc. et al., n.d.).

Natural resources management issues that apply to the cantonment area are addressed in their respective resource areas within Section 5.0. For example, the abundance of white-tailed deer represent a significant nuisance on the Main Post. They browse landscaped shrubs and flower gardens and cause a number of vehicular accidents each year. The management measures for controlling the deer population on the Main Post are described in detail in Section 5.8.1.4. Measures to be implemented for the control and management of pests on the Main Post are described in Section 5.12.

5.15 MONITORING

The monitoring measures described in Section 5.0 of this INRMP will be implemented consistent with the implementation of other management measures using an ecosystem management approach. The monitoring program that USMA has established, in accordance with this INRMP, will be implemented on a "before and after" basis to determine the effectiveness of the management actions. Monitoring potentially tracks the effects of USMA's management activities, of natural processes (such as plant succession), and external factors (climate change, acid deposition, the spread of invasive species, etc.). Monitoring activities will involve the following actions:

- Establish a baseline data set and determine the baseline conditions for each resource area (e.g., water quality, aquatic macroinvertebrates, and habitat assessment).

- Using the baseline data, establish and maintain GIS databases for all available attributes.

- Track the status and trends of the attributes and determine whether the management activities are achieving the desired objectives.

USMA has been conducting biosurveys for aquatic macroinvertebrates and habitat assessments both to detect aquatic life impairments and to assess the relative condition of the aquatic habitats and their communities. USMA intends to use the results of the biosurveys to evaluate the effectiveness of management activities, and within a planning and management framework to prioritize water quality problems for more stringent assessments and to document "environmental recovery" following control actions and rehabilitation activities.

The inventorying and monitoring measures that have been incorporated into USMA's INRMP are being used to monitor the temporal and spatial dynamics of the ecosystems. The monitoring programs generate the necessary data to develop baseline conditions and to determine whether the implemented management measures and strategies are effective in achieving their intended goals and objectives. Changes in resource management can be implemented on an as-needed basis after a thorough evaluation of the data.

The results of these monitoring efforts will be used in an adaptive management framework to make changes, if necessary, to the management activities to ensure that the objectives of the NRB are being successfully achieved in a manner consistent with the goals of the INRMP.

5.16 INTEGRATION OF MANAGEMENT MEASURES

As previously stated in Section 5.1, the goal of the INRMP for the USMA is to ensure that the natural resources located on the reservation are managed in such a way as to provide the optimum environment which sustains the military mission and provides the conditions required for realistic training. The management measures in this INRMP have been developed to successfully achieve the stated objectives necessary to meet this goal.

The overlap of similar management measures for different resource areas is indicative of the relationship that various components of an ecosystem have with one another. The need for integrated natural resources management is evident by the complexity of these relationships. For example, the watersheds on the reservation are, for the most part, forested and provide the continuous cover required to support the military mission. In addition to being essential for the military mission, the condition of the forests directly influence the quality of wildlife habitat and, therefore, the condition and diversity of wildlife inhabiting the reservation. The condition of the forested watersheds also directly influences water quality, the condition of the fisheries, and sensitive habitats, such as the numerous wetlands, vernal pools, and riparian areas located on USMA property. These habitats are necessary to maintain or to increase the biodiversity at USMA. Managing the forests using an ecosystem approach will maintain, protect, and enhance the natural resources. Furthermore, the results from screening level watershed and habitat assessments serve as indicators to the overall condition of the natural resources. Degraded watershed and habitat conditions will result in loss of ecological integrity and biodiversity. Soil stabilization and revegetation LRAM projects conducted under the ITAM program ultimately improve the habitat conditions on a small scale and watershed conditions on a larger scale. The effects from these types of improvements are far more reaching than the particular area in which they are performed. Soil stabilization and revegetation stops erosion, decreases sediment loads to streams, lakes, and wetlands and ultimately improves the habitat for the biological communities, including fish, inhabiting those waterbodies. Soil stabilization and revegetation also creates or improves habitat conditions for terrestrial wildlife species.

Selected management measures useful for facilitating the integration and implementation of resource-specific

management measures are outlined below.

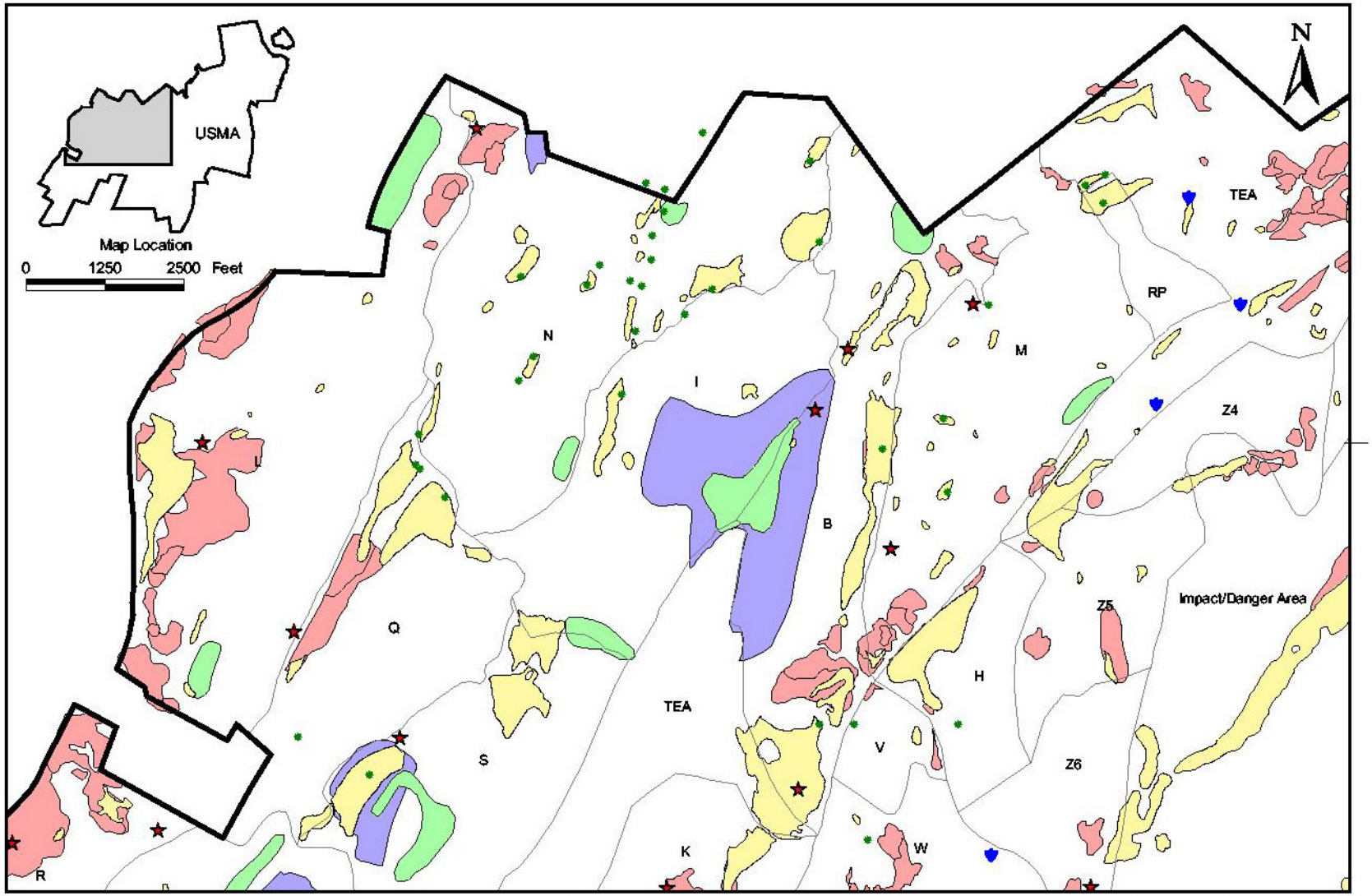
Data Collection and Analysis. Complete integration of natural resources data facilitates the comprehensive analyses of the complex relationships between ecosystem components. The data collections provide a portion of the data necessary for these analyses, and therefore are a vital component of the natural resources management program. This program is planned to continue through and beyond the five year scope of this INRMP.

Utilization of Imaging Tools. Using a Global Positioning System (GPS) will improve the accuracy of the data collections, and the use of infra-red aerial photography, satellite imagery, and imaging processing software will significantly enhance the evaluation and integration process.

Update GIS Coverages. GIS databases and map coverages for all natural resources will be updated as the data becomes available.

Development of Training Maps. GIS coverages are used to develop detailed maps that indicate areas within the training lands that are relatively sensitive to training impacts. These maps are developed by compositing GIS coverages such as critical habitat; sensitive species; ecological preserves; wetlands and vernal pools; riparian, floodplain, wetland, vernal pool and water resource buffer zones; steep slopes and highly erodible soils; rare plants; threatened and endangered species; and locations of cultural and archeological resources (see Figures 5-10 through 5-12 as examples). The maps are provided to military trainers to increase their awareness of the areas to avoid, if possible, or to minimize activity and the level of disturbance resulting from training. The composited maps may also be translated into more general training guides to simplify their application in the field and to minimize the release of sensitive natural resources data (e.g., location of dens, nesting sites) (Figure 5-13).

Environmental Awareness. The Environmental Awareness (EA) element of the ITAM program is very useful and needs to continue informing users of the training areas of the natural and cultural resources located throughout the reservation. Steps taken toward avoiding or minimizing the potential for impacts to occur greatly reduces the future costs and efforts necessary to rehabilitate areas once they become degraded. Under

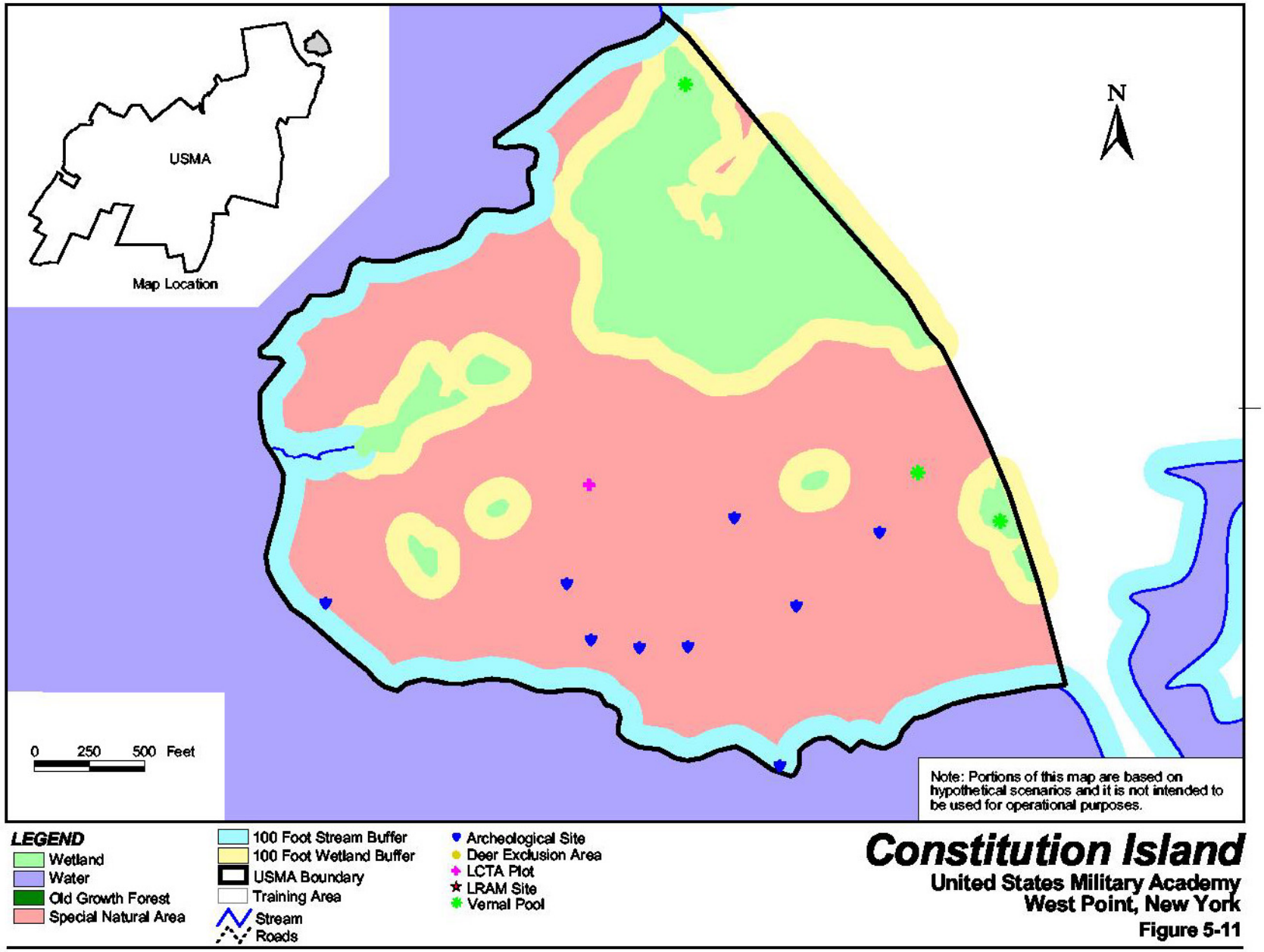


LEGEND

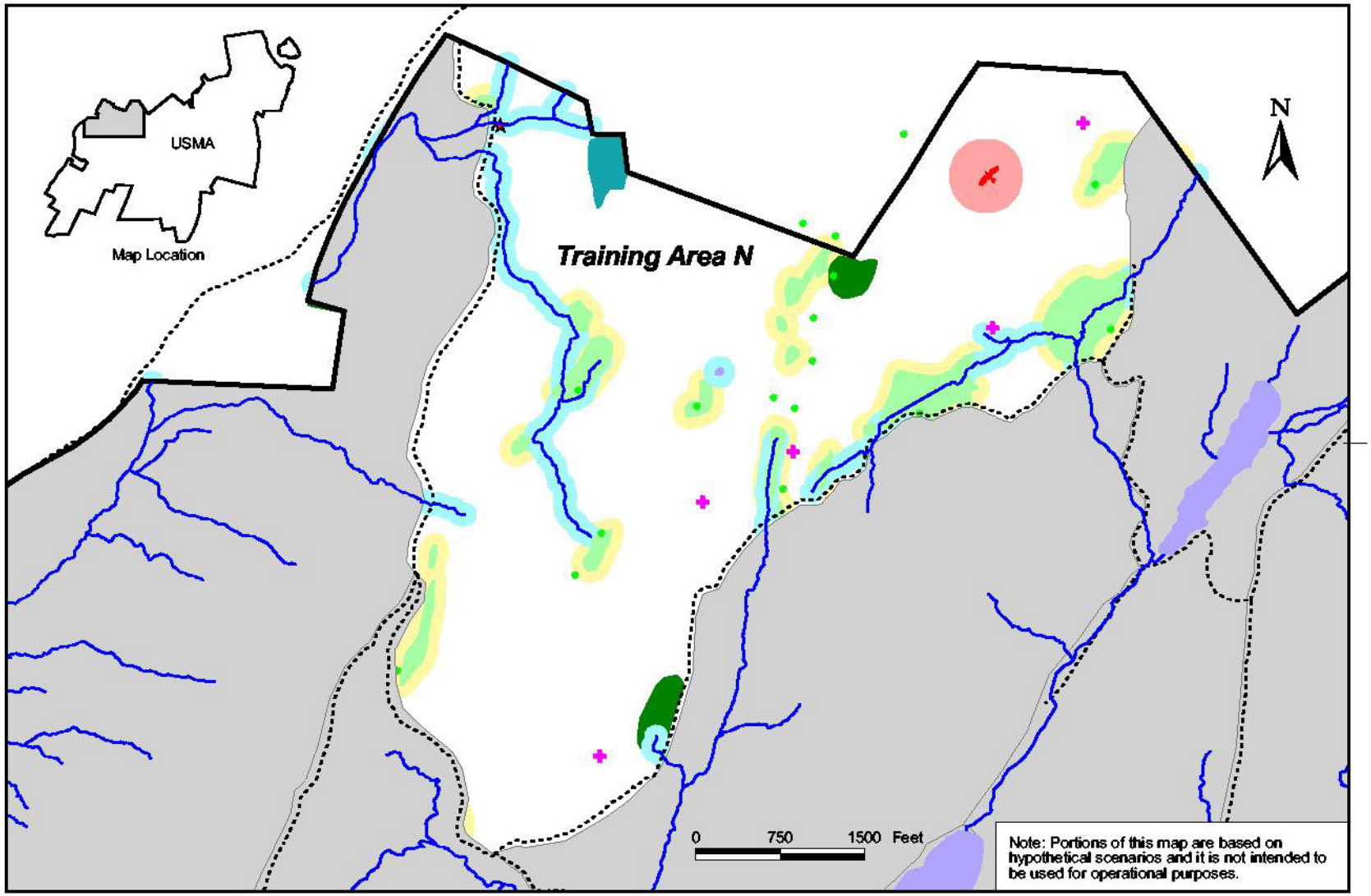
- Wetland
- Old Growth Forest
- Ecological Reserve
- Barberry Plot
- Y Training Area
- Vernal Pool
- Archeological Site
- LRAM Site
- USMA Boundary

Training Area Summary - Northwest

United States Military Academy
West Point, New York
Figure 5-10



Constitution Island
United States Military Academy
West Point, New York
Figure 5-11



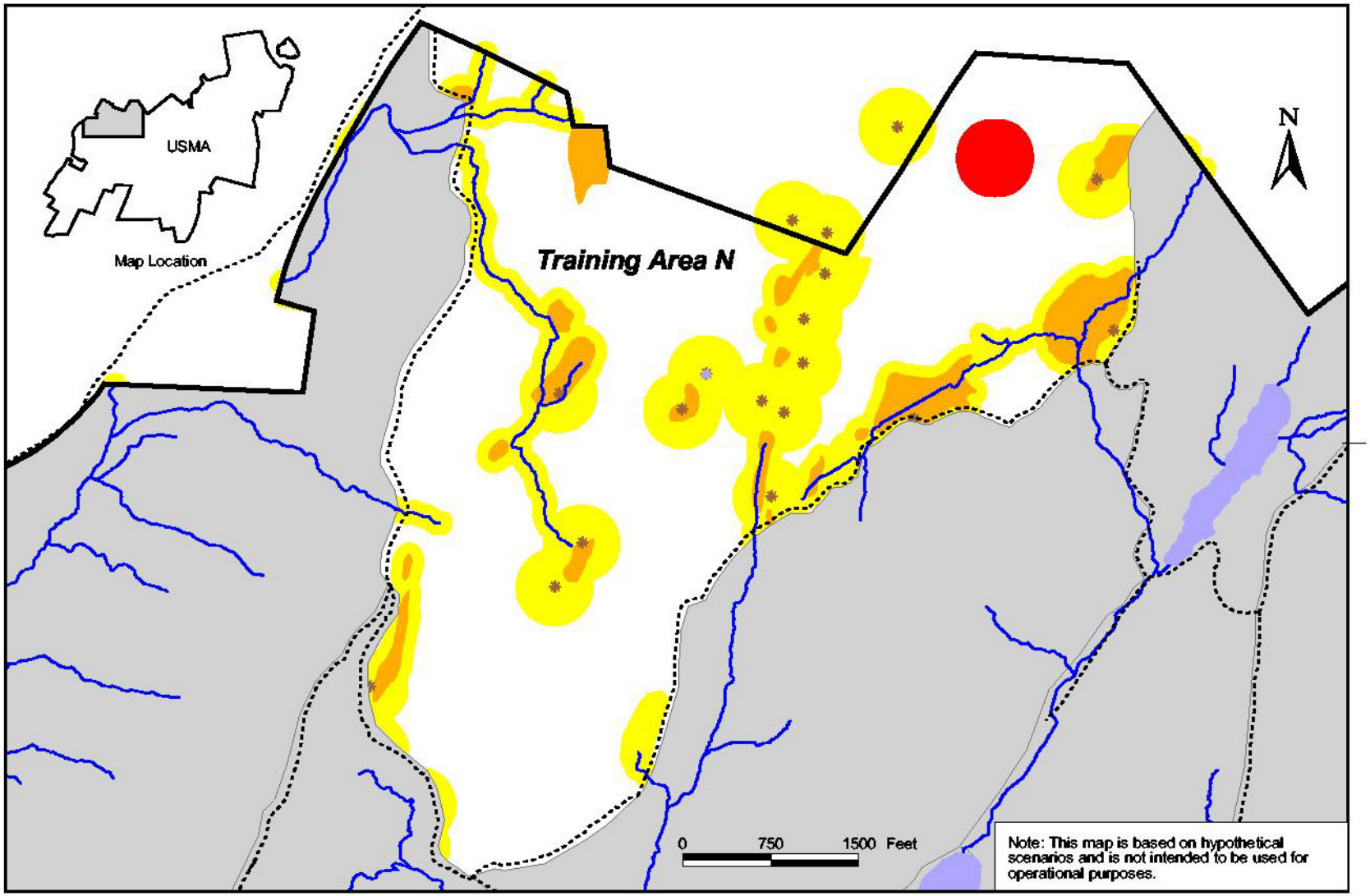
LEGEND

- Wetland
- Lake
- Old Growth Forest
- Special Natural Area
- 100 Foot Stream Buffer
- 100 Foot Wetland Buffer
- USMA Boundary
- Training Area Boundary
- Stream
- Road
- Archeological Site
- Deer Exclusion Area
- LCTA Plot
- LRAM Site
- Vernal Pool
- Hypothetical Raptor Nest and Buffer Zone

Sample of Training Area N

United States Military Academy
West Point, New York

Figure 5-12



LEGEND

Training Limitations

- No Limitations
- Limit Activity
- Avoid When Possible
- No Intrusion Between May and July
- USMA Boundary
- Training Area Boundary
- Stream
- Roads

Training Limitations

United States Military Academy
West Point, New York

Figure 5-13

the EA program, outreach and training materials will continue to be updated and developed. These materials includes posters, handbooks, presentations, the EA video, the USMA Soldier Card, and the Leader Handbook.

Enforcement Education and Training. To ensure enforcement of laws and regulations pertaining to natural resources, there is a need for natural resources law enforcement education and training for USMA law enforcement officials. In addition, consultation and coordination between the Provost Marshall's Office and the NRB needs to continue in order to evaluate and update procedures as the need arises.

5.17 SUMMARY OF MANAGEMENT MEASURES

An annotative summary of resource-specific management measures are presented in Table 5-10. Selected management measures that pertain to multiple resources (e.g., forestry, terrestrial habitat, and small game) are presented in each resource section so that a complete set of resource management measures are present for each section. General management measures that cut across all resource areas, as outlined in the section above, are also presented in Table 5-10. Table 5-10 also includes all resource management measures pertaining to inventorying and monitoring under each resource area as appropriate. However, to facilitate an evaluation of inventorying and monitoring efforts, a separate list of inventorying and monitoring activities are presented in Table 5-11.

SECTION 6.0:
IMPLEMENTATION OF THE INRMP

6.1 ORGANIZATION, ROLES, AND RESPONSIBILITIES

The ecosystem approach described in this INRMP to manage the natural resources of USMA can be implemented by the Academy's existing organization. The Natural Resources Branch of Environmental Management Division has the primary role and responsibility for the implementation of this INRMP. No changes of organization are expected, or necessary, to implement this INRMP. There exists the possibility that the Natural Resources function at USMA, along with most DHPW functions, will undergo formal study for outsourcing. It is expected that the study will begin in 2003.

6.2 MANPOWER

6.2.1 Staffing

USMA currently has the core staff of professionally trained natural resources management personnel necessary to implement this INRMP. The personnel that currently constitute the natural resources management staff at USMA are listed in Table 6-1.

Additional sources of temporary labor, include seasonal employees, Oak Ridge Institute for Science and Education (ORISE) participants, and outside agency reimbursable assistance. However, the core, permanent natural resources management professionals currently in-house provide the foundation and fulfill the supervisory roles necessary to continue the successful natural resources program at the USMA.

Table 6-1
USMA Natural Resources Management Staff

Number	Position	Status
1	Natural Resources Manager	Full-time, permanent
1	Fishery and Wildlife Biologist	Full-time, permanent
1	Forestry Technician	Full-time, permanent
1	Natural Resources Specialist	Contract

The current exception to this is the area of natural resources law enforcement, where USMA staffing is not completely adequate and is under study.

6.2.2 Outside Assistance

Implementation of a number of the projects discussed in this INRMP will require active outside assistance. This outside assistance, which is described as needed in Sections 1.0 and 5.0, will come from state and federal agencies, private consortiums and organizations, universities, contractors, and skilled volunteers. Using these resources is the most efficient and cost-effective method for acquiring expertise on a temporary basis. Some of the parties will be reimbursed for their assistance, as agreed based on Memoranda of Understanding and contractual agreements, whereas others will supply their assistance in accordance with cooperative agreements.

6.3 PROJECT/PROGRAM PRIORITIES

USMA considers funding for the preparation and implementation of this INRMP, as required by the Sikes Act, and the associated NEPA analysis and documentation to be a high priority. However, the reality is that not all of the projects and programs identified in this INRMP will receive immediate funding. As such, these programs and projects have been placed into three priority-based categories: 1) high priority projects; 2) important projects; and 3) projects of lesser importance. The prioritization of the projects is based on need, and need is based on a project's importance in moving the natural resources management program closer towards successfully achieving its goal. The time frame during which these projects are to occur is provided in parenthesis following the project description.

6.3.1 High-Priority Projects

- Implement ecosystem principles in managing natural resources at USMA. (FY 03-07)
- Continue to implement ITAM program. (FY 03-07)
- Continue to use the LRAM program to repair degraded areas. (FY 03-07)

- Continue to implement the Environmental Awareness program, including updating outreach and training materials (e.g., posters, handbooks, presentations, environmental awareness video, USMA Soldier Card, and Leader Handbook). (FY 03-07)

- Collect and analyze LCTA data. (FY 03-07)

- Update GIS coverages for all natural resource areas as necessary. (FY 03-07)

- Develop and provide users of training areas with detailed maps indicating sensitive areas. These maps will be developed by compositing GIS coverages of vital habitat; sensitive species; ecological preserves; wetlands and vernal pools; riparian, wetland, vernal pool and water resource buffer zones; steep slopes and highly erodible soils; rare plants; threatened and endangered species; and locations of cultural and archeological resources. (FY 03-07)

- Implement soil resources management measures. (FY 03-07)

- Implement water resources management measures. (FY 03-07)

- Monitor surface water quality. (FY 03-07)

- Conduct habitat assessments for all water bodies at USMA. (FY 03-07)

- Implement aquatic habitat management measures. (FY 03-07)

- Implement riparian management measures. (FY 03-07)

- Implement riparian zone restoration projects for areas identified in surveys. (FY 03-07)

- Maintain protective vegetative buffer zones around streams, lakes, ponds, wetlands and vernal pools. (FY 03-07)

- Implement wetlands (including vernal pools) management measures. (FY 03-07)
- Implement terrestrial habitat management measures. (FY 03-07)
- Implement forest management measures. (FY 03–07)
- Develop and implement a Forest Regulation Plan. (FY 03-07)
- Protect Special Natural Areas. (FY 03-07)
- Implement wildlife management measures. (FY 03-07)
- Implement fisheries management measures (FY 03-07)
- Monitor bald eagle activity on the reservation and Constitution Island. (FY 03-07)
- Continue timber rattlesnake (Crotalus horridus) recovery and monitoring program. (FY 03-07)
- Implement pest management measures. (FY 03-07)
- Continue efforts to eliminate and/or control terrestrial and aquatic invasive species (FY 03-07)
- Implement fire management measures. (FY 03-07)
- Protect cultural resources while implementing this INRMP. (FY 03-07)
- Increase natural and cultural resources law enforcement activities, including training. (FY 03-07)
- Issue hunting and fishing permits. (FY 03-07)
- Obtain funding to implement this INRMP. (FY 03-07)

- Provide command support to implement this INRMP. (FY 03-07)

6.3.2 Important Projects

- Install bat gate over the opening of Zints Mine to limit disturbance from humans. (FY 05)

6.3.3 Projects of Lesser Importance

- Continue participating in the Mapping Avian Productivity and Survivorship (MAPS) program. (FY 03-07)

- Design, construct, and maintain boardwalk into wetland at upper Cragston Lake and a hiking and nature trail around lower Cragston Lake. (FY 03-07)

6.4 IMPLEMENTATION OF FUNDING OPTIONS

The natural resources program at USMA receives financial support from appropriated funds (e.g., Operations and Maintenance), funded reimbursements (forestry), and user fees (hunting, fishing, trapping, and outdoor recreation). The use of funded reimbursements and user fees are restricted by Federal law. Funded reimbursements can be used only for timber management-related expenses, and user fees may be used only to fund project related to hunting, fishing, trapping, and outdoor recreation. Expenses not directly associated with timber management or with hunting, fishing, trapping, and outdoor recreational activities must be funded from appropriated funds.

The following section presents the funding options and anticipated budgets (revenues) expected to be available to fund the natural resources program at USMA from 2003 through 2007.

6.4.1 Forestry Funds

Funding for forest management at installations is from the appropriated Operations and Maintenance funds and from the Army Forestry account. Operations and Maintenance funds may generally be used for

all forest management activities. Proceeds from the sale of timber and other forest products are deposited into the Forestry account at the Army level, and may only be used for activities directly related to the management of the forest ecosystem for the production of commercial forest products, such as timber management, reforestation, TSI, inventories, fire protection, construction and maintenance of timber area access roads, purchase of forestry equipment and supplies, disease and insect control, planning (to include actions necessary to maintain forestry compliance with applicable laws and regulations), timber marking, inspections, sales preparation, training of personnel, and timber sales (AR 200-3, Chapter 5-4(a)). The funds in the Forestry account are distributed based on requirements, as submitted by installations through the Reimbursable Programs Tracking System, and the total account funds available. Funding obtained by USMA from the Forestry account in FY 2002 was $38,000.

USMA generates forestry funds from the occasional sale of firewood and from commercial timber sales. Revenue generated in FY 2002 from the sale of timber was $40,000. These activities and the revenue they generate are expected to continue and to remain relatively constant (provided the market value for timber remains relatively constant) during 2003 through 2007. Funds required to make up shortfalls between the funds that are generated by forestry activities and the funds that are required to operate the forestry program may, if available, come from the DoD Forestry Reserve Account. Other natural resource programs may also use these Reserve Account funds if available.

Forestry operations are accomplished by the NRB staff, so project expenses are generally reflected as labor costs. The typical annual allocation is shown in Table 6-2.

Table 6-2
Forest Management Elements Funded By Forestry Funds

Program Element	Annual Funding
Management and Planning	$5,000
Timber Harvest	$4,750
Stand Improvement	$4,250
Protection (fire, insect)	$3,750
Regeneration	$11,750
Inventory	$3,500
Training	$2,000
Travel	$2,000
Supplies/Equipment	$3,000
Totals	**$40,000**

6.4.2 Wildlife Conservation Funds

Pursuant to 16 U.S.C. § 670a-f, and as described in AR 200-3, Chapter 6-3, "Installation commanders will establish fees for hunting, fishing or trapping." These fees are solely for defraying costs incurred for fisheries and wildlife management on the installation, and not for the construction of recreational structures, such as blinds, deer stands, and fishing piers. Fees are deposited into the "Wildlife Conservation, Military Reservations" Army account 21X5095.

Total revenues from the sale of hunting, fishing, and trapping permits were $12,525 in FY 02, a figure that has held relatively steady for the past five years. The programs and projects that are expected to be funded with these revenues are listed in Table 6-3. In past years, if the revenue exceeded expenses, the balance was carried over to be applied to new FY expenses. USMA has had a carryover for several years, which is being slowly reduced. This carryover is expected to be reduced to $0 by the final out year of this INRMP (FY 07).

6.4.3 Environmental Program Requirements (EPR) Reports Funds

Funding requirements for most of the Army's environmental program are identified in the Environmental Program Requirements (EPR) Report. USMA natural resources projects for FY 2003 through FY 2007 that will accomplished by contract or agreement with other agencies are identified in the EPR and summarized in Table 6-4. Most of the management actions described in this INRMP are accomplished by government employees on the NRB staff. Funding for these staff positions is identified in the EPR as part of overall USMA environmental management personnel requirements and is not reflected in Table 6-4.

Table 6-3

Projected Expenditures for 21X Account Revenues (2003-2007)

Program	FY 03	FY 04	FY 05	FY 06	FY 07
Fish Stocking	$9,000	$9,000	$9,000	$9,000	$9,000
Habitat Improvement	$5,000		$5,000		$5,000
Aquatic Weed Control		$5,000		$5,000	
Pheasant/Quail Stocking	$2,000	$2,000	$2,000	$2,000	$2,000
Totals	$16,000	$16,000	$16,000	$16,000	$16,000

Table 6-4
Environmental Program Requirements (EPR) for
USMA Natural Resources Management Program

Project	FY 03	FY 04	FY 05	FY 06	FY 07
Wetlands Restoration			$25,000		
GIS Equipment and Support	$5,000	$2,000	$1,000	$2,000	$7,000
Conservation Law Enforcement		$90,000	$90,000	$90,000	$90,000
Field Studies/Monitoring of INRMP Management Measures			$50,000		
Noxious Weed Control	$15,000	$10,000	$15,000	$20,000	$20,000
Bald Eagle Survey	$10,000	$5,000	$10,000	$5,000	$10,000
INRMP Implementation, Review, Tracking, and Update	$5,000	$5,000	$5,000	$5,000	$5,000
USFWS Technical Assistance - fish population surveys via electrofishing - habitat and stream assessments - wetland evaluations	$10,000	$10,000	$10,000	$10,000	$10,000
Natural Resource Surveys - Rattlesnake	$7,000	$10,000	$10,000	$10,000	$10,000
- Mollusc	$10,000				$10,000
- Arthropoda	$20,000				
- Rare Plants		$10,000			$10,000
- Endangered Species			$32,000		
- Bryophytes				$10,000	
- Shrews				$10,000	
Contract Technical Support	$75,000	$75,000	$80,000	$80,000	$80,000
Totals	**$157,000**	**$217,000**	**$328,000**	**$242,000**	**$252,000**

The total Environmental Conservation Fund budget for this INRMP is estimated at $1,196,000 for 2003 through 2007. These estimates will be adjusted each year on an as needed basis.

6.4.4 Training Funds

Funding for the ITAM program is through military training channels. The total USMA ITAM requirement for fiscal years 2003 through 2007 totals $2,349,800 (Table 6-5). Of course, this is an estimated value that is subject to adjustment based on changing needs and revised project cost estimates.

The proposed annual budget for each fiscal year includes funds for continuing the positions of ITAM Program Manager and GIS technician, and the LCTA survey crew by contracting personnel through Colorado State University. In addition to maintaining key personnel and natural resources data collection efforts, the ITAM work plan budget will fund a number of projects of major importance to maintaining,

Table 6-5
ITAM Work Plan Budget

Project	FY 03	FY 04	FY 05	FY 06	FY 07
LCTA	$160,600	$146,600	$168,600	$172,600	$188,600
LRAM	$140,000	$145,000	$140,000	$135,000	$124,000
TRI	$149,800	$155,500	$162,000	$173,000	$176,000
EA	$2,500	$2,500	$2,500	$2,500	$2,500
Total	$452,900	$449,600	$473,100	$483,100	$491,100

preserving and protecting the natural resources at West Point. Program budget detail is in separate ITAM Annual Work Plans prepared in accordance with the ITAM Program Strategy.

6.4.5 Summary of INRMP Implementation Costs

The average annual costs of implementing this INRMP are presented below by funding category. These total annual costs represent an estimate of the cost of implementation; however; some variability from year to- year can be expected. Variables that have the potential to affect the overall cost of implementation include changes in labor and contract costs, numbers of hunting and fishing permits issued, quantity of timber harvested, market value of timber, and the availability of funds.

- **Forestry:** $ 78,000 ($40,000 from the sale of timber).
- **Fish and Wildlife:** $16,000 from the sale of hunting, fishing, and trapping permits.
- **Environmental:** $239,200 for projects that qualify for Environmental Conservation Funds.
- **Training:** $469,960 for the ITAM Program.

The total average annual funding necessary to implement this INRMP is $803,160. The total cost over 5 years of implementing this INRMP is $4,015,800.

6.5 COMMAND SUPPORT

The Garrison Commander and subordinate leaders at USMA fully support this INRMP. The command is dedicated to ensuring the long-term sustainability of the natural resources and the management of those resources necessary to support the military mission.

6.6 PLAN REVIEW

The NRB will annually conduct a review of this INRMP in light of the preceding year's accomplishments. The schedule of activities as appear in Sections 5.0 and 6.0 will be the basis for monitoring plan implementation.

SECTION 7.0: ENVIRONMENTAL CONSEQUENCES

This section of the document assesses known, potential and reasonably foreseeable environmental consequences related to implementing the INRMP and managing natural resources at USMA. Section 7.1 addresses implementation of the no action alternative, which reflects the continuation of existing baseline conditions as described in Section 3.0. Section 7.2 presents potential effects in the context of the scope of the proposed action and in consideration of the affected environment. This assessment is organized by resource area (as presented in Section 3.0) and considers implementation of the selected management measures in their entirety (as presented in Section 5.15). Cumulative effects are discussed in Section 7.3. Implementing the proposed action is the USMA's preferred alternative. A summary of the potential environmental consequences associated with the no action alternative and the proposed action is presented in Section 7.4.

As discussed in Section 1.4.5, *Description of the Proposed Action and Alternatives*, the EA addresses two alternatives—the proposed action and the no action alternative. Other management alternatives were considered during the screening process, but eliminated because they were economically infeasible, ecologically unsound, or incompatible with the requirements of the military mission. Section 5.0, *Natural Resources Management*, provides a description of the methods used to develop management measures for each resource area and the rationale for why certain management measures were selected. Therefore, the analytical framework supporting each resource area is not repeated in this section. This approach supports Army guidance for concurrent preparation and integration of the INRMP and NEPA documentation.

As discussed in Section 1.4.5, the USMA INRMP is a "living" document that focuses on a 5-year planning period based on past and present actions. Short-term management practices included in the plan have been developed without compromising long-range goals and objectives. Because the plan will be modified over time, additional environmental analyses may be required as new management measures are developed over the long-term (i.e., beyond 5 years).

7.1 NO ACTION ALTERNATIVE

Adoption of the no action alternative would mean that USMA's 5-year INRMP update (this INRMP) would not be implemented and current natural resource management practices at USMA would continue "as is." Existing conditions and management practices presented in Section 3.0, Affected Environment, would continue and no new initiatives would be established.

Potential consequences associated with the no action alternative are discussed in this section for each resource area described in Section 3.0, *Affected Environment.* Section 7.4 summarizes the analysis of potential consequences for the no action alternative and compares them to the proposed action. As shown, no significant or adverse effects would be expected. Under the no action alternative, the environmental conditions at USMA would not benefit from the management measures associated with implementing the proposed INRMP.

Expected consequences of the no action alternative for each resource area are presented in the following paragraphs.

Environmental Setting. No effects on the general environmental conditions of USMA would be expected under the no action alternative. Under the no action alternative, the current INRMP would continue to be implemented, however, new measures to improve the environmental setting would not be implemented.

Climate. No effects on climate would be expected.

Air Quality. No effects would be expected. The primary concern regarding air quality and potential environmental effects pertains to increases in pollutant emissions; exceedances of National Ambient Air Quality Standards and other federal, state, and local limits; and impacts on existing air permits. Potential effects on existing pollutant emissions are precluded by the fact that current natural resource management actions do not involve any activities that would contribute to changes in existing air quality. Therefore, there would be no effects regarding air quality as a result of implementing the no action alternative.

Noise. No effects would be expected. The primary concern regarding noise and potential environmental effects pertains to increases in sound levels, exceedances of acceptable land use compatibility guidelines, and changes in public acceptance (i.e., noise complaints). Activities occurring under the current INRMP do not involve any activities that would impact noise conditions. Existing noise levels would not change. Therefore, there would be no effects regarding noise levels or sound quality as a result of implementing the no action alternative.

Topography. No effects would be expected. The current INRMP includes a comprehensive soil resources management program that minimizes impacts on microtopography associated with erosion and sedimentation at USMA.

Geology. No effects would be expected. The current INRMP includes a comprehensive soil resources management program that minimizes impacts on geologic resources associated with erosion and sedimentation at USMA.

Petroleum and Minerals. No effects on petroleum and mineral resources would be expected from implementation of the no action alternative. No petroleum or commercially valuable mineral resources are known to occur at USMA.

Soils. No effects would be expected. The current INRMP includes a comprehensive soil resource management program that minimizes, and when necessary, mitigates erosion and sedimentation at USMA. The LRAM program would continue to identify and repair sites where erosion has been determined to be a problem, and soil conditions would continue to be monitored

Water Resources. No effects would be expected. The current INRMP established a formal plan of action for monitoring and protecting the water resources at USMA. This plan of action includes watershed protection measures, nonpoint source pollution controls, and a comprehensive monitoring program designed to identify water quality problems at their onset.

Wetlands. No effects would be expected. The current INRMP provides a formal plan for evaluating and monitoring wetland habitat conditions and it establishes formal protection measures to prevent or minimize potential impacts that could result from training and other mission-related activities.

Vernal Pools. No effects would be expected. The current INRMP provides a formal plan that resulted in a complete inventory and characterization of the vernal pools on USMA lands. It also established management measures to prevent or minimize the potential for adjacent activities to adversely affect these sensitive habitats.

Aquatic Habitat. No effects would be expected. The current INRMP established the implementation of a routine habitat assessment and monitoring program. The continued implementation of this program provides a method for protecting these habitats, contributes to the database of information used to prioritize stream restoration projects, identifies the most efficient allocation of resources, and establishes routine management measures to protect and enhance these habitats by preventing or minimizing potential impacts.

Riparian Habitat. No effects would be expected. As with aquatic habitats, the current INRMP has established the conduct of habitat assessments and monitoring to protect these habitats, while providing a database of information to prioritize restoration projects and to allocate resources. In addition, the use of riparian buffers would continue to be limited to protect water quality, and the potential impacts resulting from training and other mission-related activities would be minimized.

Terrestrial Ecosystems. No effects would be expected. Under the current INRMP, management measures are in place to improve terrestrial habitat conditions and diversity, provide benefits to wildlife species, and to maintain or improve overall biodiversity.

Special Natural Areas. No effects would be expected. Under the current INRMP, protective measures have been implemented to protect and conserve these sites, minimize impacts from training, and to control invasive species.

Fauna. No effects would be expected. Management measures have been implemented to increase the abundance and biodiversity of wildlife, protect and enhance wildlife habitats (i.e., aquatic, riparian, wetlands, vernal pools, terrestrial), and to increase the quality and complexity of the habitat.

Endangered, Threatened, and Rare Species. There is the potential for minor adverse effects to occur to the federally-endangered Indiana bat (*Myotis sodalis*) under the no action alternative. The current

INRMP does not provide special measures for the protection and management of this species that has recently been identified at USMA. Implementation of the no action alternative would continue to leave this species vulnerable to potential impacts due to habitat degradation resulting from timber harvests.

Cultural Resources. No effects would be expected. Under the no action alternative the current INRMP would continue to be implemented, although newly identified cultural resources might not be included in the original INRMP. The primary concern regarding cultural resources pertains to protecting prehistoric and historic sites located within the boundaries of USMA. Under the no action alternative, the original INRMP would still be in use as the overall management plan, providing a formal plan for consultation and coordination with the Cultural Resources Manager prior to the initiation of a natural resource management activity that might have the potential to impact historic or cultural resources. The purpose of the consultation is to determine whether historic or cultural resources are in close proximity to the proposed activity, and whether the activity would have the potential to adversely affect these resources.

Land Use. No effects would be expected. Under the no action alternative, no changes to onsite land uses or land use patterns would occur. Because land uses would not be expected to change on site, land use patterns in the surrounding area would not be affected.

Facilities. No effects would be expected. All facilities would continue to be maintained and operated in accordance with required permits and capabilities of the systems. Under the no action alternative, the demand for utilities and roads would not be expected to change, and therefore would not adversely affect existing facilities.

Hazardous and Toxic Materials. No effects would be expected. All hazardous and toxic materials would continue to be handled in accordance with federal laws and Army regulations, including the Resource Conservation and Recovery Act (RCRA), the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Toxic Substances Control Act (TSCA), and AR 200-1. Thus, no adverse effects regarding the generation of hazardous and toxic materials would be expected under the no action alternative.

Socioeconomic Resources. No effects would be expected. Potential effects are precluded by the fact that the no action alternative does not involve any activities that would change existing socioeconomic resources.

Environmental Justice. No effects would be expected. The no action alternative would not create any advantage or disadvantage for any group or individual, and is not expected to create disproportionately high or adverse human health or environmental effects on children or minority or low-income populations at or surrounding the USMA.

In summary, analysis of the existing (i.e., baseline) conditions identifies no serious environmental concerns. However, the current INRMP does not provide the mechanisms to address the outcome of a variety of faunal and floral surveys and management actions that have taken place since its implementation in 1998. In addition, AR 200-3 requires installations to conduct a major revision of "all parts" of their INRMP every five years. The five-year time period for the current INRMP expires at the end of FY 2002. Therefore, the implementation of the no action is not favored.

7.2 PROPOSED ACTION (PREFERRED ALTERNATIVE)

Potential consequences associated with the proposed action are discussed in this section for each resource area described in Section 3.0, *Affected Environment*. Section 7.4 summarizes the analysis of potential consequences for the proposed action and compares them to the no action alternative (i.e., baseline or existing conditions). Potential environmental consequences associated with implementing the INRMP would result in either no effects or beneficial effects for the resource areas. Compared to the no action alternative, environmental conditions at USMA would improve as a result of implementing the proposed INRMP. Therefore, the proposed action is the preferred alternative.

Expected consequences of the preferred alternative for each resource area are presented in the following paragraphs.

Environmental Setting. Beneficial effects on the general environmental conditions of USMA would be expected from implementation of the proposed action. Implementation of the proposed action will have

beneficial effects for many of USMA's natural resources, which will result in the overall improvement of the environmental setting.

Climate. No effects on climate would be expected.

Air Quality. No effects would be expected. The primary concern regarding air quality and potential environmental effects pertains to increases in pollutant emissions; exceedances of National Ambient Air Quality Standards and other federal, state, and local limits; and impacts on existing air permits. Examples of activities that would result in potential adverse changes in air quality conditions include (1) changes in military equipment, (2) increase in the number or location of personnel, (3) construction of new facilities or modification of existing facilities, or (4) increase or change in military operations. However, potential effects on existing pollutant emissions are precluded by the fact that the proposed action does not involve any activities that would contribute to changes in existing air quality conditions. Therefore, there would be no effects regarding air quality as a result of implementing the proposed action.

Noise. No effects would be expected. The primary concern regarding noise and potential environmental effects pertains to increases in sound levels, exceedances of acceptable land use compatibility guidelines, and changes in public acceptance (i.e., noise complaints). However, potential effects are precluded by the fact that the proposed action does not involve any activities that would impact noise conditions, such as (1) changes in military equipment, (2) increase in the number or location of personnel, (3) construction of new facilities or modification of existing facilities, or (4) increase or change in military operations. Therefore, there would be no effects regarding noise levels or sound quality as a result of implementing the proposed action.

Topography. Beneficial effects would be expected. By continuing to adapt the comprehensive soil resource management program to current conditions, impacts on microtopography associated with erosion and sedimentation at USMA would be minimized.

Geology. Beneficial effects would be expected. By continuing to adapt the comprehensive soil resource management program to current conditions, impacts on geologic resources associated with erosion and sedimentation on USMA would be minimized.

Petroleum and Minerals. No effects on petroleum and mineral resources would be expected from implementation of the proposed action. No petroleum or commercially valuable mineral resources are known to occur at USMA.

Soils. Beneficial effects would be expected. By continuing to adapt the comprehensive soil resource management program to current conditions, impacts on soils associated with erosion and sedimentation on USMA would be minimized. As part of the proposed action, existing sites where erosion has been determined to be a problem would be addressed through the LRAM component of the ITAM program. In addition, monitoring of soil conditions on the installation to identify potential problem areas, the implementation of conservation measures in areas where exposure of soils is necessary and, when possible, the avoidance of activities likely to result in erosion would minimize potential impacts on the soil resource and result in a reduction in erosion at USMA.

Water Resources. Beneficial effects would be expected. The maintenance of previously established riparian buffers will continue to result in beneficial effects on water quality on USMA by reducing nonpoint source impacts associated with runoff and adjacent land uses. Continued efforts to limit impacts on water bodies and riparian areas in the impact zone will reduce the potential for water quality degradation both in and downstream of the training areas. Implementation of new management measures for the application of turf management chemicals, fungicides, and insecticides will minimize the potential impacts on water bodies associated with the use of these chemicals at USMA.

Wetlands. Beneficial effects would be expected. Implementation of the proposed action would continue to protect wetlands by providing a basis to evaluate and monitor habitat conditions through the continuing development of the wetland database for USMA. The maintenance of established buffers would minimize potential impacts to wetlands associated with adjacent activities. Aggressive control of invasive species would protect wetland integrity and biodiversity. Additional efforts would be made to reduce impacts to wetlands by planning mission activities, when possible, in a manner consistent with wetland protection objectives. Where current activities may be impacting wetland functions, efforts would be made to identify the type and source of impacts and, where applicable, restoration of affected habitats would be implemented.

Vernal Pools. Beneficial effects would be expected. Implementation of the proposed action would protect vernal pools located at USMA. Continued maintenance of buffers would minimize potential impacts on vernal pools associated with adjacent activities. Additional efforts would be made to reduce impacts on vernal pools by planning mission activities, when possible, in a manner consistent with vernal pool protection objectives.

Aquatic Habitat. Beneficial effects would be expected. The continued assessment of aquatic habitats would build on the baseline of information that has already been collected. This information can be used to track the status and trends of these habitats, and to evaluate the effectiveness of other management measures. This allows resources to be applied where and when needed, as well as allowing the adaptation of management activities to changing conditions. The maintenance of established limited use buffers around water bodies would provide protection to habitats both in and adjacent to the resource. Where impacts on aquatic habitats occur as a result of mission activities, management objectives provide for the timely mitigation of the impacts. Aggressive control of invasive species would protect the ecological integrity and biodiversity of these habitats.

Riparian Habitat. Beneficial effects would be expected. As with aquatic habitats, the continued assessment of riparian habitats would build on the existing database of information. This information can be used to track the status and trends of these habitats, and to evaluate the effectiveness of other management measures. This allows resources to be applied where and when needed, as well as allowing the adaptation of management activities to changing conditions. The maintenance of previously established limited use riparian buffers would result in beneficial effects on water quality at USMA by reducing nonpoint source impacts associated with runoff and adjacent land uses. Aggressive control of invasive species would protect the ecological integrity and biodiversity of these habitats.

Additional management measures that would continue to be implemented to protect or enhance riparian habitats include proper planning of recreational developments and training exercises; limiting of pesticide and fertilizer use in the riparian buffer; proper location, construction, and design of stream crossings to reduce impacts on flora and fauna, to minimize the modification of existing hydrologic characteristics and minimize erosion and sedimentation; and the continued implementation of existing riparian zone/floodplain restoration projects.

Terrestrial Ecosystems. Beneficial effects would be expected. Implementation of the proposed action would result in the aggressive control and monitoring of invasive species, which would provide direct positive benefits to the military mission, while protecting the ecological integrity and biodiversity of these habitats. The proposed action would also result in the continued improvement of terrestrial habitat conditions for wildlife by maintaining a high level of habitat diversity. As part of this action, forest openings would continue to be created to provide a greater diversity of habitat and community types on the reservation; snags and downed woody material would be preserved for potential nesting and forage sites, additional nest boxes would be erected; native trees and shrubs would be planted to provide additional habitat for wildlife; and unique tree stands would be improved to provide higher quality habitat for targeted species (e.g., aspen stands for ruffed grouse).

Forest management practices comprising part of the proposed action would similarly result in improved terrestrial ecosystem conditions by focusing on the long-term balance between maintaining forest ecosystem integrity (through timber stand improvements) and producing commercially valuable forest products.

Special Natural Areas. Beneficial effects would be expected. Under the proposed action, the Special Natural Areas would continue to be provided with a quasi-protective status, allowing additional efforts to be made to minimize impacts occurring as a result of training exercises and timber harvesting. Protective buffers around each site, where training and timbering activities are restricted or modified, would continue to be maintained. In addition, the aggressive monitoring and control of invasive species would protect the ecological integrity and biodiversity of these areas. A database of information would continue to be develop through continued monitoring efforts.

Fauna. Beneficial effects on both game and nongame species would be expected. Surveys conducted under the current INRMP have resulted in the observation of additional species previously unknown at USMA. As a result, monitoring and management efforts would be expanded to develop a database of information from which additional management measures can be developed to protect the species and maintain the high degree of biodiversity. In addition, implementation of the proposed action would continue to produce a healthy white-tailed deer population, as well as improved habitat conditions for small game (including fish) and nongame species. No impacts on furbearers would be expected under this plan, as management recommendations conform closely to current management practices.

Endangered, Threatened, and Rare Species. Beneficial effects on all special status species at USMA would be expected. Implementation of the proposed action would continue to provide protection and management for species not protected under the ESA (e.g., osprey, timber rattlesnake, all rare plants), as well as for the Indiana bat and bald eagle, which is federally listed but not known to nest on the installation. A follow-up survey for Indiana bats would be conducted using U.S. Fish and Wildlife protocols to determine if the species' status at USMA has changed. A cave in which Indiana bats have been observed during the winter would also be secured to prevent human disturbance during the winter hibernation. In addition, management activities aimed at encouraging the use of the reservation and Constitution Island by federal- and state-listed species and providing the potential for future nesting activity would be continued. Under the proposed action, rare flora and fauna would continue to be treated with added importance and valued for their contribution to the unique natural heritage of USMA.

Cultural Resources. Beneficial effects on the cultural resources at USMA would be expected. The primary concern regarding resources pertains to protecting prehistoric and historic sites located within the boundaries of USMA. Implementation of the proposed action provides for consultation and coordination with the Cultural Resources Manager prior to the initiation of any activity that might have the potential to impact historic or cultural resources. The purpose of the consultation is to determine whether historic or cultural resources are in close proximity to the proposed activity and whether the activity would have the potential to adversely affect those resources. Under the proposed action, the probability of disturbing potential cultural resources, including those identified between implementation of the original INRMP and this revised version, would be greatly reduced. The placement of a bat gate over the Zints Mine entrance has cultural resources implications. However, the gate could provide additional protection for the mine as well.

Land Use. No effects would be expected. Under the proposed action, no changes to onsite land uses or land use patterns would occur. Because land uses would not be expected to change on site, land use patterns in the surrounding area would not be affected.

Facilities. No effects impacts would be expected. All facilities would continue to be maintained and operated in accordance with required permits and capabilities of the systems. Under the proposed action, the demand for utilities and roads would not be expected to increase, and therefore would not adversely affect existing facilities.

Hazardous and Toxic Materials. No effects would be expected. All hazardous and toxic materials would continue to be handled in accordance with federal laws and Army regulations, including RCRA, the FIFRA, TSCA, and AR 200-1. Thus, no adverse effects regarding the generation of hazardous and toxic materials would be expected under the proposed action.

Socioeconomic Resources. No effects would be expected. The proposed action alternative would not involve any activities that would contribute to changes in population, housing, industry earnings and employment, or personal income.

Environmental Justice. No effects would be expected. Implementation of the proposed action would not create any advantage or disadvantage for any group or individual, and is not expected to create disproportionately high or adverse human health or environmental effects on children or minority or low-income populations at or surrounding the USMA.

The EA findings are consistent with the goals of the natural resources management program to maintain ecosystem viability and ensure the sustainability of desired military training area conditions; to maintain, protect and improve ecological integrity; to protect and enhance biological communities, particularly sensitive, rare, threatened and endangered species; to protect the ecosystems and their components from unacceptable damage or degradation, and to identify and restore degraded habitats. The nature of the management measures recommended by the INRMP, if implemented, would directly and positively affect the health and condition of natural resources at USMA.

7.3 CUMULATIVE EFFECTS

A cumulative effect is defined as an effect on the environment that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place locally or regionally over a period of time.

Implementation of the INRMP would result in a comprehensive environmental strategy for USMA that represents compliance, restoration, prevention, and conservation; improves the existing management

approach for natural resources on the installation; and meets legal and policy requirements consistent with national natural resources management philosophies. Implementation would be expected to improve existing environmental conditions at USMA, as shown by the potential for beneficial effects in Table 7-1. Over time, adoption of the proposed action would enable USMA to achieve its goal of maintaining ecosystem viability and ensuring sustainability of desired military training area conditions.

As described in Sections 1.2 *Background*, 1.3 *Responsible and Interested Parties*, and 2.5 *Future Military Mission Impacts on Natural Resources*, USMA and neighboring forested lands can be viewed as an island of generally stable, well-managed natural systems surrounded by areas of varying levels of growth and development. One potential future problem with this, however, is that USMA may become the only remaining location for some rare species that could become candidates for listing under the ESA. This could then lead to restrictions on training activities at USMA.

There are no known changes planned for the USMA military mission or to the intensity and extent of training that presently occurs on the installation. Also, there are no known changes in the operation or management of the lands comprising Black Rock Forest and the Palisades Interstate Park Commission in the foreseeable future.

Although growth and development can be expected to continue outside of USMA and the surrounding natural areas, its environmental effects, although possibly somewhat adversely affecting natural resources within the ecoregion, would not be expected to result in cumulatively adverse effects to these resources when added to the effects of activities associated with the proposed management measures contained in the INRMP.

7.4 SUMMARY OF POTENTIAL ENVIRONMENTAL CONSEQUENCES

Table 7-1
Summary of Potential Environmental Consequences

Resource Area/Environmental Condition[1]	Environmental Consequences	
	No Action	Proposed Action
Environmental Setting	None	Beneficial
Climate	None	None
Air Quality	None	None
Noise	None	None
Topography	None	Beneficial
Geology	None	Beneficial
Petroleum and Minerals	None	None
Soils	None	Beneficial
Water Resources	None	Beneficial
Wetlands	None	Beneficial
Vernal Pools	None	Beneficial
Aquatic Habitat	None	Beneficial
Riparian Habitat	None	Beneficial
Terrestrial Ecosystems	None	Beneficial
Special Natural Areas	None	Beneficial
Fauna	None	Beneficial
Endangered, Threatened, and Rare Species	Minor Adverse	Beneficial
Cultural Resources	None	Beneficial
Land Use	None	None
Facilities	None	None
Hazardous and Toxic Materials	None	None
Socioeconomic Resources	None	None
Environmental Justice	None	None
Cumulative Effects [2]	None	None

[1] Resource areas presented in this column are the same resource areas presented in Section 3.0, *Affected Environment.*
[2] Cumulative effects (see Section 7.3) have been added to this table for reader convenience.

SECTION 8.0: CONCLUSIONS

INRMP Summary. This document reflects the commitment set forth by the Army to conserve, protect, and enhance the natural resources necessary to provide realistic military training for the Corps of Cadets. The primary purpose and objective of this document is to present an implementable INRMP that guides USMA in meeting mission requirements, achieving natural resource management goals, and complying with environmental policies and regulations. In addition, the NEPA analysis required for undertaking this major federal action (i.e., implementation of this plan) is embodied within the INRMP. The resultant "planning assessment" includes a comprehensive description, evaluation, and assessment of environmental conditions and natural resources at USMA.

This INRMP is the final plan that will direct the natural resources management program at USMA from 2003 through 2007. An ecosystem approach was used to develop the management measures for each resource area. Implementation of the management measures will maintain, protect, and enhance the ecological integrity of the training lands and the biological communities inhabiting them. In addition, the natural resources management measures described in this plan will protect USMA ecosystems and their components from unacceptable damage or degradation and identify and restore previously degraded habitats. The estimated average annual costs of implementing this INRMP by funding category are as follows:

- **Forestry:** $78,000
- **Fish and Wildlife:** $16,000
- **Environmental:** $239,200
- **Training:** $469,960

The total average annual funding necessary to implement this INRMP is $803,160, and the total cost over 5 years is $4,015,800.

Command support is essential for the implementation of this INRMP and is required for many of the natural resources management projects described herein. This INRMP has the support of the Garrison Commander and subordinate leaders at USMA.

NEPA Findings and Conclusions. The proposed action to implement the INRMP for USMA was analyzed by comparing potential environmental consequences against existing conditions. Findings indicate that, under the preferred alternative, potential consequences would result in either no significant adverse effects or only beneficial effects on each resource area (see Section 7.1). The affected environment would not be significantly or adversely impacted by proceeding with the preferred alternative. Additionally, no significant cumulative effects would be expected.

Based on this EA, implementation of the proposed action would have no significant environmental or socioeconomic effects. Because no significant effects would result from implementation of the proposed action, preparation of an EIS is not required, and preparation of a Finding of No Significant Impact is appropriate.

SECTION 9.0:
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APPENDIX A

Agency Consultation Letters

New York State Department of Environmental Conservation
Division of Environmental Permits, Region 3
21 South Putt Corners Road, New Paltz, New York 12561-1696
Phone: (845) 256-3000 FAX: (845) 255-3042
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

July 11, 2002

ERIC DOHNER
TETRA TECH INC
1960 EAGLE VALLEY COURT
LAWRENCEVILLE GA 30043

Dear Mr. Dohner:

Marc Moran has asked me to respond to your recent letter regarding your request for information ion the USMA installation.

Information regarding a list of federal and state listed endangered ,threatened and protected species is best obtained from the Natural Heritage Program at 625 Broadway, 5th Floor, Albany , NY 12233-4757, (518) 402-8944, www.nynhp.org. or at dec.state.ny.us and click on "Fish, Wildlife & Marine" and than click on "Natural Heritage Program".

Information on DEC regulated wetlands can be obtained by ordering the quadrangle sheet, using the enclosed order form. You will need to contact the Army Corps of Engineers (see enclosed notice) regarding the presence of any federal wetlands. Information on stream classification is available in our office here in New Paltz at (845) 256-3054 or in 6NYCRR (Title 6, Official Compilation of Codes, Rules and Regulations of the State of New York).

You may also wish to visit the DEC Website to see what other information is available that may be of interest to you. Please feel free to call me at (845) 256-3059 if you have questions or need further information.

Sincerely,

Margaret E. Duke

Margaret E. Duke
Regional Permit Administrator
Region 3

MED/dv
cc: M. Moran
W. Rudge
T. Kerpez
NYNHP- N. Conrad (4757) w/incoming
J. Isaacs/R. Jacobson

Dohner ltr (PD1)

New York State
Department of Environmental Conservation

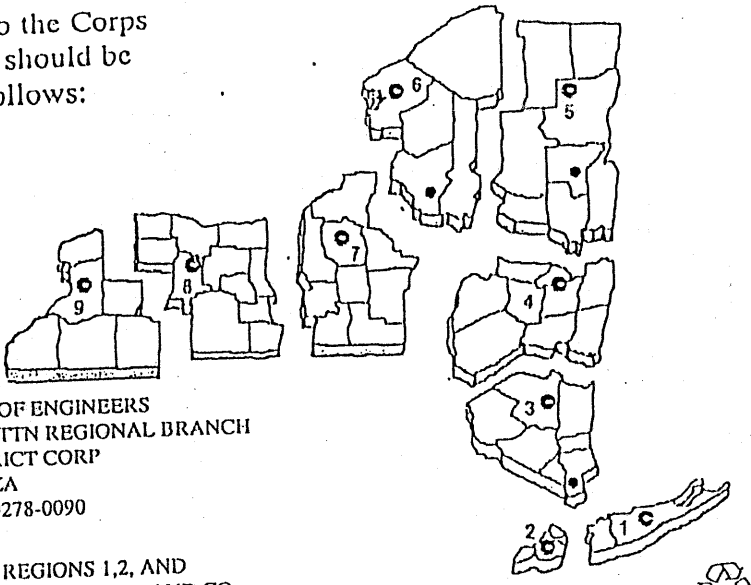
Please Note

The U.S. Army Corps of Engineers regulates the placement of fill and the construction of certain structures in waterways and wetlands. Over recent years, the Corps of Engineers' jurisdiction has expanded beyond the major waterways that were traditionally referred to as "navigable waters."

Please recognize that a determination that no permit is required from the New York State Department of Environmental Conservation does not necessarily mean that no permit is required from the Corps of Engineers. Likewise, having obtained a permit from the New York State Department of Environmental Conservation does not relieve anyone from the obligation to comply with federal law and regulation implemented by the Corps of Engineers.

We recommend that all parties considering constructing projects consult directly with the Corps of Engineers along with other agencies to accurately determine what regulatory requirements will apply to the projects.

Inquiries to the Corps of Engineers should be directed as follows:



US ARMY CORPS OF ENGINEERS
DEPT OF ARMY ATTN REGIONAL BRANCH
NEW YORK DISTRICT CORP
26 FEDERAL PLAZA
NEW YORK NY 10278-0090

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(212) 264-6731 DEC REGIONS 1,2, AND WESTCHESTER/ROCKLAND CO
(212) 264-0185 DEC REGION 3 EXCEPT WESTCHESTER/ROCKLAND

~~ALBANY FIELD OFFICE~~
~~PO BOX 209~~
~~TROY NY 12182~~
~~(518) 270-0588/0589 DEC REGION 4,5~~

~~BUFFALO DISTRICT OFFICE~~
~~1776 NIAGARA ST~~
~~BUFFALO NY 14207-3199~~
~~TELEPHONE(716) 879-4330 DEC REGIONS 6,7,8,9~~

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APPENDIX B

Finding of No Significant Impact (FNSI)

FINDING OF NO SIGNIFICANT IMPACT FOR IMPLEMENTING AN INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN FOR THE UNITED STATES MILITARY ACADEMY, WEST POINT, NEW YORK

Pursuant to the Council on Environmental Quality (CEQ) Regulations (40 CFR Parts 1500-1508) for implementing the procedural provisions of the National Environmental Policy Act (42 U.S.C 4321 et seq.) and Army Regulation 200-2 *(Environmental Effects of Army Actions),* the United States Military Academy (USMA) has conducted an Environmental Assessment (EA) of the potential effects associated with implementing an Integrated Natural Resources Management Plan (INRMP). USMA has prepared this INRMP in accordance with the provisions of the Sikes Act (16 U.S.C 670a et seq.) and Army Regulation 200-3 *(Natural Resources-Land, Forest, and Wildlife Management).*

Proposed Action. USMA proposes to implement an INRMP, which supports the management of natural resources as described by the plan itself. The purpose of the proposed action is to carry out the set of resource-specific management measures developed in the INRMP, which would enable USMA to manage effectively the use and condition of natural resources located on the installation to protect the natural setting primarily for training purposes. Implementation of the proposed action would support the Army's continuing need to train the Corps of Cadets in a realistic natural setting while meeting other mission and community support requirements, practicing sound resource stewardship and complying with environmental policies and regulations.

The proposed action supports an ecosystem approach and includes natural resource management measures to be undertaken on the West Point Military Reservation, located in the Towns of Highlands, Cornwall, Woodbury and Philipstown, New York. The proposed action focuses on a 5-year planning period, which is consistent with the time frame for the management measures described in the INRMP. This planning period would begin in Fiscal Year (FY) 2003 and end in FY 2007. Additional environmental analyses may be required as new management measures are developed over the long-term (i.e., beyond 5 years).

Alternatives. The development of proposed management measures for the INRMP included a screening analysis of resource-specific alternatives. The screening analysis involved the use of accepted criteria, standards, and guidelines, when available, and best professional judgment, to identify management practices for achieving USMA's natural resource management objectives. The outcome of the screening analysis led to the development of the proposed action as described above. Consistent with the intent of NEP A, this screening process focused on identifying a range of reasonable resource-specific management alternatives and, from that, developing a plan that could be implemented, as a whole, in the foreseeable future. Management alternatives deemed to be infeasible were not analyzed further. As a result of the screening process, the EA, made an integral part of the INRMP, formally addresses two alternatives, the proposed action (i.e., implementation of the INRMP) and the no action alternative.

Implementation of the no action alternative means that the proposed management measures set forth in the INRMP would not be implemented. Current management measures for natural resources would remain in effect, and existing conditions would continue. This document refers to the continuation of existing (i.e., baseline) conditions of the affected environment, without implementation of the proposed action, as the no action alternative. Inclusion of a no action alternative is prescribed by CEQ regulations and serves as a benchmark against which the proposed action could be evaluated.

Factors Considered in Determining that No Environmental Impact Statement is Required. The EA, which is incorporated by reference into this Finding of No Significant Impact (FONSI), examines potential effects of the proposed action and the no action alternative on resources and areas of environmental concern that could be affected by implementing the INRMP. These include environmental setting, climate, air quality, noise, topography, geology, soils, water resources, wetlands, aquatic habitat, riparian habitat, terrestrial ecosystems, conservation sites, fauna, endangered, threatened, and rare species, cultural resources, land use, facilities, hazardous and toxic materials, socioeconomic resources and environmental justice. Implementation of the proposed action would result in short- and long-term beneficial effects on identified resources and areas of environmental concern.

Findings. Based on the results of the EA, it is determined that implementation of the proposed action would have no significant direct, indirect or cumulative impacts on the quality of the natural or human environment. Implementation of the INRMP would be expected to improve existing conditions at USMA, as shown by the potential for beneficial effects. The proposed action would enable USMA over time to achieve its goal of maintaining ecosystem viability and ensuring sustainability of desired military training area conditions. Because there would be no significant environmental impacts resulting from implementation of the proposed action, an Environmental Impact Statement is not required and will not be prepared.

Comments on the INRMP and a draft FONSI were solicited at the beginning of a 30-day public review period which ended August 4, 2003. Public Notices in local and regional newspapers announced the availability of the documents in area libraries, and letters to other agencies and organizations sought comments. No comments were received from the public or other agencies and organizations.

Date: 18 Nov 2003

Ann L. Horner
Colonel, U.S. Army
Garrison Commander
United States Military Academy
West Point, New York

APPENDIX C

Species Lists: Fish, Birds, Odonata, Butterflies, Molluscs, and Crayfish

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi
Loons - Grebes					
Red-throated Loon	*Gavia stellata*	*o*		*o*	*o*
Common Loon	*Gavia immer*	*o*		*o*	*o*
Pied-billed Grebe	*Podilymbus podiceps*	*o*	*o*	*o*	
Horned Grebe	*Podiceps auritus*	*o*		*o*	*r*
Red-necked Grebe	*Podiceps grisegena*	*r*		*r*	
Cormorants					
Double-crested Cormorant	*Phalacrocorax auritus*	*u*	*u*	*o*	
Great Cormorant	*Phalacrocorax carbo*	*u*		*u*	*u*
Bitterns - Herons - Ibis					
American Bittern	*Botaurus lentiginosus*	*u*	*u*		
Least Bittern *	*Ixobrychus exilis*	*u*	*u*	*u*	
Great Blue Heron *	*Ardea herodias*	*c*	*c*	*c*	*o*
Great Egret	*Egretta albus*	*u*	*c*	*u*	
Snowy Egret	*Egretta thula*	*u*	*u*	*u*	
Little Blue Heron	*Egretta caerulea*	*r*	*r*		
Tricolored Heron	*Egretta tricolor*		*r*		
Green Heron *	*Butorides striatus*	*c*	*c*	*c*	
Black-crowned Night-Heron	*Nycticorax nycticorax*		*o*		
Glossy Ibis	*Plegadis falcinellus*	*o*		*o*	
Swans - Geese - Ducks					
Mute Swan *	*Cygnus olor*	*c*	*c*	*c*	*c*
Snow Goose	*Chen caerulescens*	*c*		*c*	
Brant	*Branta bernicla*	*u*		*u*	*u*
Canada Goose *	*Branta canadensis*	*a*	*a*	*a*	*a*
Wood Duck *	*Aix sponsa*	*c*	*c*	*c*	*u*
Green-winged Teal	*Anas crecca*	*c*		*c*	
American Black Duck *	*Anas rubripes*	*c*	*u*	*c*	*c*
Mallard *	*Anas platyrhynchos*	*a*	*c*	*a*	*c*
Northern Pintail	*Anas acuta*	*u*		*u*	
Blue-winged Teal	*Anas discors*	*u*		*u*	
Northern Shoveler	*Anas clypeata*	*o*		*o*	
Gadwall	*Anas strepera*	*u*		*u*	
American Wigeon	*Anas americana*	*o*		*o*	

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi
Canvasback	*Aythya valisineria*	*u*		*u*	*u*
Redhead	*Aythya americana*	*u*		*u*	
Ring-necked Duck	*Aythya collaris*	*u*		*u*	*o*
Greater Scaup	*Aythya marila*	*o*		*o*	
Lesser Scaup	*Aythya affinis*	*o*		*o*	
Oldsquaw	*Clangula hyemalis*	*o*		*o*	*o*
Black Scoter	*Melanitta nigra*	*o*		*o*	
Surf Scoter	*Melanitta perspicillata*	*r*		*r*	
White-winged Scoter	*Melanitta deglandi*	*r*		*r*	
Common Goldeneye	*Bucephala clangula*	*o*		*o*	*c*
Bufflehead	*Bucephala albeola*	*o*		*o*	*c*
Hooded Merganser *	*Lophodytes cucullatus*	*u*	*o*	*o*	
Common Merganser	*Mergus merganser*	*c*	*o*	*c*	*c*
Red-breasted Merganser	*Mergus serrator*	*o*		*o*	
Ruddy Duck	*Oxyura jamaicensis*	*o*		*o*	
Vultures - Hawks - Falcons					
Black Vulture	*Coragyps atratus*	*o*	*o*	*o*	*r*
Turkey Vulture *	*Cathartes aura*	*c*	*c*	*c*	*o*
Osprey	*Pandion haliaetus*	*u*	*o*	*u*	
Bald Eagle	*Haliaeetus leucocephalus*	*u*	*o*	*o*	*u*
Northern Harrier	*Circus cyaneus*	*o*		*o*	
Sharp-shinned Hawk *	*Accipiter striatus*	*c*	*o*	*c*	*o*
Cooper's Hawk *	*Accipiter cooperii*	*u*	*u*	*o*	*r*
Northern Goshawk	*Accipiter gentilis*	*u*	*o*	*u*	*o*
Red-shouldered Hawk *	*Buteo lineatus*	*u*	*u*	*u*	*u*
Broad-winged Hawk *	*Buteo platypterus*	*c*	*c*	*c*	
Red-tailed Hawk *	*Buteo jamaicensis*	*c*	*c*	*c*	*c*
Rough-legged Hawk	*Buteo lagopus*	*u*		*u*	*u*
Golden Eagle	*Aquila chrysaetos*			*o*	*o*
American Kestrel *	*Falco sparverius*	*c*	*c*	*c*	*u*
Merlin	*Falco columbarius*	*r*		*r*	*r*
Peregrine Falcon	*Falco peregrinus*	*o*	*o*	*o*	*r*
Grouse - Turkey					
Ruffed Grouse *	*Bonasa umbellus*	*a*	*a*	*a*	*a*

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi
Wild Turkey *	*Meleagris gallopavo*	*a*	*a*	*a*	*a*
Ring-necked Pheasant	*Phasianus colchicus*	*o*	*o*	*c*	*c*
Rails - Plovers - Sandpipers					
King Rail	*Rallus elegans*	*r*		*r*	
Virginia Rail *	*Rallus limicola*	*u*	*u*	*u*	*o*
Sora	*Porzana carolina*	*u*	*u*	*u*	
Common Moorhen	*Gallinula chloropus*	*u*	*u*	*u*	
American Coot	*Fulica americana*	*u*		*u*	
Black-bellied Plover	*Pluvialis squatarola*	*r*		*r*	
Lesser Golden Plover	*Pluvialis dominica*	*r*		*r*	
Semipalmated Plover	*Charadrius semipalmatus*	*r*		*r*	
Killdeer *	*Charadrius vociferus*	*c*	*c*	*c*	
Greater Yellowlegs	*Tringa melanoleuca*	*o*		*o*	
Lesser Yellowlegs	*Tringa flavipes*	*o*		*o*	
Solitary Sandpiper	*Tringa solitaria*	*o*	*o*	*o*	
Spotted Sandpiper *	*Actitis macularia*	*c*	*c*	*c*	
Upland Sandpiper	*Bartramia longicauda*	*r*		*r*	
Ruddy Turnstone	*Arenaria interpres*	*r*		*r*	
Sanderling	*Calidris alba*	*o*		*o*	
Semipalmated Sandpiper	*Calidris pusilla*	*u*		*u*	
Least Sandpiper	*Calidris minutilla*	*u*		*u*	
Pectoral Sandpiper	*Calidris melanotus*	*r*		*r*	
Dunlin	*Calidris alpina*	*r*		*r*	
Short-billed Dowitcher	*Limnodromus griseus*	*o*		*o*	
Common Snipe *	*Gallinago gallinago*	*u*	*u*	*u*	*r*
American Woodcock *	*Scolopax minor*	*c*	*c*	*c*	*r*
Gulls - Terns					
Laughing Gull	*Larus atricilla*	*r*	*o*	*o*	
Bonaparte's Gull	*Larus philadelphia*	*o*		*o*	*r*
Ring-billed Gull	*Larus delawarensis*	*a*	*a*	*a*	*a*
Herring Gull	*Larus argentatus*	*c*	*u*	*c*	*c*
Iceland Gull	*Larus glaucoides*				*o*
Lesser Black-backed Gull	*Larus fuscus*		*r*		

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi
Glaucous Gull	*Larus hyperboreus*				*o*
Greater Black-backed Gull	*Larus marinus*	*c*	*c*	*c*	*c*
Caspian Tern	*Sterna caspia*	*o*		*o*	
Royal Tern	*Sterna maxima*		*r*	*r*	
Common Tern	*Sterna hirundo*	*o*	*r*	*o*	
Forster=s Tern	*Sterna forsteri*	*o*		*o*	
Least Tern	*Sterna antillarum*		*r*	*r*	
Sooty Tern	*Sterna fuscata*		*r*	*r*	
Black Tern	*Chilodonias niger*	*o*		*o*	
Doves - Cuckoos - Owls - Goatsuckers - Swifts - Hummingbirds					
Rock Dove *	*Columbia livia*	*a*	*a*	*a*	*a*
Mourning Dove *	*Zenaida macroura*	*a*	*a*	*a*	*a*
Black-billed Cuckoo *	*Coccyzus erythropthalmus*	*u*	*u*	*u*	
Yellow-billed Cuckoo *	*Coccyzus americanus*	*u*	*u*	*u*	
Common Barn Owl *	*Tyto alba*	*o*	*o*	*o*	*o*
Eastern Screech Owl *	*Otus asio*	*c*	*c*	*c*	*c*
Great Horned Owl *	*Bubo virginianus*	*c*	*c*	*c*	*c*
Snowy Owl	*Nyctea scandiaca*				*r*
Barred Owl *	*Strix varia*	*u*	*u*	*u*	*u*
Common Nighthawk	*Chordeiles minor*	*o*		*o*	
Whip-poor-will *	*Caprimulgus vociferus*	*u*	*u*	*u*	
Chimney Swift *	*Chaetura pelagica*	*c*	*c*	*c*	
Ruby-throated Hummingbird *	*Archilochus colubris*	*c*	*c*	*c*	
Belted Kingfisher *	*Ceryle alcyon*	*c*	*c*	*c*	*o*
Red-headed Woodpecker	*Melanerpes erythrocephalus*	*r*	*r*	*r*	
Red-bellied Woodpecker *	*Melanerpes carolinus*	*u*	*u*	*o*	*o*
Yellow-bellied Sapsucker	*Sphyrapicus varius*	*o*	*o*	*o*	*r*
Downy Woodpecker *	*Picoides pubescens*	*c*	*c*	*c*	*c*
Hairy Woodpecker *	*Picoides villosus*	*c*	*c*	*c*	*c*
Yellow-shafted Flicker *	*Colaptes auratus*	*a*	*a*	*a*	*u*
Pileated Woodpecker *	*Dryocopus pileatus*	*c*	*c*	*c*	*c*
Olive-sided Flycatcher	*Contopus borealis*	*u*		*u*	
Eastern Wood-Pewee *	*Contopus virens*	*c*	*c*	*c*	

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi
Yellow-bellied Flycatcher	*Empidonax flaviventris*	*u*		*u*	
Acadian Flycatcher	*Empidonax virescens*	*r*	*r*		
Alder Flycatcher *	*Empidonax alnorum*	*o*	*o*	*o*	
Willow Flycatcher *	*Empidonax traillii*	*u*	*u*	*u*	
Least Flycatcher	*Empidonax minimus*	*c*	*c*	*c*	
Eastern Phoebe *	*Sayornis phoebe*	*c*	*c*	*c*	
Great Crested Flycatcher *	*Myiarchus crinitus*	*c*	*c*	*c*	
Eastern Kingbird *	*Tyrannus tyrannus*	*c*	*c*	*c*	
Lark - Swallows - Jays - Crows					
Horned Lark	*Eremophila alpestris*				*o*
Purple Martin	*Progne subis*	*o*		*o*	
Tree Swallow *	*Tachycineta bicolor*	*a*	*a*	*a*	
Northern Rough-winged Swallow *	*Stelgidopteryx serripennis*	*u*	*u*	*u*	
Bank Swallow *	*Riparia riparia*	*u*	*u*	*u*	
Cliff Swallow *	*Hirundo pyrrhonota*	*u*	*u*	*u*	
Blue Jay *	*Cyanocitta cristata*	*a*	*a*	*a*	*a*
American Crow *	*Corvus brachyrhynchos*	*a*	*a*	*a*	*a*
Fish Crow *	*Corvus ossifragus*	*u*	*u*	*u*	
Common Raven	*Corvus corax*	*o*	*o*	*o*	*u*
Titmice - Nuthatches - Wrens					
Black-capped Chickadee *	*Parus atricapillus*	*a*	*a*	*a*	*a*
Boreal Chickadee	*Parus hudsonicus*				*r*
Tufted Titmouse *	*Parus bicolor*	*c*	*c*	*c*	*c*
Red-breasted Nuthatch	*Sitta canadensis*	*u*		*u*	*u*
White-breasted Nuthatch *	*Sitta carolinensis*	*u*	*u*	*u*	*u*
Brown Creeper *	*Certhia americana*	*u*	*u*	*u*	*u*
Carolina Wren *	*Thyrothorus ludovicianus*	*u*	*u*	*u*	*u*
House Wren *	*Troglodytes aedon*	*c*	*c*	*c*	*c*
Winter Wren	*Troglodytes troglodytes*	*o*		*o*	*o*
Marsh Wren *	*Cistothorus palustris*	*o*		*o*	
Kinglets - Thrushes - Thrashers					
Golden-crowned Kinglet	*Regulus satrapa*	*u*	*u*	*u*	
Ruby-crowned Kinglet	*Regulus calendula*	*c*	*u*	*c*	
Blue-gray Gnatcatcher *	*Polioptilla caerulea*	*u*	*u*	*u*	

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi
Eastern Bluebird *	*Sialia sialis*	*u*	*u*	*u*	*o*
Veery *	*Catharus fuscescens*	*u*	*u*	*u*	
Gray-cheeked Thrush	*Catharus minimis*	*o*		*o*	
Swainson=s Thrush	*Catharus ustulatus*	*o*		*o*	
Hermit Thrush *	*Catharus guttatus*	*o*	*o*	*o*	
Wood Thrush *	*Hylocichla mustelina*	*u*	*u*	*u*	
American Robin *	*Turdus migratorius*	*a*	*a*	*a*	*u*
Gray Catbird *	*Dumetalla carolinensis*	*a*	*a*	*a*	*r*
Northern Mockingbird *	*Mimus polyglottos*	*c*	*c*	*c*	*c*
Brown Thrasher *	*Toxostoma rufum*	*c*	*c*	*c*	
Waxwing - Shrikes - Starling					
Cedar Waxwing *	*Bombycilla cedrorum*	*u*	*u*	*u*	
Northern Shrike	*Lanius excubitor*	*r*			*r*
Loggerhead Shrike	*Lanius ludovicianus*	*r*			*r*
European Starling *	*Sturnus vulgaris*	*a*	*a*	*a*	*a*
Vireos - Wood Warblers					
White-eyed Vireo	*Vireo griseus*	*o*	*o*	*o*	
Solitary Vireo	*Vireo solitarius*	*u*		*u*	
Yellow-throated Vireo *	*Vireo flavifrons*	*c*	*c*	*c*	
Warbling Vireo *	*Vireo gilvus*	*c*	*c*	*c*	
Philadelphia Vireo	*Vireo philadelphicus*	*u*		*u*	
Red-eyed Vireo *	*Vireo olivaceus*	*c*	*c*	*c*	
Blue-winged Warbler *	*Vermivora pinus*	*c*	*c*	*c*	
Golden-winged Warbler *	*Vermivora chrysoptera*	*u*	*u*	*u*	
Tennessee Warbler	*Vermivora peregrina*	*c*		*c*	
Orange-crowned Warbler	*Vermivora celata*	*r*		*r*	
Nashville Warbler	*Vermivora ruficapilla*	*o*	*r*	*o*	
Northern Parula	*Parula americana*	*o*		*o*	
Yellow Warbler *	*Dendroica petechia*	*c*	*c*	*c*	
Chestnut-sided Warbler *	*Dendroica pensylvanica*	*u*	*u*	*u*	
Magnolia Warbler	*Dendroica magnolia*	*u*	*r*	*u*	
Cape May Warbler	*Dendroica tigrina*	*o*		*u*	
Black-throated Blue Warbler *	*Dendroica caerulescens*	*o*	*r*	*o*	
Myrtle Warbler	*Dendroica coronata*	*u*		*u*	*r*

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi
Black-throated Green Warbler *	*Dendroica virens*	*o*		*o*	
Blackburnian Warbler	*Dendroica fusca*	*o*	*o*	*o*	
Pine Warbler *	*Dendroica pinus*	*u*	*u*	*u*	
Prairie Warbler *	*Dendroica discolor*	*u*	*u*	*u*	
Palm Warbler	*Dendrioca palmarum*	*u*		*u*	
Bay-breasted Warbler	*Dendrioca castanea*	*u*		*u*	
Blackpoll Warbler	*Dendroica striata*	*u*		*u*	
Cerulean Warbler *	*Dendroica cerulea*	*u*	*u*	*u*	
Black and White Warbler *	*Mniotilta varia*	*c*	*c*	*c*	
American Redstart *	*Setophaga ruticilla*	*c*	*c*	*c*	
Worm-eating Warbler *	*Helmitheros vermivorus*	*u*	*u*	*u*	
Ovenbird *	*Seiurus aurocapillus*	*c*	*c*	*c*	
Northern Waterthrush	*Seiurus noveboracensis*	*u*	*u*	*u*	
Louisiana Waterthrush *	*Seiurus motacilla*	*u*	*c*	*u*	
Kentucky Warbler	*Oporornis formosus*	*r*			
Connecticut Warbler	*Oporornis agilis*			*o*	
Mourning Warbler	*Oporornis philadelphia*	*u*		*u*	
Common Yellowthroat *	*Geothlypis trichas*	*c*	*c*	*c*	
Hooded Warbler *	*Wilsonia citrina*	*u*	*u*	*u*	
Wilson=s Warbler	*Wisonia pusilla*	*u*		*u*	
Canada Warbler	*Wilsonia canadensis*	*u*	*o*	*u*	
Yellow-breasted Chat	*Icteria virens*	*o*	*o*		
Tanagers - Sparrows					
Scarlet Tanager *	*Piranga olivacea*	*u*	*u*	*u*	
Northern Cardinal *	*Cardinalis cardinalis*	*c*	*c*	*c*	*c*
Rose-breasted Grosbeak *	*Pheucticus ludovicianus*	*u*	*u*	*u*	*u*
Indigo Bunting *	*Passerina cyanea*	*c*	*c*	*c*	
Eastern Towhee *	*Pipilo erythrophthalmus*	*u*	*u*	*u*	*r*
American Tree Sparrow	*Spizella arborea*	*u*		*c*	*c*
Chipping Sparrow *	*Spizella passerina*	*c*	*c*	*c*	*u*
Field Sparrow *	*Spizella pusilla*	*u*	*u*	*u*	*c*
Vesper Sparrow	*Pooecetes gramineus*	*r*	*o*	*r*	
Savannah Sparrow	*Passerculus sandwichensis*	*o*	*o*	*o*	*r*
Fox Sparrow	*Passerella iliaca*	*u*		*u*	

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi
Song Sparrow *	*Melospiza melodia*	*c*	*c*	*c*	*c*
Lincoln's Sparrow	*Melospiza lincolnii*	*r*		*r*	
Swamp Sparrow *	*Melospiza georgiana*	*u*	*u*	*u*	*o*
White-throated Sparrow	*Zonotrichia albicollis*	*c*		*c*	*c*
White-crowned Sparrow	*Zonotrichia leucophrys*	*u*		*u*	*u*
Dark-eyed Junco *	*Junco hyemalis*	*c*	*r*	*c*	*c*
Lapland Longspur	*Calcarius lapponicus*				*o*
Snow Bunting	*Plectrophenax nivalis*			*r*	*o*
Blackbirds - Finches					
Bobolink *	*Dolichonyx oryzivorus*	*u*	*u*	*u*	
Red-winged Blackbird *	*Agelaius phoeniceus*	*c*	*c*	*c*	*u*
Eastern Meadowlark *	*Sturnella magna*	*u*	*u*	*u*	
Rusty Blackbird	*Euphagus carolinus*	*u*	*u*	*u*	
Common Grackle *	*Quiscalus quiscula*	*a*	*a*	*a*	*u*
Brown-headed Cowbird *	*Molothrus ater*	*c*	*c*	*c*	*u*
Orchard Oriole	*Icterus spurius*	*u*	*u*	*u*	
Baltimore Oriole *	*Icterus galbula*	*c*	*c*	*c*	
Pine Grosbeak	*Pinicola enucleator*				*r*
Purple Finch	*Carpodacus purpurens*	*u*	*u*	*u*	*u*
House Finch *	*Carpodacus mexicanus*	*c*	*c*	*c*	*c*
Red Crossbill	*Loxia curvirostris*				*r*
White-winged Crossbill	*Loxia leucoptera*				*r*
Common Redpoll	*Carduelis flammea*				*r*
Hoary Redpoll	*Carduelis hornemanni*				*r*
Pine Siskin	*Carduelis pinus*				*r*
American Goldfinch *	*Carduelis tristis*	*c*	*c*	*c*	*u*
Evening Grosbeak	*Coccusthraustes vespertina*			*u*	*u*
House Sparrow *	*Passer domesticus*	*a*	*a*	*a*	*a*

Table C-1
Bird Species of the West Point Military Reservation

Common Name	Scientific Name	Season [1, 2]			
		Sp	Su	Fa	Wi

* - indicates probable nesting on the reservation

[1] Sp - Spring (March, April, May)
Su - Summer (June, July, August)
Fa - Fall (September, October, November
Wi - Winter (December, January, February)

[2] Relative abundance
a - abundant (species encountered very often and numerous on the reservation)
c - common (species easily found in their preferred habitat)
u - uncommon (species less easily found, but regularly occurring at West Point)
o - occasional (species that have been observed in the area, but sporadically at least once each year
r rare (very infrequently observed species, likely to be seen at least once over a 5-year period)

Source: A Checklist for the Birds of the West Point Military Reservation

Table C-2 Fish Species Common to the West Point Military Reservation

Common Name	Latinized Name	Beaver Pond	Brooks Hollow Brook	Bull Pond	Cascade Brook	Cat Hollow Brook	Cragston Creek	Cragston Lake (lower)	Cranberry Pond	Cranberry Brook	Crown Brook	Crows Nest Brook	Dassori Pond Outlet	Deep Hollow Brook	Delafield Pond Outlet	Hemlock Brook	Highland Brook	Johnson Meadow Brook	Kinsley Farm Brook	Lake Frederick	Lake Georgina	Long Pond Creek	Lusk Reservoir	Mine Lake	Mineral Springs Brook	Owl Swamp	Popolopen Brook	Popolopen Lake	Queensboro Brook	Round Pond	Sinclair Pond Brook	Stilwell Lake	Stony Lonesome Brook	Trout Brook	Weyants Pond	Wilkins Hollow Brook	Wilkins Pond	Zints Brook	Constitution Island	
Freshwater Eels	**Anguillidae**																																							
American eel	*Anguilla rostrata*							?	?			?							?						?		?	?		?		?		?	?				?	12
Herrings	**Clupeidae**																																							
alewife	*Alosa pseudoharengus*			?																			?					?				?								4
Bullhead Catfish	**Ictaluridae**																																							
yellow bullhead	***Ameiurus natalis***		?	?		?												?	?			?					?	?		?										9
brown bullhead	***Ameiurus nebulosus***	?		?		?		?	?									?			?		?	?			?	?		?		?			?		?			15
channel catfish	***Ictalurus punctatus***																		?	?			?					?				?								5
Suckers	**Catostomidae**																																							
white sucker	*Catostomus commersoni*		?		?									?			?	?									?	?	?			?		?						10
creek chubsucker	*Erimyzon succetta*			¤																							?													2
Minnows	**Cyprinidae**																																							
goldfish	*Carassius auratus*											?								?																				2
triploid grass carp	*Ctenopharyngodon idella*																																		?					1
common carp	*Cyprinus carpio*																						?																	1
cutlips minnow	*Exoglossum maxillingua*																										?													1
common shiner	*Luxillus cornutus*				?									?			?	?									?		?											6
golden shiner	*Notemigonus crysoleucas*	?	?	?	?			?	?								?	?		?	?		?	?			?	?		?		?						?		17
bridle shiner	*Notropis bifrenatus*																												¤											1
spottail shiner	*Notropis hudsonius*																?																							1
bluntnose minnow	*Pimephales notatus*				?																																			1
fathead minnow	*Pimephales promelas*											?									?							?				?					?			5
eastern blacknose dace	*Rhinichthys atratulus*				?	?	?			?	?	?	?	?		?	?	?							?		?		?		?		?	?		?		?		19
longnose dace	*Rhinichthys cataractae*				?	?	?										?								?		?		?					?						8
creek chub	*Semotilus atromaculatus*					?	?			?	?			?		?	?	?				?			?		?		?		?		?	?		?				16
fallfish	*Semotilus corporalis*																										?		?											2
Mudminnows	**Umbridae**																																							
central mudminnow	*Umbra limi*																																						?	1
eastern mudminnow	*Umbra pygmaea*		?															?						?			?													4
Sticklebacks	**Gasterosteidae**																																							
four-spined stickleback	*Apeltes quadrucus*																													?										1
Killifishes	**Cyprinodontidae**																																							
banded killifish	*Fundulus diaphanus*																											?		?										2
Pikes	**Esocidae**																																							
chain pickerel	*Esox niger*	?	?					?	?													?	?	?	?		?	?	?	?		?			?					14
redfin pickerel	*Esox americanus*			?														?									?	?												4
Trout	**Salmonidae**																																							
brook charr	*Salvelinus fontinalis*			?			¤			¤		?											?				?			?										7
brown trout	*Salmo trutta*			?			¤					?					?						?		?		?		?	?				?						10
rainbow trout	*Oncorhynchus mykiss*			?								?											?				?		?	?										6
tiger trout	S. fontinalis x S. trutta			?													?													?										3
Sunfishes	**Centrarchidae**																																							
rock bass	*Ambloplites rupestris*																																							0
blue-spotted sunfish	*Enneacanthus gloriosus*																	?				?					?													3
redbreast sunfish	*Lepomis auritus*									?		?			?		?	?				?			?		?		?					?						10
green sunfish	*Lepomis cyanellus*																			?																				1
pumpkinseed	*Lepomis gibbosus*	?	?	?				?	?								?	?		?	?		?	?			?	?		?		?		?	?	?	?			19
warmouth	*Lepomis gulosus*																			?																				1
bluegill	*Lepomis macrochirus*	?	?	?				?	?								?	?		?	?		?	?			?	?	?	?		?			?		?			18
smallmouth bass	*Micropterus dolomieu*																			?		?						?				?								4
largemouth bass	*Micropterus salmoides*	?	?	?		?		?												?	?	?	?	?	?		?	?	?	?		?		?	?		?			19
black crappie	*Pomoxis nigromaculatus*							?	?											?			?	?				?		?		?			?					9
Perches	**Percidae**																																							
tesselated darter	*Etheostoma olmstedi*																																	?						1
yellow perch	*Perca flavescens*							?	?											?			?	?				?		?		?								8
walleye	*Stizostedion vitreum*																											?				?								2
# Species identified per water body		6	8	13	6	6	5	9	8	4	2	8	1	4	1	2	12	13	3	11	6	7	14	9	8	0	23	18	13	16	2	15	2	10	8	3	5	1	3	
? = Confirmed Presence		6	8	12	6	6	3	9	8	3	2	8	1	4	1	2	12	13	3	11	5	7	14	9	8	0	22	17	12	16	2	14	2	10	8	3	4	1	3	
¤ = Historical Record		0	0	1	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
? = Recent Record but not observed last 10 yrs.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	0	0	

Table C-3
Fish Common to the Hudson River[1]

Scientific Name	Common Name
Acipenser brevirostrum[2,5]	Shortnose sturgeon [6]
Acipenser oxyrhynchus[3,5]	Atlantic sturgeon
Alosa aestivalis[5]	blueback herring
Alosa pseudoharengus[5]	alewife
Alosa sapidissima[3,5]	American shad
Anchoa mitchilli[4]	bay anchovy
Anguilla rostrata	American eel
CATOSTOMIDAE	Suckers
CENTRARCHIDAE	Sunfishes
CLUPEIDAE	Herring
Fundulus heteroclitus[4]	mummichog
Microgadus tomcod[3,5]	American tomcod
Morone americana	white perch
Morone saxatiles[5, 6]	striped bass
Pomatomus saltatrix [7]	bluefish
Trinectes maculatus[4]	hogchoker

[1] *This is a partial listing of common species that may be found in the Hudson River near West Point. The USWF and NYSDEC have identified a total of 66 species as residents or migrants.*
[2] *Federally listed endangered species.*
[3] *Species have show a significant population decline in recent years.*
[4] *Species use river for spawning*
[5] *Use river as migratory pathway to spawn in upstream freshwater.*
[6] *The scientific name for striped bass and the common name for the Shortnose sturgeon have been changed to reflect current nomenclature. In the document referenced below (USMA, 1980b), the names of these species are listed as Roccus saxatilis (striped bass) and short-nosed sturgeon.*
[7] *Junveniles may forage offshore of West Point during periods of low freshwater flow.*

Source: USMA, 1980b.

Table C-4
Odonata Observed on USMA

Family (Scientific Name)	**Family (Common Name)**
Calopterygidae	**Broad-winged Damselflies**
Calopteryx aequabilis	river jewelwing
Calopteryx maculata	ebony jewelwing
Lestidae	**Spread-winged Damselflies**
Lestes congener	spotted spreadwing
Lestes dryas	emerald spreadwing
Lestes eurinas	amber-winged spreadwing
Lestes forcipatus	sweetflag spreadwing
Lestes inaequalis	elegant spreadwing
Lestes rectangularis	slender spreadwing
Lestes vigilax	swamp spreadwing
Coenagrionidae	**Pond Damselflies**
Amphiagrion saucium	eastern red damselfly
Argia fumipennis violacea	violet dancer
Argia translata	dusky dancer
Chromagrion conditum	openwing dancer
Enallagma aspersum	azure bluet
Enallagma civile	familiar bluet
Enallagma cyathigerum	northern bluet
Enallagma divagans	turquoise bluet
Enallagma durum	big bluet
Enallagma ebrium	marsh bluet
Enallagma exsulans	stream bluet
Enallagma geminatum	skimming bluet
Enallagma hageni	Hagen=s bluet
Enallagma laterale	New England bluet
Enallagma signatum	orange bluet
Enallagma traviatum	slender bluet
Enallagma vesperum	vesper bluet
Ischnura kellicotti	lilypad forktail
Ischnura posita	fragile forktail

Table C-4
Odonata Observed on USMA

Family (Scientific Name)	**Family (Common Name)**
Ischnura verticalis	eastern forktail
Nehalennia gracilis	sphagnum sprite
Nehalennia irene	sedge sprite
Aeshnidae	**Darners**
Aeshna canadensis	Canada darner
Aeshna clepsydra	mottled darner
Aeshna mutata	spatterdock darner
Aeshna tuberculifera	black-tipped darner
Aeshna umbrosa	shadow darner
Aeshna verticalis	green-striped darner
Anax junius	green darner
Anax longipes	comet darner
Basiaeschna janata	springtime darner
Boyeria vinosa	fawn darner
Epiaeschna heros	swamp darner
Gomphaeschna furcillata	harlequin darner
Nasiaeschna pentacantha	Cyrano darner
Gomphidae	**Clubtails**
Arigomphus furcifer	lilypad clubtail
Arigomphus villosipes	unicorn clubtail
Dromogomphus spinosus	black-shouldered spinyleg
Gomphus exilis	lancet clubtail
Gomphus lividus	ashy clubtail
Gomphus spicatus	dusky clubtail
Stenogomphurus rogersi	sable clubtail
Stylogomphus albistylus	least clubtail
Cordulegastridae	**Spiketails**
Cordulegaster diastatops	delta-spotted spiketail
Cordulegaster maculata	twin-spotted spiketail
Cordulegaster obliqua	arrowhead spiketail
Macromiidae	**Cruisers**
Didymops transversa	stream cruiser

Table C-4
Odonata Observed on USMA

Family (Scientific Name)	**Family (Common Name)**
Macromia illinoiensis	Illinois River cruiser
Corduliidae	**Emeralds**
Cordulia shurtleffi	American emerald
Dorocordulia lepida	petite emerald
Dorocordulia libera	racket-tailed emerald
Epicordulia princeps	water prince
Helocordulia uhleri	Uhler=s sunfly
Neurocordulia obsoleta	umber shadowfly
Somatochlora linearis	mocha emerald
Somatochlora tenebrosa	clamp-tipped emerald
Somatochlora walshii	brush-tipped emerald
Somatochlora williamsoni	Williamson=s emerald
Tetragoneuria canis	beaverpond baskettail
Tetragoneuria cynosura	common baskettail
Libellulidae	**Skimmers**
Celithemis elisa	calico pennant
Celithemis eponina	Halloween pennant
Celithemis fasciata	banded pennant
Celithemis martha	Martha=s pennant
Erythemis simplicicollis	eastern pondhawk
Ladona deplanata	blue corporal
Ladona exusta	white corporal
Ladona julia	chalk-fronted corporal
Leucorrhinia frigida	frosted whiteface
Leucorrhinia intacta	dot-tailed whiteface
Libellula auripennis	golden-winged skimmer
Libellula axilena	bar-winged skimmer
Libellula cyanea	spangled skimmer
Libellula incesta	slaty skimmer
Libellula luctuosa	pied skimmer
Libellula needhami	Needham=s skimmer
Libellula pulchella	twelve-spotted skimmer

Table C-4
Odonata Observed on USMA

Family (Scientific Name)	**Family (Common Name)**
Libellula quadrimaculata	four-spotted skimmer
Libellula semifasciata	painted skimmer
Libellula vibrans	great blue skimmer
Nannothemis bella	elfin skimmer
Pachydiplax longipennis	blue dasher
Pantala flavescens	globe glider
Pantala hymenaea	spot-winged glider
Perithemis tenera	eastern amberwing
Plathemis lydia	common whitetail
Sympetrum janeae	Jane-s meadowfly
Sympetrum semicinctum	band-winged meadowfly
Sympetrum vicinum	yellow-legged meadowfly
Tramea carolina	violet-masked glider
Tramea lacerata	black-mantled glider

Source: Soltesz, 1995

Table C-5
West Point Butterflies

Scientific Name	Common Name
Achalarus lyciades	hoary edge
Ancyloxypha numitor	least skipper
*Anthocaris midea**	falcate orangetip
*Asterocampa celtis**	hackberry emperor
*Asterocampa clyton**	tawny emperor
Atrytone logan	Delaware skipper
*Atrytonopsis hianna**	dusted skipper
*Battus philenor***	pipevine swallowtail
*Callophrys augustinus***	brown elfin
Callophrys gryneus	olive hairstreak
Celastrina ladon	spring azure
Cercyonis pegagla	common wood nymph
*Chlosyne harrissii***	Harris= checkerspot
Coenonympha tullia	common ringlet
Colias eurytheme	orange sulfur
Colias philodice	common sulfur
Danaus plexippus	monarch
Enodia anthedon	northern pearly-eye
Epargyreus clarus	silver-spotted skipper
Erynnis baptisiae	wild indigo duskywing
*Erynnis horatius**	Horace=s duskywing
Erynnis icelus	dreamy duskywing
Erynnis juvenalis	Juvenal=s duskywing
Euphydyas phaeton	Baltimore
*Euphyes conspicua**	black dash
*Euphyes dion***	Dion or sedge skipper
Euphyes vestris	dun skipper
Everes comyntas	eastern tailed blue
*Hesperia leonardus***	Leonard=s skipper
*Hesperia metea***	cobweb skipper
Hesperia sassacus	Indian skipper
Limenitis archippus	viceroy
Limenitis astyanax	red-spotted purple

Table C-5
West Point Butterflies

Scientific Name	Common Name
Lycaena phlaeas	little copper
Megisto cymela	little wood satyr
Nymphalis antiopa	mourning cloak
Nymphalis vau-album	Compton=s tortoiseshell
Papilio glaucus	tiger swallowtail
*Papilio polyxenes****	black swallowtail
Papilio troilus	spicebush swallowtail
Phoebis sennae	cloudless sulfur
Phyciodes tharos	pearl crescent
Pieris rapae	cabbage butterfly
Poanes hobomok	hobomok skipper
Poanes massasoit	mulberry-wing
Poanes viator	broad-winged skipper
Poanes zabulon	zabulon skipper
Polites mystic	long dash
Polites origenes	crossline skipper
Polites peckius	Peck=s skipper
Polites themistocles	tawny-edged skipper
*Polygonia comma****	comma
Polygonia interrogationis	question mark
Pompeius verna	little glassy-wing
Pyrgus communis	checkered skipper
Satyrium acadia	acadian hairstreak
Satyrium calanus	banded hairstreak
Satyrium caryaevoris	hickory hairstreak
*Satyrium edwardsii**	Edward=s hairstreak
*Satyrium favonius ontario**	northern hairstreak
Satyrium liparops	striped hairstreak
Satyrium titus	coral hairstreak
Satyrodes appalachia	Appalachian brown
Speyeria cybele	great spangled fritillary
Strymon melinus	gray hairstreak
Thorybes bathyllus	southern cloudywing
Thorybes pylades	northern cloudywing

Table C-5
West Point Butterflies

Scientific Name	Common Name
Thymelicus lineola	European skipper
Vanessa atlantica	red admiral
Vanessa cardui	painted lady
Vanessa virginiensis	American lady
Wallengrenia egeremet	northern broken dash

* rare
** regionally rare
*** rare at West Point

Source: Barbour, 1995d.

Table C-6
Mollusc and Crayfish Species Collected from West Point Waters

Species	Number	Most Abundant Species	
Amnicola cf *grana*	17	*Amnicola limosus*	579
A. limosus	579	*Planorbella trivolvis*	136
Aplexa elongata	10	*Pisidium casertanum*	152
Cambarus bartonii	4	*Pyganodon cataracta*	120
Campeloma decisum	20	*Musculium partumeium*	130
Cipangopaulidina chinensis	4	**67 % of total individuals**	**1117**
Elliptio complanata	27		
Ferrissia californica	14	**Less Common Species**	
F. walkeri	5	*Cambarus bartonii*	4
Fossaria obrussa	4	*Cipangopaulidina chinensis*	4
F. rustica	6	*F. walkeri*	5
Gyraulus circumstriatus	21	*Fossaria obrussa*	4
G. parvus	13	*F. rustica*	6
Helisoma anceps	30	*Micromenetus dilatatus*	1
Micromenetus dilatatus	1	*Pisidium ferrugineum*	2
Musculium partumeium	130	*P. henslowanum*	4
Musculium securis	56	*P.* cf. *insigne*	3
Orconectes limosus	14	*P. ventricosum*	4
Physella ancillaria	17	*Sphaerium nitidum*	1
P. gyrina	65	**2 % of total individuals**	**38**
P. heterostropha	82		
Pisidium casertanum	152		
P. ferrugineum	2		
P. henslowanum	4		
P. cf. *insigne*	3		
Planobid sp. novo	1		
Planorbella trivolvis	136		
P. ventricosum	4		
P. ventricosum f. *rotundatum*	26		
Probythinella lacustris	11		
Pseudosuccinea columella	25		
Pyganodon cataracta	120		
Sphaerium nitidum	1		
S. simile	20		
Valvata tricainata	38		
Viviparus georgiannus	16		
Total individuals	**1678**		

APPENDIX D

Water Quality Data for Selected USMA Lakes, Ponds, and Streams

Table D-1
Water Quality Data – Crown Brook

Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolved Solids (mg/l)	Temperature (C°)
01/10/80	12.72	5.6	0.05	0.01	153	39.0	0.1	62	1.0
03/04/80	6.90	5.4	0.90	0.01	20	11.3	0.1	14	4.0
04/08/80	9.60	5.3	0.65	0.01	1	1.0	0.1	16	10.0

Source: USMA, 1980b.

Table D-2
Water Quality Data - Bull Pond Outlet

Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolved Solids (mg/l)	Temperature (C°)
12/20/79	10.30	6.6	0.05	0.01	30	1.4	0.1	46	2.3
03/05/80	10.00	6.7	0.10	0.01	7	5.0	0.1	400	1.5
04/08/82	11.22	5.7	0.08	0.01	4	2.6	0.1	66	7.0

Source: USMA, 1980b.

Table D-3
Water Quality Data - Wilkins Pond

Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolved Solids (mg/l)	Temperature (C°)
12/20/79	12.70	6.3	0.05	0.01	34	1.0	0.1	36	1.0
03/04/80	12.20	6.0	0.24	0.01	11	1.9	0.1	50	4.0
04/08/80	11.30	5.8	0.25	0.01	8	1.5	0.1	34	11.0

Source: USMA, 1980b.

Table D-4
Water Quality Data - Cascade Brook[1]

Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolved Solids (mg/l)	Temperature (C°)
10/78	13.30	7.7	-	-	4	<5.0	-	-	3.0
12/19/79	13.06	7.7	<0.05	<0.01	46	2.5	<0.1	74	0.0
03/04/80	12.84	6.6	0.16	<0.01	24	2.3	<0.1	28	1.0
04/08/80	10.44	6.2	0.25	0.01	6	<1.0	<0.1	72	11.3

Source: USMA, 1980b.

[1] Samples were taken at the confluence with Highland Brook.

Table D-5
Water Quality Data - Cragston Creek[1]

Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolved Solids (mg/l)	Iron (mg/l)	Temperature (C°)
12/19/79	13.46	7.1	0.05	0.01	-	1.1	0.1	72	0.15	0.0
02/20/80	12.64	7.0	0.05	0.01	-	1.0	0.13	80	0.70	2.0
03/21/80	12.30	7.2	0.28	0.01	-	3.7	0.28	74	3.10	5.5

Source: USMA, 1980b.
[1] Samples were taken near Route 9W.

Table D-6
Water Quality Data - Crows Nest Brook

Location	Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolved Solids (mg/l)	Temperature (C°)
Station 6A (at Storm king Highway)	12/19/79	13.01	7.7	<0.05	<0.01	2	1.1	<0.1	120	1.0
	03/05/80	13.22	6.5	0.39	<0.01	8	2.1	<0.1	134	1.5
	04/08/80	17.10	6.2	0.35	<0.01	2	<1.0	<0.1	76	8.2
Station 6B (Near Post Elementary School)	12/19/79	12.92	6.0	<0.05	<0.01	2	1.1	<0.1	44	1.0
	03/05/80	12.68	6.0	<0.05	<0.01	10	2.6	<0.1	36	4.5
	04/08/80	11.82	5.8	0.08	<0.01	5	1.1	<0.1	30	10.2
Station 6C (Below Lee Road)	12/19/79	14.20	7.6	<0.05	<0.01	14	2.0	<0.1	124	-
	03/05/80	13.40	7.4	0.29	<0.01	8	10.2	<0.1	336	1.5
	04/08/80	11.48	6.7	0.19	<0.01	3	1.4	<0.1	140	10.3

Source: USMA, 1980b.

Table D-7
Water Quality Data - Highland Brook

Location	Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolve d Solids (mg/l)	Temperature (C°)
Station 5A (Outlet of Little Bog Meadow)	12/20/79	12.92	6.0	<0.05	<0.01	2	1.1	<0.1	44	2.0
	03/04/80	12.68	6.0	<0.05	<0.01	10	2.6	<0.1	36	2.5
	04/08/80	11.82	5.8	0.08	<0.01	5	1.1	<0.1	30	9.5
Below confluence with Cascade Brook	10/79	12.50	7.9	-	-	<2	<5.0	-	-	5.5
Station 5C (at Highland Falls water intake reservoir)	12/20/79	13.70	7.0	<0.05	<0.01	93	<1.0	<0.1	78	0.5
	03/04/80	13.28	6.6	0.21	<0.01	14	1.9	<0.1	54	2.0
	04/08/80	12.12	6.3	0.13	<0.01	2	<1.0	<0.1	74	9.3

Source: USMA, 1980b.

Table D-8
Water Quality Data - Long Pond[1]

Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolved Solids (mg/l)	Temperature (C°)
12/20/79	11.84	7.0	0.05	0.01	29	1.0	0.1	80	-
03/04/80	12.30	6.4	0.15	0.01	9	2.1	0.1	76	5.0
04/08/80	11.50	6.7	0.16	0.01	6	1.9	0.1	16	9.5

Source: USMA, 1980b.

[1] Samples were taken at the Stony Lonesome Intake.

Table D-9
Water Quality Data - Popolopen Brook

Location	Date of Sample	Dissolved Oxygen (mg/l)	pH (Standard Units)	Nitrates (mg/l-N)	Nitrites (mg/l-N)	Total Suspended Solids (mg/l)	BOD (mg/l)	Total Phosphorus (mg/l-P)	Total Dissolved Solids (mg/l)	Iron (mg/l)	Lead (mg/l)	Temperature (C°)
Station 1A (Skeet Area)	12/20/79	12.50	6.8	<0.05	<0.01	14	2.7	<0.1	52	0.22	<0.05	1.0
	03/04/80	11.86	6.9	0.06	<0.01	7	1.0	<0.1	16	0.12	0.05	4.5
	04/08/80	11.42	6.5	<0.05	<0.01	6	1.6	<0.1	54	0.21	<0.05	9.0
Station 1B (upstream of skeet area)	12/20/79	12.62	7.0	<0.05	<0.01	6	2.1	<0.1	64	0.43	<0.05	1.0
	03/04/80	11.90	6.6	<0.05	<0.01	8	1.4	<0.1	46	0.10	<0.05	4.5
	04/08/80	12.46	6.4	<0.05	<0.01	8	1.5	<0.1	50	0.19	<0.05	9.0
Station 1C (downstream of skeet area)	12/20/79	11.90	6.8	<0.05	<0.01	2	1.4	<0.1	124	0.21	<0.05	1.0
	03/04/80	11.82	6.5	0.07	<0.01	4	2.7	<0.1	48	0.48	<0.05	4.0
	04/08/80	11.60	6.6	<0.05	<0.01	8	20.0	<0.1	46	0.46	<0.05	8.5
Station 8A (at Stilwell Lake outlet)	12/20/79	12.20	7.0	0.05	0.01	44	1.0	0.1	56			1.5
	03/04/80	13.62	6.5	0.05	0.01	8	1.7	0.1	34			3.5
	04/09/80	13.04	6.5	0.05	0.01	2	1.1	0.1	52			10.0
Station 8C (at Camp Shea Road)	12/20/79	13.30	7.2	0.05	0.01	42	1.1	0.1	80			2.0
	03/04/80	12.30	6.9	0.10	0.01	13	2.0	0.1	30			3.5
	04/09/80	12.46	6.3	0.05	0.01	15	2.9	0.1	42			10.0

Source: USMA, 1980b.

APPENDIX E

Recorded Fish Harvest and Stocking Data for Selected USMA Lakes

Table E-1
Recorded Fish Harvest for Bull Pond

Species	Mean (›81-‹87)	Range (›81-‹87)	1995 Total
Trout	1,397	656-1,739	416
Largemouth Bass	2	0-9	1
Bluegill/Sunfish	122	12-244	5
Crappie	4	0-12	0
Bullhead	22	13-33	0
Yellow Perch	7	0-16	0
Chain Pickerel	<1	0-1	0

Source: USMA, 1994a; Beemer, 1996c.

Table E-2
Recorded Fish Harvest for Mine Lake

Species	Mean (›83-‹87)	Range (›83-‹87)	1995 Total
Largemouth Bass	32	14 - 61	0
Bluegill/Sunfish	77	12 - 144	28
Crappie	37	2 - 84	13
Channel Catfish	1	0 - 3	0
Bullhead	2	0 - 8	2
Yellow Perch	11	2 - 23	3
Chain Pickerel	7	0 -12	8

Source: USMA, 1994a; Beemer, 1996c.

Table E-3
Recorded Fish Harvest for Popolopen Lake

Species	Mean (›81-‹87)	Range (›81-‹87)	1995 Total
Largemouth Bass	348	141 - 664	9
Bluegill/Sunfish	656	345 - 925	156
Crappie	234	81 - 525	25
Channel Catfish	17	5 - 34	4
Bullhead	37	9 - 60	4
Yellow Perch	197	52 - 341	118
Walleye	10	2 - 36	2
Tiger Muskie	<1	0 - 2	Not reported
Chain Pickerel	46	8 - 110	15

Source: USMA, 1994a; Beemer, 1996c.

Table E-4
Recorded Fish Harvest for Round Pond

	Mean (›81-‹87)	Range (›81-‹87)	1995 Total
Trout [1]	1239	697 - 1,647	627
Largemouth Bass	22	3 - 47	4
Bluegill/Sunfish	171	72 - 368	112
Crappie	4	0 - 14	0
Bullhead	4	0 - 18	0
Yellow Perch	5	0 - 7	4

[1] According to a 1981 creel survey (USFWS), the trout catch from Round Pond is under-reported by 58 percent.
Source: USMA, 1994a; Beemer, 1996c.

Table E-5
Recorded Fish Harvest for Stilwell Lake

Species	Mean (›81-‹87)	Range (›81-‹87)	1995 Total
Largemouth Bass	192	127 - 299	6
Bluegill/Sunfish	709	298 - 1,124	77
Crappie	226	105 - 444	37
Channel Catfish	3	0 - 6	0
Bullhead	9	1 - 39	0
Yellow Perch	51	24 - 114	6
Walleye	<1	0 - 2	0
Tiger Muskie	<1	0 - 1	0
Chain Pickerel	46	13 - 133	2

Source: USMA, 1994a; Beemer, 1996c.

Table E-6
Summary of 1995 Harvest Data

	Fish Species									
Waterbody	Bass	All Sunfish	Crappie	Channel Catfish	Bullhead	Yellow Perch	Walleye	Chain Pickerel	Trout	Total
Round Pond	4	112	0	0	0	4	0	0	627	747
Bull Pond	1	5	0	0	0	0	0	0	416	422
Popolopen Lake	9	156	25	4	4	118	2	15	0	333
Lake Frederick	2	130	8	29	3	3	0	0	0	175
Cranberry Pond	1	6	0	0	0	166	0	0	0	173
Stilwell Lake	6	77	37	0	0	6	0	2	0	128
Popolopen Brook	0	0	0	0	0	0	0	0	88	88
Mine Lake	0	28	13	0	2	3	0	8	0	54
Wilkins Pond	2	45	0	0	1	0	0	0	0	48
Cragston Lakes	0	1	34	0	0	5	0	1	0	41
Lusk Reservoir	0	0	1	1	1	0	0	1	17	21
Weyants Pond	0	18	0	0	0	0	0	0	0	18
Beaver Pond	1	0	0	0	0	0	0	6	0	7
Lake Georgina	0	0	0	0	0	0	0	0	0	0
Total	26	578	118	34	11	305	2	33	1148	2255

Source: USMA, 1994a; Beemer, 1996c.

Table E-7
1995 Fish Stocking Record for Lusk Reservoir

Species	Month	Size	Number
Brook Trout	March	8	250
RainbowTrout	March	9	400
Rainbow Trout	May	14*	100

Purchased with proceeds from sale of USMA fishing permits. All other fish provided by U.S. Fish and Wildlife Service.
Source: USMA, 1994a; Beemer, 1996c.

Table E-8
Popolopen Lake Stocking History

Species	Year	Size	Number
Walleye	1954	fingerling	39,786
	1955	fingerling	30,765
	1970	fingerling	700
	1971	fingerling	600
	1972	fingerling	1,400
	1974	fry	250,000
	1976	fry	250,000
	1977	fry	250,000
	1978	fry	300,000
	1979	fingerling	27,800
	1980	fry	24,000
	1983	fry	535,000
Channel Catfish	1979	3 - 4 inches	1,400
	1981	3 - 4 inches	7,800
	1983	3 - 4 inches	8,000
	1987	3 - 4 inches	10,300
Tiger Muskie	1980	4 - 7 inches	250
	1981	9.5 inches	750
	1983	9.5 inches	250
Largemouth Bass	1942-47	?	16,400
	1980	fry	700
	1981	fry	4,800
Trout	1942-47	fingerling	10,000
Fathead Minnow	1978	2 inches	11,000
	1980	2 inches	8,000
	1983	2 inches	24,000
	1985	2 inches	14,285

Source: USMA, 1994a; Beemer, 1996c.

Table E-9
Recorded Fish Transfers to Beaver Pond

Species	Year	Size	Number
Largemouth Bass	1970, 1971	8 - 14 inches fingerlings	45,500
Chain Pickerel	1972	6 - 14 inches	125
Golden Shiner	1971	fingerlings	2,000

Source: USMA, 1994a; Beemer, 1996c.

Table E-10
Fish Stocking in Weyants Pond

Species	Year	Size	Number
Triploid Grass Carp (*Ctenopharyngodon idella*)	1998	12 inches	400

Source: Beemer, 2002. Personal comm.

APPENDIX F

Wetlands on USMA

Table F-1
Wetlands by Predominant USFWS Class

Wetland	Total Acreage	Acreages Per Class[1]	Wetland	Total Acreage	Acreages Per Class
WP-A1	3.4	PSS 3.4	WP-A22	1.8	POF 1.8
WP-B1	11.4	POF 7.2, PEM 1.9, PSS 2.3	WP-B22	1.7	PEM 0.8, PSS 0.9
WP-A2	0.4	POF 0.4	WP-A23	0.3	POF 0.3
WP-A3	0.1	POF 0.1	WP-A24	10.4	PEM 10.4
WP-A4	0.7	POF 0.7	WP-B24	16.6	POF 8.0, PEM 8.6
WP-B4	0.9	POF 0.9	WP-A26	21.0	POF 21.0
WP-C4	4.3	POF 4.3	WP-A28	2.4	POF 2.4
WP-D4	1.4	POF 1.4	WP-B28	0.9	POF 0.9
WP-A5	0.7	PEM 0.7	WP-A29	1.5	POF 1.5
WP-A9	1.4	POF 1.4	WP-B29	0.7	POF 0.7
WP-A10	18.8	POF 18.8	WP-A31	1.9	POF 1.9
WP-B10	1.4	POF 1.4	WP-A33	3.2	POF 3.2
WP-C10	0.7	POF 0.7	WP-B33	6.2	POF 5.7, PEM 0.5
WP-A11	9.6	POF 9.6	WP-A34	37.5	POF 7.9, PEM 19.7, PSS 9.9
WP-B11	2.1	PSS 2.1	WP-B34	6.4	POF 6.4
WP-C11	2.0	POF 2.0	WP-C34	2.0	POF 2.0
WP-D11	0.6	POF 0.6	WP-D34	1.0	POF 1.0
WP-A14	0.7	POF 0.7	WP-A35	16.2	POF 6.5, PEM 9.7
WP-B14	0.3	POF 0.3	WP-B35	1.0	POF 1.0
WP-A15	29.0	POF 12.5, PEM 11.5, PSS 5.0	WP-C35	3.2	POF 2.9, PEM 0.3
WP-B15	4.7	POF 4.7	WP-A36	2.5	PEM 2.5
WP-A16	1.8	POF 1.8	WP-B36	1.9	POF 1.9
WP-B16	4.8	POF 4.8	WP-C36	0.2	POF 0.2
WP-C16	0.5	POF 0.5	WP-A37	14.6	POF 12.2, PEM 0.5, PSS 1.9

Table F-1
Wetlands by Predominant USFWS Class

Wetland	Total Acreage	Acreages Per Class[1]	Wetland	Total Acreage	Acreages Per Class
WP-A17	3.4	POF 3.4	WP-B37	20.0	POF 20.0
WP-B17	13.1	POF 8.2, PSS 4.9	WP-C37	0.3	POF 0.3
WP-A21	7.1	POF 4.5, PEM 2.6	WP-D37	0.4	POF 0.4
WP-A38	9.2	POF 1.9, PEM 7.3	WP-D59	0.6	PEM 0.6
WP-B38	1.7	POF 1.7	WP-E59	0.7	PSS 0.7
WP-A41	5.9	POF 3.9, PEM 2.0	WP-F59	5.1	PEM 0.7, PSS 4.4
WP-A42	0.2	POF 0.2	WP-G59	0.3	PEM/PSS 0.3
WP-B42	0.2	POF 0.2	WP-A60	0.5	POF 0.5
WP-C42	0.5	POF 0.5	WP-B60	1.9	POF 1.6, PEM 0.3
WP-A43	25.1	POF 2.2, PEM 13.4, PSS 9.5	WP-C60	2.3	POF 1.5, PEM 0.8
WP-B43	0.2	POF 0.2	WP-D60	1.0	POF 1.0
WP-A46	2.6	POF 2.5, PEM O.1	WP-E60	1.9	PEM 1.9
WP-B46	0.5	POF 0.5	WP-A63	0.3	POF 0.3
WP-A47	9.3	POF 5.6, PEM 3.7	WP-A65	1.7	PEM 1.7
WP-A48	8.4	POF 8.4	WP-A70	9.2	POF 0.7, PEM 8.5
WP-B48	2.0	POF 2.0	WP-A71	7.5	POF 3.9, PEM 1.3, PSS 2.3
WP-A49	7.5	POF 3.3, PEM 2.6, PSS 1.6	WP-A73	0.6	PSS 0.6
WP-B49	0.4	POF 0.4	WP-A75	0.7	PEM/PSS 0.7
WP-A51	1.5	POF 1.5	WP-A76	1.9	POF 1.9
WP-A52	1.5	POF 1.5	WP-B76	20.5	POF 16.4, PEM 0.8, PEM/PSS 3.3
WP-B52	1.5	POF 1.5	WP-A78	2.6	POF 0.6, PEM 2.0
WP-C52	0.7	POF 0.7	WP-A80	17.9	POF 6.8, PEM 9.6, PSS 1.5
WP-D52	0.5	POF 0.4, PSS 0.1	WP-A81	0.4	POF 0.4
WP-A53	0.8	POF 0.8	WP-B81	3.0	POF 3.0
WP-B53	1.9	POF 1.9	WP-C81	2.2	POF 1.4, PEM 0.8

Table F-1
Wetlands by Predominant USFWS Class

Wetland	Total Acreage	Acreages Per Class[1]	Wetland	Total Acreage	Acreages Per Class
WP-C53	71.6	POF 19.5, PEM 30.7, PSS 21.4	WP-A82	0.4	POF 0.4
WP-A54	0.8	PEM 0.8	WP-A84	6.4	POF 5.5, PSS 0.9
WP-A58	1.8	PSS 1.8	WP-CI-C	32.1	POF 7.1, PSS 9.9, PEM/PSS 15.1
WP-A59	3.0	PEM 3.0	WP-CI-D	0.8	PEM 0.8
WP-B59	1.3	PEM 1.3	WP-CI-E	0.2	POF 0.2
WP-C59	2.5	PSS 2.5	WP-CI-F	0.3	POF 0.3
WP-B91	0.1	PEM/PSS 0.1	WP-CI-G	0.2	PSS 0.2
WP-C91	0.3	PEM/PSS 0.3	WP-B84	0.7	POF 0.7
WP-D91	0.1	POF 0.1	WP-A90	1.8	POF 1.2, PEM 0.6
WP-A93	0.3	POF 0.3	WP-B90	5.3	POF 3.2, PEM 2.1
WP-A94	9.8	POF 4.2, PSS 5.6	WP-A91	2.3 ✳	POF 1.8
WP-B94	1.1	POF 1.1	WP-CI-H	0.2	POF 0.2
WP-A95	3.8	POF 3.8	WP-AC-250	21.9	POF 18.4, PEM 3.5
WP-B95	2.4	POF 2.4	WP-D-250	1.7	POF 1.7
WP-C95	0.7	PEM 0.2, PSS 0.5	WP-E-250	0.2	POF 0.2
WP-D95	1.4	POF 1.4	WP-F-250	2.2	PEM 1.4, PSS 0.8
WP-A96	2.0	POF 0.5, PEM 1.5	WP-G-250	32.7	POF 21.7, PEM 9.9, PSS 1.1
WP-B96	6.1	POF 3.6, PEM 2.5	WP-H-250	3.8	POF 3.1, PSS 0.7
WP-A97	0.4	POF 0.4	WP-I-250	1.1	POF 1.1
WP-B97	1.5	POF 1.5	WP-J-250	3.1	POF 1.5, PSS 1.6
WP-C97	0.5	POF 0.5	WP-K-250	2.5	POF 2.5
WP-D97	1.4	POF 1.4	WP-L-250	3.1	POF 1.5, PSS 1.6
WP-CI-A	0.8	POF 0.8	WP-M-250	0.5	PSS 0.5

Table F-1
Wetlands by Predominant USFWS Class

Wetland	Total Acreage	Acreages Per Class[1]	Wetland	Total Acreage	Acreages Per Class
WP-CI-B	2.6	PSS 2.6	WP-N-250	1.5	POF 1.5

[1] POF=Palustrine Forested Wetland, PEM=Palustrine Emergent Wetland, PSS=Palustrine Scrub Shrub, PEM/PSS=Palustrine Emergent/ Palustrine Scrub Shrub Weltand

✳ Includes 0.5 acres of lacustrine wetlands

Source: USACE, 1993.

Table F-2
Wetlands by Predominant Wetland Class/Total Estimated Acreage

Wetland Designator	Total Estimated Acreage	USFWS Wetland Class
WP-A8	0.26	Palustrine forested
WP-A30	0.19	Palustrine forested
WP-A32	15.35	Palustrine forested
WP-A40	1.92	Palustrine emergent
WP-A44	0 .58	Palustrine forested
WP-A45	10.21	Palustrine emergent
WP-A56	0.77	Palustrine scrub shrub
WP-A57	47.60	Palustrine emergent
WP-A61	0.63	Palustrine forested
WP-A64	0.43	Palustrine forested
WP-A66	1.14	Palustrine emergent
WP-A67	0.29	Palustrine forested
WP-A68	57.76	Palustrine scrub shrub
WP-A69	2.15	Palustrine emergent
WP-A72	0.37	Palustrine forested
WP-A77	0.85	Palustrine forested
WP-A79	0.52	Palustrine forested
WP-A85	0.64	Palustrine scrub shrub
WP-A86	0.35	Palustrine forested
WP-A87	1.44	Palustrine forested
WP-A101	0.22	Palustrine forested
WP-B5	0.20	Palustrine forested
WP-B8	0.12	Palustrine forested
WP-B9	0.23	Palustrine forested
WP-B21	0.30	Palustrine forested

Table F-2
Wetlands by Predominant Wetland Class/Total Estimated Acreage

Wetland Designator	Total Estimated Acreage	USFWS Wetland Class
WP-B23	4.42	Palustrine emergent
WP-B26	9.19	Palustrine forested
WP-B31	0.24	Palustrine forested
WP-B32	7.30	Palustrine emergent
WP-B41	0.31	Palustrine forested
WP-B45	0.73	Palustrine emergent
WP-B47	0.17	Palustrine forested
WP-B51	0.20	Palustrine forested
WP-B63	0.05	Palustrine forested
WP-B64	0.09	Palustrine forested
WP-B65	0.39	Palustrine forested
WP-B66	1.25	Palustrine scrub shrub
WP-B67	0.15	Palustrine forested
WP-B68	0.69	Palustrine forested
WP-B69	0.50	Palustrine forested
WP-B70	0.27	Palustrine forested
WP-B71	0.13	Palustrine forested
WP-B72	0.91	Palustrine forested
WP-B75	0.79	Palustrine forested
WP-B78	7.47	Palustrine emergent
WP-B79	2.57	Palustrine forested
WP-B80	0.20	Palustrine forested
WP-B82	0.48	Palustrine forested
WP-C1	8.22	Palustrine forested
WP-C8	0.53	Palustrine forested
WP-C9	0.84	Palustrine forested

Table F-2
Wetlands by Predominant Wetland Class/Total Estimated Acreage

Wetland Designator	Total Estimated Acreage	USFWS Wetland Class
WP-C15	0.49	Palustrine forested
WP-C21	0.07	Palustrine forested
WP-C28	0.23	Palustrine forested
WP-C31	0.22	Palustrine forested
WP-C32	27.94	Palustrine forested
WP-C33	0.14	Palustrine forested
WP-C43	0.31	Palustrine scrub shrub
WP-C45	5.40	Palustrine forested
WP-C47	0.03	Palustrine forested
WP-C48	0.52	Palustrine forested
WP-C49	0.35	Palustrine emergent
WP-C51	0.68	Palustrine forested
WP-C65	0.58	Palustrine emergent
WP-C67	0.13	Palustrine forested
WP-C68	0.41	Palustrine forested
WP-C69	0.58	Palustrine scrub shrub
WP-C70	0.11	Palustrine forested
WP-C78	24.79	Palustrine emergent
WP-C82	0.26	Palustrine forested
WP-C84	4.38	Palustrine forested
WP-C90	0.18	Palustrine forested
WP-C94	0.29	Palustrine forested
WP-D9	0.20	Palustrine forested
WP-D10	0.14	Palustrine forested
WP-D15	0.30	Palustrine forested
WP-D16	0.52	Palustrine forested

Table F-2
Wetlands by Predominant Wetland Class/Total Estimated Acreage

Wetland Designator	Total Estimated Acreage	USFWS Wetland Class
WP-D32	1.15	Palustrine emergent
WP-D35	0.43	Palustrine forested
WP-D36	0.16	Palustrine forested
WP-D42	0.45	Palustrine forested
WP-D43	0.27	Palustrine forested
WP-D47	0.19	Palustrine forested
WP-D49	0.61	Palustrine forested
WP-D51	0.12	Palustrine forested
WP-D53	0.63	Palustrine emergent
WP-D53	3.01	Palustrine forested
WP-D65	0.40	Palustrine scrub shrub
WP-D67	0.48	Palustrine forested
WP-D69	0.16	Palustrine emergent
WP-D70	0.36	Palustrine forested
WP-D71	0.75	Palustrine forested
WP-D78	0.55	Palustrine forested
WP-D81	0.72	Palustrine forested
WP-D84	0.08	Palustrine emergent
WP-D90	0.18	Palustrine forested
WP-D94	0.30	Palustrine forested
WP-E9	0.34	Palustrine forested
WP-E10	0.45	Palustrine forested
WP-E11	0.90	Palustrine forested
WP-E16	0.16	Palustrine forested
WP-E32	0.29	Palustrine forested
WP-E37	0.66	Palustrine forested

Table F-2
Wetlands by Predominant Wetland Class/Total Estimated Acreage

Wetland Designator	Total Estimated Acreage	USFWS Wetland Class
WP-E42	0.17	Palustrine forested
WP-E47	0.11	Palustrine forested
WP-E49	0.14	Palustrine forested
WP-E53	0.83	Palustrine forested
WP-E65	0.06	Palustrine forested
WP-E69	8.21	Palustrine forested
WP-E70	6.29	Palustrine scrub shrub
WP-E71	0.37	Palustrine forested
WP-E81	0.27	Palustrine forested
WP-E84	3.66	Palustrine scrub shrub
WP-E90	0.35	Palustrine forested
WP-E95	0.16	Palustrine forested
WP-E97	0.36	Palustrine forested
WP-F9	0.32	Palustrine forested
WP-F10	0.67	Palustrine forested
WP-F11	0.48	Palustrine forested
WP-F16	0.11	Palustrine forested
WP-F32	0.54	Palustrine forested
WP-F37	0.28	Palustrine forested
WP-F37	0.14	Palustrine forested
WP-F42	1.79	Palustrine scrub shrub
WP-F42	0.03	Palustrine forested
WP-F49	0.16	Palustrine forested
WP-F53	1.02	Palustrine emergent
WP-F60	0.09	Palustrine forested
WP-F65	0.44	Palustrine forested

Table F-2
Wetlands by Predominant Wetland Class/Total Estimated Acreage

Wetland Designator	Total Estimated Acreage	USFWS Wetland Class
WP-F70	0.26	Palustrine emergent
WP-F81	0.71	Palustrine forested
WP-F84	0.27	Palustrine forested
WP-F97	0.03	Palustrine forested
WP-G9	0.16	Palustrine forested
WP-G10	0.67	Palustrine forested
WP-G11	0.14	Palustrine forested
WP-G16	0.21	Palustrine forested
WP-G42	0.30	Palustrine forested
WP-G49	0.23	Palustrine forested
WP-G81	0.59	Palustrine forested
WP-G84	2.15	Palustrine scrub shrub
WP-H9	1.45	Palustrine forested
WP-H59	0.44	Palustrine forested
WP-H81	0.27	Palustrine emergent
WP-I9	0.17	Palustrine forested
WP-0-250	0.10	Palustrine scrub shrub
WP-P-250	0.14	Palustrine scrub shrub
WP-Q-250	0.27	Palustrine forested
WP-R-250	0.81	Palustrine forested
WP-S-250	0.41	Palustrine forested
WP-T-250	0.15	Palustrine forested
WP-U-250	0.10	Palustrine forested
WP-V-250	0.31	Palustrine forested
WP-W-250	0.52	Palustrine forested

Source: USACE, 1993.

APPENDIX G

Flora of USMA

A Checklist of the Flora of the West Point Military Academy Reservation

Richard S. Mitchell and Gordon C. Tucker

1993

Botanical Research Report # 93-2

NEW YORK STATE MUSEUM

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Albany, New York 12230

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Introduction

In 1992-93 the State Botanist's Office of the New York State Museum was awarded contracts by the U. S. Army Corps of Engineers Construction Engineering Research Laboratories to carry out a floristic survey of the West Point Military Reservation. Its purpose was to supplement former studies in the area and provide a thorough botanical baseline; the inventory of vascular plants is to be used in making land management decisions as well as in wildlife, forestry and related ecological research. Prior to 1990, little botanical collection had been carried out at West Point, but, in that year, botanists from the Brooklyn Botanic Garden conducted a floristic survey of the reservation under contract to CERL. That study yielded a list of ca. 570 species of vascular plants. The supplemental study carried out by the New York State Museum (1992-93) increased the number of species known from the area to 1082.

Study Methods

Research Team: A team of three field botanists was established. Two members of the staff of the New York State Museum: Dr. Richard S. Mitchell (State Botanist) and Dr. Gordon C. Tucker (Scientist, Botany) were joined by naturalist and private consultant J. G. Barbour in the study. Mr. Barbour, a resident of Saugerties, was subcontracted to explore the West Point properties on an ongoing basis, due to his proximity to the area. Albany-based scientists also visited regularly, staying 2-3 days per visit.

Botanical Collecting: In accordance with detailed guidelines set down in the contract, site visits were carried out by one to three members of the collecting team from May to November, 1992, for a total of 66 man-days. Other scientists, including West Point staff, sometimes accompanied the botanists in the field. Specimens were made using conventional pressing, heat-drying and curatorial procedures. Complete records were kept by team members on habitat data, site locations (using UTM coordinates), plant abundance and associated species. Each field worker also recorded his itinerary.

Specimen Processing: All specimens were identified or verified by Tucker and Mitchell, using botanical manuals, taxonomic literature and the State Museum's herbarium. Specimens were labeled, and a complete specimen database was logged and submitted to CERL. Two specimens of each species added to the West Point list have been provided, except in cases of rarity, when a single, small, diagnostic voucher was supplied.

Results and Conclusions

Intensive field collecting in 1992-93 yielded 502 species of vascular plants new to the West Point Military Reservation. These represent 94 families and 277 genera of ferns, horsetails, trees, shrubs and flowering herbs. Twenty-two species listed as rarities by current state or federal government publications were discovered at West Point during the study, several of which are endangered or threatened in New York, and whose legal status changes due to our work. The study nearly doubled the previously recorded flora of the area, resulting in a documented and vouchered total of 1082 plant species.

Plants found at West Point were mostly those to be expected in the Hudson Highlands, with a few exceptions (*i.e.* netted chain fern, *Woodwardia areolata* and mountain white birch, *Betula cordifolia*) that were outside their recorded natural ranges. Because of the great increase in the number of species known from the area, speculations by former authors concerning the lack of species-diversity must be reevaluated. Botanical diversity at West Point is well within the range or higher than that of nearby areas formerly studied (Bear Mountain, Trailside Museum, 1972; Raup, 1938).

The West Point Military Reservation is a magnificent area in terms of scenic beauty, physiographic contrasts and habitat diversity, ranging from the muddy shores of the estuarine Hudson River to wooded slopes, oligotrophic ponds and severe cliff sites at the Crow's Nest. It harbours known sites for an impressive 35 species of rare plants, and it has not given up all of its botanical secrets yet. The area will receive well-deserved further study, but we now speculate that over 95% of the native and introduced plant species of the area are known.

Rare Plants

Thirty-four species listed as rare, threatened or endangered by the New York Natural Heritage Program are currently reported from the West Point Military Academy Reservation, and an additional species of sedge is possibly extirpated. They are as follows (see Young, 1992, for a complete explanatiion of rarity codes):

1) *Asclepias purpurascens* L. PURPLE MILKWEED
   Rarity Status: State T; NYNHP G4G5 S2

2) *Aster schreberi* Nees LARGE-LEAF ASTER, SCHREBER'S ASTER
   Rarity Status: State T; NYNHP G5 S2

3) *Aster vimineus* Lam. SMALL WHITE ASTER
   Rarity Status: State U; NYNHP G5 S1

4) *Bidens laevis* (L.) BSP. BUR-MARIGOLD, BEGGAR-TICKS
   Rarity Status: State R; NYNHP G5 S2

5) *Callitriche terrestris* Raf. STARWORT
   Rarity Status: State U; NYNHP G5 S1

6) *Cardamine longii* Fern. LONG'S BITTERCRESS
Rarity Status: Federal C2; State U; NYNHP G3G4 S1

7) *Carex bushii* Mackz. SEDGE
Rarity Status: State R; NYNHP G4 S2

8) *Carex cumulata* (Bailey) Mackz. SEDGE
Rarity Status: State R; NYNHP G3G4 S2

9) *Carex emmonsii* Dewey ex Torr. SEDGE
Rarity Status: State R; NYNHP G5 S1

10) *Carex seorsa* Howe ex Gord. & Howe SEDGE
Rarity Status: State R; NYNHP G4 S1

11) *Carex straminea* Willd. ex Schkuhr SEDGE
Rarity Status: State U; NYNHP G5 SH

12) *Carex striatula* Michx. SEDGE
Rarity Status: State U; NYNHP G4G5 SH

13) *Chenopodium standleyanum* Aellen GOOSEFOOT
Rarity Status: State U; NYNHP G5 SH

14) *Corydalis flavula* (Raf. ex Desv.) DC. YELLOW HARLEQUIN, PALE CORYDALIS
Rarity Status: State R; NYNHP G5 S2

15) *Cuscuta pentagona* Engelm. FIELD-DODDER
Rarity Status: State R; NYNHP G5 S1

16) *Cunila origanoides* (L.) Britt. DITTANY
Rarity Status: NYNYHP G5 S3

17) *Cyperus erythrorhizos* Muhl. CYPERUS, FLAT-SEDGE
Rarity Status: State R; NYNHP G5 S1

18) **Cyperus houghtonii* Torr. CYPERUS, FLAT-SEDGE
Rarity Status: State R; NYNHP G4 S1
*This species, once collected on Constitution Island, has not been rediscovered during the current study.

19) *Cyperus odoratus* L. CYPERUS, FLAT-SEDGE
Rarity Status: State R pending; NYNHP G5 S2S3

20) *Digitaria filiformis* (L.) Koeler SLENDER CRABGRASS
Rarity Status: State R; NYNHP G5 S1S2

21) *Hottonia inflata* Ell. FEATHERFOIL, WATER-VIOLET
Rarity Status: State T; NYNHP G3G4 S1

22) *Lechea racemulosa* **Lamarck** PINWEED
Rarity Status: State R; NYNHP G5 S2S3

23) *Linum medium* **(Planch.) Britt.** WILD FLAX
var. *texanum* **(Planch.) Fern.** SOUTHERN YELLOW FLAX
Rarity Status: State T; NYNHP G5 S1

24) *Lycopus rubellus* **Moench** GYPSY-WORT, WATER-HOREHOUND, BUGLEWEED
Rarity Status: State U; NYNHP G5 SH

25) *Crassula aquatica* **(L.) Schoenl.** PIGMYWEED
(*Tillaea aquatica* L.)
Rarity Status: State E; NYNHP G5 S1

26) *Pilea fontana* **(Lunell) Rydb.** EMERALD-FRUITED CLEARWEED, COOLWORT, RICHWEED
Rarity Status: State T pending; NYNHP G5 S1

27) *Pinus virginiana* **Mill.** VIRGINIA PINE, SCRUB PINE, JERSEY PINE
Rarity Status: State E; NYNHP G5 S1

28) *Podostemum ceratophyllum* **Michx.** RIVERWEED, RIVER-MOSS, THREADFOOT
Rarity Status: State R; NYNHP G5 S2

29) *Polygonum careyi* **Olney** SMARTWEED, PINKWEED
Rarity Status: State U; NYNHP G4 S1

30) *Polygonum tenue* **Michx.** KNOTWEED
Rarity Status: State R; NYNHP G5 S3

31) *Potamogeton pulcher* **Tuckerm.** PONDWEED
Rarity Status: State U; NYNHP G5 SH

32) *Ranunculus micranthus* **Nutt. ex Torr. & Gray** SMALL-FLOWERED CROWFOOT
Rarity Status: State U; NYNHP G5? S1

33) *Scirpus georgianus* **Harper** BULRUSH
Rarity Status: State U; NYNHP G5 SH

34) *Utricularia biflora* **Lam.** TWO-FLOWERED BLADDERWORT
Rarity Status: State R; NYNHP G5 S1

35) *Utricularia radiata* **Small** SMALL FLOATING BLADDERWORT
Rarity Status: State R; NYNHP G4 S2

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Catalog

The following list was compiled from collections made by the authors and their cooperators during 1992-93 in addition to specimens collected by Clements & Barringer (1990, annotated and amended; see Appendix 1), historical specimens and citations in the literature. A total of 1081 species and hybrids are listed alphabetically under plant families, organized according to Cronquist's 1981 system of classification. An asterisk (*) indicates a non-native species that is naturalized or escapes cultivation; plants in cultivation, but which could be mistaken for naturalized species, are marked. Botanical nomenclature follows Mitchell (1986) and recently published taxonomic studies on certain groups.

LYCOPODIACEAE (CLUBMOSS FAMILY)

Huperzia lucidula (Michx.) Trev. SHINING FIRMOSS OR CLUBMOSS
[Lycopodium lucidulum Michx.]

Lycopodiella inundata (L.) Holub BOG CLUBMOSS
[Lycopodium inundatum L.]

Lycopodium clavatum L. RUNNING CEDAR, STAGHORN CLUBMOSS

Lycopodium dendroideum Michx. NORTHERN TREE CLUBMOSS
[L. obscurum var. dendroideum (Michx.) D. Eaton]

Lycopodium digitatum A. Br. RUNNING-PINE, WOLF'S-CLAWS, STAGHORN EVERGREEN
(L. complanatum var. flabelliforme Fern.)

Lycopodium obscurum L. GROUND PINE, TREE CLUBMOSS

SELAGINELLACEAE (SPIKEMOSS FAMILY)

Selaginella apoda (L.) Fern. CREEPING OR MEADOW SPIKEMOSS

Selaginella rupestris (L.) Spring ex Mart. ROCK SPIKEMOSS

ISOETACEAE (QUILLWORT FAMILY)

Isoëtes echinospora Durieu QUILLWORT
(I. braunii Durieu, I. muricata Durieu)

EQUISETACEAE (HORSETAIL FAMILY)

Equisetum arvense L. FIELD HORSETAIL, COMMON HORSETAIL

Equisetum fluviatile L. WATER HORSETAIL, PIPES

Equisetum hyemale L. SCOURING RUSH
var. *affine* (Engelm.) A. Eaton
[E. hyemale var. elatum (Engelm.) Morton; E. hyemale var. pseudohyemale (Farw.) Morton]

OPHIOGLOSSACEAE (ADDER'S-TONGUE FAMILY)

Botrychium dissectum Spreng. CUT-LEAF GRAPE FERN
[B. dissectum var. obliquum (Muhl. ex Willd.) Clute]

Botrychium matricariifolium (A. Br. ex Döll) A. Br. ex Koch
MATRICARY GRAPE FERN, DAISY-LEAF GRAPE FERN

Botrychium virginianum (L.) Sw. RATTLESNAKE FERN

OSMUNDACEAE (FLOWERING-FERN FAMILY)

Osmunda cinnamomea L. CINNAMON FERN

Osmunda claytoniana L. INTERRUPTED FERN

Osmunda regalis L. ROYAL FERN, FLOWERING FERN
var. *spectabilis* (Willd.) Gray

POLYPODIACEAE (POLYPODY FAMILY)

Polypodium appalachianum Haufler & Windham ARROW-LEAF POLYPODY, ROCK POLYPODY
(P. virginianum in part)

Polypodium virginianum L. ROCK POLYPODY, COMMON POLYPODY
[P. vulgare var. virginianum (L.) Eaton]

ADIANTACEAE (MAIDENHAIR FAMILY)

Adiantum pedatum L. MAIDENHAIR FERN, MAIDENHAIR SPLEENWORT

DENNSTAEDTIACEAE (BRACKEN FAMILY)

Dennstaedtia punctilobula (Michx.) Moore HAY-SCENTED FERN

Pteridium aquilinum (L.) Kuhn BRACKEN, BRAKE-FERN, BRAKE

ASPLENIACEAE (SPLEENWORT FAMILY)

Asplenium platyneuron (L.) BSP. EBONY SPLEENWORT
[A. platyneuron var. incisum (Howe ex Peck) Robinson]

Asplenium trichomanes L. MAIDENHAIR SPLEENWORT

Cystopteris tenuis (Michx.) Desv. FRAGILE FERN
(C. fragilis var. mackayi Laws.)

Dryopteris campyloptera (Kunze) Clarkson MOUNTAIN WOOD FERN
[D. austriaca (Jacq.) Woyner ex Schinz & Thellung; D. dilatata var. americana (Fisch. ex Kunze) Benedict; D. spinulosa var. americana (Fisch. ex Kunze) Fern.]

Dryopteris carthusiana (Vill.) Fuchs SPINULOSE WOOD FERN
[D. austriaca var. spinulosa (Müll.) Fiori; D. spinulosa (Müll.) Watt]

Dryopteris clintoniana (D. Eaton ex Gray) Dowell CLINTON'S SHIELD FERN
[D. cristata var. clintoniana (D. Eaton ex Gray) Underw.]

Dryopteris cristata (L.) Gray CRESTED WOOD FERN

Dryopteris cristata x *intermedia* = *D.* x *boottii* (Tuckerm.) Underw. BOOTT'S WOOD FERN

Dryopteris intermedia (Muhl. ex Willd.) Gray FANCY FERN, COMMON WOOD FERN
[D. austriaca var. intermedia (Muhl. ex Willd.) Morton; D. spinulosa var. intermedia (Muhl. ex Willd.) Underw.]

Dryopteris marginalis (L.) Gray MARGINAL WOOD FERN

Onoclea sensibilis L. SENSITIVE FERN

Phegopteris hexagonoptera (Michx.) Fée BROAD BEECH FERN
[Dryopteris hexagonoptera (Michx.) Christ.; Thelypteris hexagonoptera (Michx.) Weath.]

Polystichum acrostichoides (Michx.) Schott CHRISTMAS FERN, SHIELD FERN

Thelypteris noveboracensis (L.) Nieuwl. NEW YORK FERN
[Dryopteris noveboracensis (L.) Gray]

Thelypteris palustris Schott MARSH FERN
[Dryopteris thelypteris (L.) Sw., Thelypteris thelypteroides (Michx.) Holub]

Woodsia ilvensis (L.) R. Br. RUSTY WOODSIA

Woodsia obtusa (Spreng.) Torr. BLUNT-LOBED WOODSIA

Woodwardia areolata (L.) Moore NETTED OR NARROW-LEAF CHAIN FERN
[Lorinseria areolata (L.) Presl]

PINACEAE (PINE FAMILY)

**Larix decidua* Mill. EUROPEAN LARCH (Naturalized)

Larix laricina (DuRoi) Koch TAMARACK, AMERICAN LARCH

**Picea abies* (L.) Karst. NORWAY SPRUCE (Naturalized)

Picea rubens Sarg. RED SPRUCE, HE-BALSAM

**Pinus nigra* Arn. AUSTRIAN PINE (Rare Escape)

Pinus rigida Mill. PITCH PINE

Pinus strobus L. WHITE PINE

**Pinus sylvestris* L. SCOTCH PINE (Naturalized)

Pinus virginiana Mill. VIRGINIA PINE, SCRUB OR JERSEY PINE
Rarity Status: State E; NYNHP G5, S1 (ALSO CULTIVATED)

Tsuga canadensis (L.) Carr. HEMLOCK, NORTHERN HEMLOCK

CUPRESSACEAE (CYPRESS FAMILY)

Juniperus virginiana L. RED CEDAR, SAVIN

MAGNOLIACEAE (MAGNOLIA FAMILY)

Liriodendron tulipifera L. TULIP TREE, YELLOW POPLAR, TULIP POPLAR

LAURACEAE (LAUREL FAMILY)

Lindera benzoin (L.) Blume SPICEBUSH, BENZOIN-BUSH, BENJAMIN-BUSH

Sassafras albidum (Nutt.) Nees SASSAFRAS, WHITE SASSAFRAS

ARISTOLOCHIACEAE (BIRTHWORT FAMILY)

Asarum canadense L. WILD GINGER, ASARABACCA
var. *canadense*

NYMPHAEACEAE (WATERLILY FAMILY)

Nuphar lutea (L.) Sibth. & Sm. YELLOW POND-LILY, COWLILY
ssp. *variegata* (Engelm. ex Durand in Clinton) Beal
(N. variegata Engelm. ex Durand in Clinton)

Nymphaea odorata Dryand. ex Ait. WHITE WATERLILY
(N. tuberosa Paine)

CABOMBACEAE (WATER-SHIELD FAMILY)

Brasenia schreberi Gmel. WATER-SHIELD, PURPLE WEN-DOCK

CERATOPHYLLACEAE (HORNWORT FAMILY)

Ceratophyllum demersum L. COONTAIL, HORNWORT

RANUNCULACEAE (CROWFOOT FAMILY)

Actaea pachypoda Ell. WHITE BANEBERRY, COHOSH, DOLL'S-EYES
[A. alba of American authors, not (L.) Mill.]

Anemone quinquefolia L. WOOD ANEMONE, SNOWDROPS

Anemone virginiana L. THIMBLEWEED, TALL ANEMONE

Anemonella thalictroides (L.) Spach RUE ANEMONE
[Thalictrum thalictroides (L.) Eames & Boiv.]

Aquilegia canadensis L. WILD OR RED COLUMBINE, ROCK-BELLS, MEETINGHOUSES
[A. canadensis var. coccinea (Small) Munz; A. coccinea Small]

Caltha palustris L. MARSH MARIGOLD, COWSLIP

**Clematis terniflora* DC. YAM-LEAF CLEMATIS OR VIRGIN'S-BOWER (Naturalized)
(C. dioscoreifolia Levl. & Van.; C. maximowicziana Franch. & Sav.; C. paniculata Thunb.)

Clematis virginiana L. VIRGIN'S-BOWER, TRAVELLER'S-JOY

Coptis trifolia (L.) Salisb. GOLDTHREAD(S), CANKER-ROOT
[C. groenlandica (Oed.) Fern.]

Hepatica nobilis Mill. LIVERLEAF, LIVERWORT, HEPATICA
var. *acuta* (Pursh) Steyerm. SHARP-LOBED LIVERLEAF
(H. acutiloba DC.)
var. *obtusa* (Pursh) Steyerm. BLUNT-LOBED LIVERLEAF
[H. americana (DC.) Ker]

Ranunculus abortivus L. KIDNEYLEAF CROWFOOT, CHICKEN-PEPPER

**Ranunculus acris* L. COMMON BUTTERCUP, TALL OR FIELD BUTTERCUP (Naturalized)

Ranunculus allegheniensis Britt. ALLEGHENY CROWFOOT, MOUNTAIN CROWFOOT

**Ranunculus bulbosus* L. BULBOUS CROWFOOT OR BUTTERCUP, MEADOW-BLOOM (Naturalized)

Ranunculus hispidus Michx. BUTTERCUP, CROWFOOT
var. *caricetorum* (Greene) Duncan SWAMP OR MARSH BUTTERCUP
(R. septentrionalis of authors, not Poir.)
var. *hispidus* HISPID BUTTERCUP
[R. marylandicus Poir.; R. hispidus var. falsus Fern.; R. hispidus var. marylandicus (Poir.) Benson]

Ranunculus micranthus Nutt. ex Torr. & Gray SMALL-FLOWERED CROWFOOT
Rarity Status: State E pending; NYNHP G5?, SH
[R. micranthus var. dilitescens (Greene) Fern.]

Ranunculus recurvatus Poir. ex Lam. HOOKED OR ROUGH BUTTERCUP
(R. recurvatus var. adpressipilus Weath.)

**Ranunculus sceleratus* L. CURSED CROWFOOT, BLISTERWORT (Naturalized)

Thalictrum dioicum L. EARLY MEADOW-RUE

Thalictrum pubescens Pursh TALL MEADOW-RUE, LATE MEADOW-RUE
(Thalictrum polygamum Muhl., a *nomen nudum*)

Thalictrum revolutum DC. WAXY MEADOW-RUE
(T. dasycarpum of some NY reports)

BERBERIDACEAE (BARBERRY FAMILY)

**Berberis thunbergii* DC. JAPANESE BARBERRY (Naturalized)

Caulophyllum thalictroides (L.) Michx. BLUE COHOSH, PAPOOSE-ROOT
[C. thalictroides var. giganteum Farw.]

MENISPERMACEAE (MOONSEED FAMILY)

Menispermum canadense L. MOONSEED, YELLOW PARILLA

PAPAVERACEAE (POPPY FAMILY)

**Chelidonium majus* L. GREATER CELANDINE, SWALLOW-WORT (Naturalized)

**Eschscholzia californica* Cham. ex Nees CALIFORNIA POPPY (Rare Escape)

**Macleaya cordata* (Willd.) R. Br. PLUME-POPPY, TREE CELANDINE (Rare Escape)

Sanguinaria canadensis L. BLOODROOT, PUCCOON

FUMARIACEAE (FUMITORY FAMILY)

Adlumia fungosa (Ait.) Greene ex BSP. ALLEGHENY VINE, MOUNTAIN FRINGE, CLIMBING FUMITORY

Corydalis flavula (Raf. ex Desv.) DC. YELLOW HARLEQUIN
Rarity Status: State R; NYNHP G5, S2

Corydalis sempervirens (L.) Pers. PINK CORYDALIS, ROCK HARLEQUIN, PALE CORYDALIS

Dicentra cucullaria (L.) Bernh. DUTCHMAN'S-BREECHES

PLATANACEAE (PLANE-TREE FAMILY)

Platanus occidentalis L. SYCAMORE, PLANE-TREE, BUTTONWOOD

HAMAMELIDACEAE (WITCH-HAZEL FAMILY)

Hamamelis virginiana L. WITCH-HAZEL
(H. virginiana var. parviflora Nutt.)

ULMACEAE (ELM FAMILY)

Celtis occidentalis L. HACKBERRY, SUGARBERRY

Ulmus americana L. AMERICAN ELM, WHITE ELM

Ulmus rubra Muhl. SLIPPERY ELM, RED ELM
(U. fulva Michx.)

CANNABACEAE (HEMP FAMILY)

**Humulus japonicus* Sieb. & Zucc. JAPANESE HOP(S) (Naturalized)

Humulus lupulus L. COMMON HOP, BREWER'S HOPS

MORACEAE (MULBERRY FAMILY)

**Morus alba* L. WHITE MULBERRY (Naturalized)
(M. nigra of NY reports, not L.)

Morus rubra L. RED MULBERRY

URTICACEAE (NETTLE FAMILY)

Boehmeria cylindrica (L.) Sw. FALSE-NETTLE, BOG-HEMP
[B. cylindrica var. drummondiana (Wedd.) Wedd.]

Laportea canadensis (L.) Wedd. WOOD-NETTLE, GIANT STINGING NETTLE

Parietaria pensylvanica Muhl. ex Willd. PELLITORY

Pilea fontana (Lunell) Rydb. CLEARWEED
Rarity Status: State T pending; NYNHP G5, S2

Pilea pumila (L.) Gray RICHWEED, CLEARWEED, COOLWORT
[P. pumila var. deamii (Lunell) Fern.]

Urtica dioica L. STINGING NETTLE, GREAT NETTLE
*ssp. *dioica* (Naturalized)

JUGLANDACEAE

Carya cordiformis (Wang.) Koch BITTERNUT, SWAMP HICKORY

Carya glabra (Mill.) Sweet PIGNUT (HICKORY)

Carya ovata (Mill.) Koch SHAGBARK, SHELLBARK HICKORY

Juglans cinerea L. BUTTERNUT, WHITE WALNUT

Juglans nigra L. BLACK WALNUT

MYRICACEAE (BAYBERRY FAMILY)

Comptonia peregrina (L.) Coult. SWEET-FERN
[C. peregrina var. aspleniifolia (L.) Fern.; Myrica aspleniifolia L.; M. peregrina (L.) Kuntze]

Myrica pensylvanica Loisel. BAYBERRY, CANDLEBERRY

FAGACEAE (BEECH FAMILY)

Castanea dentata **(Marsh.) Borkh.** AMERICAN CHESTNUT

Fagus grandifolia **Ehrh.** AMERICAN BEECH, BEECHNUT
[F. grandifolia var. caroliniana (Loud.) Fern. & Rehd.]

**Fagus sylvatica* L. EUROPEAN BEECH, BEECHNUT (Rare Escape)

Quercus alba L. WHITE OAK

Quercus alba x *montana* = *Q.* x *saulii* **Schneid.** OAK (Rare Hybrid)
(Q. x beadlii of NY authors, not Trel.)

Quercus bicolor **Willd.** SWAMP WHITE OAK

Quercus coccinea **Muenchh.** SCARLET OAK

Quercus ilicifolia **Wang.** SCRUB OAK, BEAR OAK

Quercus macrocarpa **Michx.** MOSSY-CUP OAK, BUR OAK, NORTHERN OVERCUP OAK

Quercus montana **Willd.** CHESTNUT OAK, ROCK OAK
(Q. prinus of American authors)

Quercus palustris **Muenchh.** PIN OAK, SPANISH OAK

Quercus prinoides **Willd.** DWARF CHESTNUT OAK, CHINQUAPIN OAK

Quercus rubra L. RED OAK
var. *borealis* **(Michx. f.) Farw.** NORTHERN RED OAK
(Q. borealis Michx. f.)

Quercus velutina **Lam.** BLACK OAK, DYER'S OAK, YELLOW-BARK OAK

BETULACEAE (BIRCH FAMILY)

Alnus glutinosa* **(L.) Gaertn. BLACK ALDER, EUROPEAN ALDER (Naturalized)

Alnus incana **(L.) Moench** SPECKLED ALDER, HOARY ALDER
ssp. *rugosa* **(DuRoi) Clausen** SPECKLED OR HAZEL ALDER
[A. rugosa (DuRoi) Spreng.]

Alnus serrulata (Dryand. ex Ait.) Willd. SMOOTH ALDER
(A. serrulata var. subelliptica Fern.)

Betula alleghaniensis Britt. YELLOW BIRCH
[B. alleghanensis of Britt. & Brown (1903); B. lutea Michx. f.]

Betula cordifolia Regel MOUNTAIN PAPER BIRCH
[B. alba var. cordifolia (Regel) Regel; B. papyrifera var. cordifolia (Regel) Fern.]

Betula lenta L. SWEET BIRCH, CHERRY BIRCH, BLACK BIRCH

Betula nigra L. RIVER BIRCH, RED BIRCH (Rare)

Betula papyrifera Marsh. PAPER BIRCH, CANOE BIRCH, WHITE BIRCH
(B. papyrifera var. pensilis Fern.)

Betula populifolia Marsh. GRAY BIRCH, FIRE BIRCH, OLD FIELD BIRCH, WHITE BIRCH

Carpinus caroliniana Walt. HORNBEAM, BLUE BEECH, IRONWOOD, WATER BEECH, MUSCLEWOOD
ssp. *virginiana* (Marsh.) Furlow

Corylus americana Walt. HAZELNUT, AMERICAN FILBERT, HAZEL

**Corylus avellana* L. EUROPEAN FILBERT OR HAZEL (Rare Escape)
(Corylus maxima of report)

Corylus cornuta Marsh. BEAKED HAZEL

Ostrya virginiana (Mill.) Koch HOP HORNBEAM, IRONWOOD
(O. virginiana var. lasia Fern.)

PHYTOLACCACEAE (POKEWEED FAMILY)

Phytolacca americana L. POKE, POKEWEED, POKEBERRY, SCOKE, PIGEONBERRY

NYCTAGINACEAE (FOUR-O'CLOCK FAMILY)

**Mirabilis jalapa* L. FOUR-O'CLOCK, MARVEL OF PERU (Rare Escape)

**Mirabilis nyctaginea* (Michx.) MacM. HEARTLEAF UMBRELLA-WORT (Naturalized)
[Oxybaphus nyctagineus (Michx.) Sweet]

CACTACEAE (CACTUS FAMILY)

Opuntia humifusa (Raf.) Raf. EASTERN PRICKLY-PEAR
[Opuntia compressa (Salisb.) MacBr.]

CHENOPODIACEAE (GOOSEFOOT FAMILY)

Atriplex patula L. SEASIDE ORACH OR ATRIPLEX, SPEARSCALE
(A. patula var. hastata (L.) Gray; A. patula var. littoralis (L.) Gray)

**Chenopodium album* L. LAMB'S-QUARTERS, GOOSE-FOOT, PIGWEED (Naturalized)

**Chenopodium ambrosioides* L. MEXICAN TEA, WORM-SEED (Naturalized)

**Chenopodium botrys* L. JERUSALEM-OAK, FEATHER-GERANIUM (Naturalized)

Chenopodium simplex (Torrey) Raf. MAPLE-LEAF GOOSEFOOT
[C. gigantospermum Aellen; C. hybridum L. var. gigantospermum (Aellen) Rouleau; C. hybridum var. simplex Torr.]

Chenopodium standleyanum Aellen GOOSEFOOT
Rarity Status: State E pending; NYNHP G5, SH
(Chenopodium berlandieri Moq. var. boscianum (Moq.) Wahl.; C. boscianum Moq.)

AMARANTHACEAE (AMARANTH FAMILY)

**Amaranthus albus* L. TUMBLEWEED, PALE AMARANTH (Naturalized)
(A. graecizans of NY reports, not L.)

Amaranthus cannabinus (L.) Sauer WATER-HEMP, SALT-MARSH HEMP
(Acnida cannabina L.)

**Amaranthus hybridus* L. GREEN AMARANTH, PIGWEED, WILD BEET, PRINCE'S-FEATHER (Naturalized)

**Amaranthus powellii* S. Wats. AMARANTH, PIGWEED (Naturalized)

MOLLUGINACEAE (CARPETWEED FAMILY)

**Mollugo verticillata* L. CARPETWEED (Naturalized)

CARYOPHYLLACEAE (PINK FAMILY)

**Arenaria serpyllifolia* L. THYME-LEAF SANDWORT (Naturalized)

**Cerastium arvense* L. FIELD CHICKWEED, MEADOW CHICKWEED (Naturalized)
[C. arvense var. villosum (Muhl.) Hollick & Britt.]

**Cerastium fontanum* Baumg. COMMON MOUSE-EAR (Naturalized)
ssp. *triviale* (Link) Jalas
(C. holostioides Fries; C. vulgatum of authors, not L.)

**Cerastium glomeratum* Thuill. MOUSE-EAR CHICKWEED (Rare Naturalized)
(C. viscosum of authors, not L.)

**Cerastium semidecandrum* L. SMALL, MOUSE-EAR CHICKWEED, SPRING MOUSE-EAR (Naturalized)

**Dianthus armeria* L. DEPTFORD PINK (Naturalized)

**Lychnis coronaria* (L.) Desr. ROSE-CAMPION, MULLEIN-PINK (Rare Escape)

**Lychnis flos-cuculi* L. RAGGED-ROBIN, CUCKOO-FLOWER (Naturalized)

**Myosoton aquaticum* (L.) Moench GIANT CHICKWEED, WATER MOUSE-EAR (Naturalized)
[Stellaria aquatica (L.) Scop.]

Paronychia canadensis (L.) Wood FORKED CHICKWEED

Paronychia fastigiata (Raf.) Fern. FORKED CHICKWEED

Sagina japonica (Sw.) Ohwi PEARLWORT, JAPANESE PEARLWORT (Rare Introduction)

**Sagina procumbens* L. PEARLWORT, BIRD'S-EYE (Naturalized)

**Saponaria officinalis* L. BOUNCING-BET (Naturalized)

**Scleranthus annuus* L. KNAWEL, GERMAN KNOT-GRASS (Naturalized)

Silene antirrhina L. SLEEPY CATCH-FLY

**Silene armeria* L. SWEET-WILLIAM, CATCH-FLY, NOT-SO-PRETTY (Naturalized)

**Silene cserei* Baumg. BLADDER-CAMPION (Naturalized)
(S. csereii of authors)

**Silene latifolia* Poir. WHITE CAMPION, WHITE COCKLE (Naturalized)
[Lychnis alba Mill.; Silene alba (Mill.) Krause; S. pratensis (Rafn) Gord. & Gren.]

**Silene noctiflora* L. NIGHT-FLOWERING CATCH-FLY, STICKY CAMPION (Naturalized)

**Silene vulgaris* (Moench) Garcke BLADDER-CAMPION, MAIDEN'S-TEARS (Naturalized)
(S. cucubalus Wibel)

**Spergula arvensis* L. CORN-SPURRY, POVERTY-WEED (Naturalized)

**Spergularia media* (L.) C. Presl ex Griseb. SAND-SPURRY (Naturalized)

**Stellaria graminea* L. COMMON OR LESSER STITCH-WORT (Naturalized)

**Stellaria media* (L.) Vill. (not Cyril.) COMMON CHICK-WEED (Naturalized)

POLYGONACEAE (BUCKWHEAT FAMILY)

Polygonum amphibium L. WATER SMARTWEED
var. *stipulaceum* Colem. AMPHIBIOUS SMARTWEED
(P. fluitans Eaton; P. hartwrightii Gray; P. natans Eaton)

**Polygonum arenastrum* Jord. ex Boreau DOORWEED, KNOTWEED, KNOTGRASS, SIDEWALK-WEED (Naturalized)
(P. aviculare of American authors in large part)

Polygonum arifolium L. ARROWLEAF OR BROADLEAF TEARTHUMB
[P. arifolium var. pubescens (Keller) Fern.]

**Polygonum aviculare* L. KNOTWEED, KNOTGRASS (Naturalized)
(P. aviculare var. vegetum Ledeb.; P. monspeliensis Pers.)

Polygonum careyi Olney SMARTWEED, PINKWEED
Rarity Status: State E pending; NYNHP G4, SH

**Polygonum cespitosum* Blume ROSY SMARTWEED (Naturalized)
var. *longisetum* (DeBruyn) Stewart

**Polygonum convolvulus* L. BLACK BINDWEED, CORN-BIND
(Naturalized)
[Bilderdykia convolvulus (L.) Dumort.]

**Polygonum cuspidatum* Sieb. & Zucc. JAPANESE BAMBOO, JAPANESE KNOTWEED (Naturalized)
(Reynoutria japonica Houtt.)

**Polygonum hydropiper* L. SMARTWEED, WATER-PEPPER
(Naturalized)

Polygonum hydropiperoides Michx. MILD WATER-PEPPER, SMARTWEED

**Polygonum lapathifolium* L. WILLOW-WEED, DOCK-LEAF OR PALE SMARTWEED (Naturalized)

**Polygonum lapathifolium* x *persicaria* SMARTWEED (Rare Hybrid)

Polygonum pensylvanicum L. PINKWEED, SMARTWEED
(P. longistylum Small; P. pensylvanicum varieties)

**Polygonum persicaria* L. LADY'S-THUMB, HEART'S-EASE, SMARTWEED
(P. dubium Stein; P. minus of authors, not Huds.; P. mite of authors, not Schrank; P. puritanorum Fern.)

Polygonum punctatum Ell. WATER SMARTWEED, DOTTED SMARTWEED
var. *confertiflorum* (Meisn.) Fassett
[P. punctatum var. leptostachyum (Meisn.) Small; P. punctatum var. parvum Vict. & Rouss.]

Polygonum ramosissimum Michx. KNOTWEED
[P. allocarpum Blake; P. atlanticum (Robins.) Bickn. in part; P. exsertum Small in part]

Polygonum robustius (Small) Fern. LARGE WATER SMARTWEED
[P. punctatum var. majus (Meisn. ex DC.) Fassett; P. punctatum var. robustior Small]

Polygonum sagittatum L. TEARTHUMB, ARROW-VINE, SCRATCH-GRASS

Polygonum scandens L. CLIMBING FALSE-BUCKWHEAT
var. *cristatum* (Engelm. & Gray) Gleason
[Bilderdykia cristata (Engelm. & Gray) Greene; Polygonum cristatum Engelm. & Gray]
var. *scandens*
[Bilderdykia scandens (L.) Greene]

Polygonum tenue Michx. KNOTWEED
Rarity Status: State R; NYNHP G5, S3

Polygonum virginianum L. JUMPSEED
[Tovara virginiana (L.) Raf.]

**Rumex acetosella* L. SHEEP SORREL, RED SORREL, SOURGRASS (Naturalized)
ssp. *angiocarpus* (Murb.) Murb.
(R. angiocarpus Murb.)

**Rumex crispus* L. CURLY DOCK, YELLOW DOCK, SOUR DOCK (Naturalized)

**Rumex obtusifolius* L. BITTER-DOCK,RED-VEINED DOCK (Naturalized)
[R. conglomeratus of NY reports, not Murr. (immature)]

Rumex orbiculatus Gray GREAT WATER DOCK
(R. britannica of American authors, not L.; R. hydrolapathum var. americanum Gray)

**Rumex triangulivalvis* (Danser) Rech. f. WILLOW-LEAF DOCK (Naturalized)
[R. mexicanus Meisn. in part; R. salicifolius Weinm. in part]

ELATINACEAE (WATERWORT FAMILY)

Elatine americana (Pursh) Arn. AMERICAN WATERWORT, WATER PURSLANE
[E. triandra var. americana (Pursh) Fassett]

**Elatine triandra* Schkuhr EURASIAN WATERWORT, WATER PURSLANE (Rare Introduction)

CLUSIACEAE (MANGOSTEEN FAMILY)

Hypericum canadense L. CANADIAN ST. JOHN'S-WORT

Hypericum gentianoides (L.) BSP. ORANGE-GRASS, PINEWEED

Hypericum mutilum L. DWARF ST. JOHN'S-WORT
[H. mutilum var. parviflorum (Willd.) Fern.]

**Hypericum perforatum* L. ST. JOHN'S-WORT (Naturalized)

Hypericum punctatum Lam. ST. JOHN'S-WORT

Triadenum virginicum (L.) Raf. MARSH OR PINK-FLOWERED ST. JOHN'S-WORT
(Hypericum virginicum L.)

TILIACEAE (LINDEN FAMILY)

Tilia americana L. BASSWOOD, WHITEWOOD, LINDEN
(T. neglecta Spach)

MALVACEAE (MALLOW FAMILY)

**Abutilon theophrasti* Medic. VELVET-LEAF, BUTTER-PRINT, PIE-MARKER (Naturalized)

Hibiscus moscheutos L. ROSE-MALLOW, SWAMP-ROSE, MARSH ROSE, MARSH-MALLOW, WILD COTTON
(H. palustris L.)

**Malva alcea* L. VERVAIN-MALLOW (Rare Escape)

**Malva neglecta* Wallr. CHEESES, MALLOW (Naturalized)
(M. rotundifolia of authors, not L.)

DROSERACEAE (SUNDEW FAMILY)

Drosera intermedia Hayne SUNDEW, NARROW-LEAF SUNDEW

Drosera rotundifolia L. SUNDEW, ROUND-LEAF SUNDEW

CISTACEAE (ROCKROSE FAMILY)

Helianthemum bicknellii Fern. FROSTWEED, ROCKROSE, HOARY FROSTWEED

Helianthemum canadense (L.) Michx. FROSTWEED, ROCK-ROSE
(H. canadense var. sabulonum Fern.)

Lechea intermedia Leggett ex Britt. PINWEED

Lechea minor L. THYME-LEAF PINWEED (Rare)

Lechea pulchella Raf. PINWEED

Lechea racemulosa Lam. (not Michx.) PINWEED
Rarity Status: State R; NYNHP G5, S2S3

Lechea villosa Ell. PINWEED
(L. mucronata Raf.)

VIOLACEAE (VIOLET FAMILY)

Viola affinis LeConte LECONTE'S VIOLET
(V. latiuscula Greene)

Viola blanda Willd. SWEET WHITE VIOLET
(Viola incognita Brainerd; V. macloskeyi Lloyd in part)

Viola conspersa Reichenb. AMERICAN DOG-VIOLET

Viola fimbriatula Sm. NORTHERN DOWNY OR FRINGED VIOLET

Viola macloskeyi Lloyd SWEET WHITE VIOLET
ssp. *pallens* (Banks ex DC.) M. Baker PALE VIOLET
[V. macloskeyi var. pallens (Banks ex DC.) Hitchc.; V. pallens (Banks ex DC.) Brainerd]

Viola palmata L. EARLY BLUE VIOLET, WOOD VIOLET, WILD OKRA

Viola pubescens Ait. YELLOW VIOLET

Viola rotundifolia Michx. ROUND-LEAF VIOLET, EARLY YELLOW VIOLET

Viola sagittata Ait. ARROW-LEAF VIOLET
[V. emarginata (Nutt.) LeConte]

Viola sororia Willd. COMMON VIOLET, WOOLY OR HOODED VIOLET (CONFEDERATE VIOLET)
[V. x bissellii House; V. domestica Pollard; V. obliqua Hill; V. papilionacea Pursh; V. priceana Pollard]

**Viola tricolor* L. JOHNNY JUMP-UPS, WILD PANSY (Naturalized)

CUCURBITACEAE (GOURD FAMILY)

Sicyos angulatus L. BUR CUCUMBER, STAR CUCUMBER

SALICACEAE (WILLOW FAMILY)

Populus deltoides Bartr. ex Marsh. COTTONWOOD, POPLAR

Populus grandidentata Michx. BIG-TOOTH ASPEN, LARGE-TOOTHED ASPEN

Populus tremuloides Michx. QUAKING ASPEN, TREMBLING ASPEN
[P. tremula L. ssp. tremuloides (Michx.) Löve & Löve]

**Salix alba* L. WHITE WILLOW (Naturalized & Escaping)
(S. alba varieties, S. xhankensonii of NY report, not Dode)

**Salix babylonica* L. WEEPING WILLOW (Rare Escape)

Salix discolor Muhl. PUSSY-WILLOW, GLAUCOUS WILLOW
(S. discolor x rigida of a NY report)

Salix eriocephala Michx. STIFF WILLOW, HEARTLEAF WILLOW
(S. discolor x rigida of a NY report, S. rigida Muhl., S. myricoides of NY reports, not Muhl.)

Salix humilis Marsh. PRAIRIE WILLOW, GRAY WILLOW, SMALL PUSSY-WILLOW, UPLAND WILLOW
[S. humilis var. hypohysa Fern.; S. humilis var. keweenawensis Farw.; S. humilis var. rigidiuscula (Anderss.) Robinson & Fern.]

Salix nigra Marsh. BLACK WILLOW, SWAMP WILLOW

**Salix pentandra* L. BAY-LEAF WILLOW (Rare Introduction)

Salix petiolaris Sm. SLENDER WILLOW
(S. gracilis Anderss.)

BRASSICACEAE (MUSTARD FAMILY)

**Alliaria petiolata* (Bieb.) Cav. & Grande GARLIC MUSTARD
(Naturalized)
(A. officinalis Andrz. ex Bieb.)

**Arabidopsis thaliana* (L.) Heynh. MOUSE-EAR CRESS
(Naturalized)

Arabis canadensis L. SICKLEPOD, ROCK-CRESS

Arabis laevigata (Muhl. ex Willd.) Poir. SMOOTH ROCK-CRESS

Arabis lyrata L. LYRE-LEAF ROCK-CRESS

**Barbarea vulgaris* R. Br. CRESS, YELLOW ROCKET, WINTER-CRESS, CREESY-GREENS (Naturalized)

**Brassica nigra* (L.) Koch BLACK MUSTARD (Naturalized)

**Capsella bursa-pastoris* (L.) Medic. SHEPHERD'S-PURSE, SHEPHERD'S-POUCH, PICK-POCKET (Naturalized)

Cardamine bulbosa (Schreb. ex Muhl.) BSP. SPRING CRESS

Cardamine diphylla (Michx.) Wood TWO-LEAVED TOOTHWORT, PEPPERWORT
(Dentaria diphylla Michx.)

**Cardamine impatiens* L. BUSHY ROCK-CRESS

Cardamine longii Fern. LONG'S BITTERCRESS
Rarity Status: Federal C2; State E pending; NYNHP G3G4, S1

Cardamine parviflora L. SMALL-FLOWERED BITTER-CRESS
var. *arenicola* (Britt.) Schulz
(C. flexuosa of NY reports, in part)

Cardamine pensylvanica Muhl. ex Willd. PENNSYLVANIA BITTERCRESS

**Cardamine pratensis* L. CUCKOO-FLOWER, LADY'S-SMOCK (Naturalized)
(C. pratensis var. palustris Wimm. & Gräb.)

**Diplotaxis tenuifolia* (L.) DC. WALL-ROCKET (Rare Introduction)

**Draba verna* L. WHITLOW-GRASS (Naturalized)
[Erophila verna (L.) Bess.]

**Erysimum cheiranthoides* L. WORMSEED-MUSTARD, TREACLE-MUSTARD (Naturalized)

**Hesperis matronalis* L. DAME'S-ROCKET, DAME'S-VIOLET, MOTHER-OF-THE-EVENING (Naturalized)

**Lepidium campestre* (L.) R. Br. COW-CRESS, FIELD-CRESS (Naturalized)

**Lepidium densiflorum* Schrad. BIRD'S PEPPERGRASS, WILD PEPPERGRASS (Rare Introduction)

**Lepidium ruderale* L. STINKING OR ROADSIDE PEPPERGRASS (Rare Introduction)

Lepidium virginicum L. WILD PEPPERGRASS, POOR-MAN'S-PEPPER

**Rorippa nasturtium-aquaticum* (L.) Hayek WATERCRESS (Naturalized)
[Nasturtium officinale R. Br. ex Ait.; Sisymbrium nasturtium-aquaticum L.]

Rorippa palustris (L.) Besser MARSH WATERCRESS, YELLOW WATERCRESS
**ssp. palustris* (Naturalized)
[R. islandica (Oed.) Borb. var. islandica; R. palustris (L.) Besser]

**Sisymbrium altissimum* L. TUMBLE-MUSTARD (Naturalized)

**Sisymbrium officinale* (L.) Scop. HEDGE-MUSTARD (Naturalized)

Thlaspi arvense L. FIELD PENNYCRESS, FANWEED, FRENCH-WEED, MITHRIDATE MUSTARD (Naturalized)

RESEDACEAE (MIGNONETTE FAMILY)

Reseda lutea L. YELLOW MIGNONETTE, SCRAMBLING ROCKET (Naturalized)

CLETHRACEAE (WHITE ALDER FAMILY)

Clethra alnifolia L. WHITE ALDER, SUMMER-SWEET, SWEET PEPPER-BUSH

ERICACEAE (HEATH FAMILY)

Chamaedaphne calyculata (L.) Moench LEATHERLEAF, CASSANDRA
[Cassandra calyculata (L.) D. Don.; Chamaedaphne calyculata varieties]

Epigaea repens L. TRAILING ARBUTUS, MAYFLOWER, GROUND-LAUREL (E. repens var. glabrifolia Fern.)

Gaultheria procumbens L. WINTERGREEN, CHECKER-BERRY, TEABERRY, MOUNTAIN-TEA, IVORY-LEAF

Gaylussacia baccata (Wang.) Koch BLACK HUCKLEBERRY

Gaylussacia frondosa (L.) Torr. & Gray ex Torr. DANGLEBERRY, DWARF HUCKLEBERRY, BLUE TANGLE

Kalmia angustifolia L. SHEEP LAUREL, LAMBKILL, DWARF LAUREL, WICKY, SHEEPKILL, PIGKILL

Kalmia latifolia L. MOUNTAIN LAUREL, CALICO-BUSH, SPOONWOOD, IVY-BUSH

Leucothoë racemosa (L.) Gray SWEETBELLS, FETTER-BUSH
[Eubotrys racemosa (L.) Nutt.]

Lyonia ligustrina (L.) DC. MALE-BERRY, HE-HUCKLEBERRY, MALE BLUEBERRY

Rhododendron maximum L. GREAT LAUREL, ROSEBAY, WHITE LAUREL

Rhododendron periclymenoides (Michx.) Shinners PINKSTER-FLOWER, PINKSTER-BLOOM, PURPLE HONEY-SUCKLE, ELECTION-PINK
[R. nudiflorum (L.) Torr.]

Rhododendron viscosum (L.) Torr. SWAMP AZALEA, SWAMP HONEY-SUCKLE, CLAMMY AZALEA, CLAMMY RHODODENDRON

Vaccinium angustifolium Ait. LOWBUSH BLUEBERRY, LOW SWEET OR LATE SWEET BLUEBERRY, SWEET-HURTS
(V. brittonii Porter ex Bickn.; V. lamarckii Camp)

Vaccinium corymbosum L. HIGHBUSH BLUEBERRY, SWAMP BLUEBERRY, WHORTLEBERRY
[V. caesariense Mackz.; V. corymbosum varieties; V. marianum S. Wats.]

Vaccinium macrocarpon Ait. CRANBERRY, LARGE CRANBERRY

Vaccinium myrtilloides Michx. SOUR-TOP BLUEBERRY, VELVET-LEAF BLUEBERRY

Vaccinium oxycoccos L. SMALL CRANBERRY
(V. oxycoccus of authors)

Vaccinium pallidum Ait. SUGAR HUCKLEBERRY, LOW, EARLY OR SWEET BLUEBERRY OR BILBERRY
(V. vacillans Kalm ex Torr.)

Vaccinium stamineum L. DEERBERRY, SQUAW-HUCKLEBERRY
[V. neglectum (Small) Fern.]

PYROLACEAE (SHINLEAF FAMILY)

Chimaphila maculata (L.) Pursh SPOTTED WINTERGREEN

Pyrola americana Sweet WILD LILY-OF-THE-VALLEY, ROUND-LEAF PYROLA
[P. rotundifolia var. americana (Sweet) Fern.]

Pyrola elliptica Nutt. SHINLEAF, WILD LILY-OF-THE-VALLEY

MONOTROPACEAE (INDIAN-PIPE FAMILY)

Monotropa uniflora L. INDIAN-PIPE, CONVULSION-ROOT

PRIMULACEAE (PRIMROSE FAMILY)

**Anagallis arvensis* L. SCARLET PIMPERNEL, POOR-MAN'S-WEATHERGLASS, SHEPHERD'S-CLOCK (Naturalized)

Hottonia inflata Ell. FEATHERFOIL, WATER-VIOLET
Rarity Status: State T; NYNHP G3G4, S1

Lysimachia ciliata L. FRINGED LOOSESTRIFE
[Steironema ciliatum (L.) Raf.]

**Lysimachia nummularia* L. MONEYWORT, CREEPING-JENNY, CREEPING-CHARLIE (Naturalized)

**Lysimachia punctata* L. GARDEN LOOSESTRIFE

Lysimachia quadrifolia L. WHORLED LOOSESTRIFE

Lysimachia quadrifolia × *terrestris* = *L.* × *producta* (Gray) Fern. LOOSESTRIFE

Lysimachia terrestris (L.) BSP. SWAMP-CANDLES, YELLOW OR SWAMP LOOSESTRIFE

Lysimachia thyrsiflora L. TUFTED LOOSESTRIFE
[Naumbergia thyrsiflora (L.) Duby]

**Lysimachia vulgaris* L. GARDEN LOOSESTRIFE (ESCAPE)

Samolus valerandii L. WATER PIMPERNEL, BROOKWEED
ssp. *parviflorus* (Raf.) Hultén
(S. floribundus Kunth; S. parviflorus Raf.)

HYDRANGEACEAE (HYDRANGEA FAMILY)

**Deutzia scabra* Thunb. DEUTZIA (Rare Escape)

**Philadelphus coronarius* L. MOCK-ORANGE, SYRINGA (Rare Escape)

GROSSULARIACEAE (CURRANT FAMILY)

**Ribes odoratum* Wendl. f. BUFFALO CURRANT, GOLDEN CURRANT (Rare Introduction)

Ribes rotundifolium Michx. ROUND-LEAF CURRANT, WILD GOOSEBERRY

**Ribes rubrum* L. NORTHERN OR GARDEN RED CURRANT, CHERRY-CURRANT (Naturalized)
[R. sativum (Reichenb.) Syme]

CRASSULACEAE (SEDUM FAMILY)

**Sedum acre* L. YELLOW SEDUM, WALL-SEDUM, WALLPEPPER, MOSSY STONECROP (Naturalized)

**Sedum hispanicum* Juslen. SEDUM (Rare Introduction)
(S. album of some NY reports, not L.)

**Sedum telephium* L. LIVE-FOREVER, GARDEN ORPINE
(Naturalized)
[S. purpureum (L.) Link]

Tillaea aquatica L. PIGMYWEED
Rarity Status: State E; NYNHP G5, S1
[Crassula aquatica (L.) Schoel.]

SAXIFRAGACEAE (SAXIFRAGE FAMILY)

Chrysosplenium americanum Schwein. ex Hook. GOLDEN SAXIFRAGE, WATER-MAT, WATER-CARPET

Heuchera americana L. ROCK GERANIUM, HEUCHERA, ALUM-ROOT
(H. americana var. brevipetala Rosend., Butters & Lak.)

Mitella diphylla L. COOLWORT, MITERWORT

Mitella nuda L. MITERWORT, BISHOP'S-CAP

Penthorum sedoides L. DITCH-STONECROP

Saxifraga pensylvanica L. SWAMP SAXIFRAGE, WILD BEET

Saxifraga virginiensis Michx. EARLY SAXIFRAGE

ROSACEAE (ROSE FAMILY)

Agrimonia gryposepala Wallr. AGRIMONY, COCKLEBUR, HARVEST LICE, STICKSEED

Amelanchier arborea (Michx. f.) Fern.
SHADBUSH,SERVICEBERRY

Amelanchier canadensis (L.) Medic. SERVICEBERRY, SHADBUSH, JUNEBERRY

Amelanchier sanguinea (Pursh) DC. ROUNDLEAF JUNE-BERRY

Amelanchier stolonifera Wieg. BUSH JUNEBERRY, SHADBUSH
[A. spicata (Lam.) Koch in part]

Aronia melanocarpa (Michx.) Ell. BLACK CHOKEBERRY
[Pyrus melanocarpa (Michx.) Willd.]

Aronia prunifolia (Marsh.) Rehd. PURPLE CHOKEBERRY
(Aronia atropurpurea Britt.; Pyrus floribunda Lindl.)

**Cotoneaster hupehensis* Rehd. & Wilson COTONEASTER
(Rare Escape)

Crataegus crus-galli L. COCKSPUR, COCKSPUR-THORN
(C. ardvennae Sarg.; C. cerasina Sarg.; C. crus-galli varieties; C. helderbergensis Sarg.; C. geneseensis Sarg.; C. laetifica Sarg.; C. xpersimilis Sarg.; C.robusta Sarg.; C. schizophylla Eggl.)

Crataegus intricata Lange HAWTHORN
[C. baxterii Sarg.; C. boyntonii Beadle; C. cornellii Sarg. C. foetida Ashe; C. intricata var. straminea (Beadle) Palmer; C. straminea Beadle; C. verecunda Sarg.]

**Crataegus monogyna* Jacq. ENGLISH HAWTHORN (Naturalized)

Crataegus pruinosa (Wendl. f.) Koch HAWTHORN, WAXY-FRUITED THORN
(C. acerba Sarg.; C. amoena Sarg.; C. aridula Sarg.; C. aristata Sarg.; C. bronxensis Sarg.; C. casta Sarg.; C. conjuncta Sarg.; C. crawfordiana Sarg.; C. deltoides Ashe; C. dissonae Sarg; C. eastmaniana Sarg.; C. formosa Sarg.; C. gracilis Sarg.; C. howeana Sarg; C. latisepala Ashe; C. leiophylla Sarg.; C. lennoniana Sarg.; C. livingstoniana Sarg.; C. macera Sarg.; C. maineana Sarg.; Sarg.; C. oblita Sarg.; C. obstipa Sarg; C. pelacris Sarg.; C. pellecta Sarg.; C. plana Sarg.; C. pruinosa vars. of NY reports; C. radiata Sarg.; C. ramosa Sarg.; C. rubrolutea Sarg.; C. rugosa Ashe; C. russata Sarg.)

Fragaria vesca L. WOODLAND OR SOW-TEAT STRAWBERRY
ssp. *americana* (Porter) Staudt
(F. vesca var. americana Porter)

Fragaria virginiana Mill. (not Dcne.) WILD STRAWBERRY, VIRGINIA STRAWBERRY

Geum canadense Jacq. WHITE AVENS
[G. canadense var. camporum (Rydb.) Fern.; G. canadense var. grimesii Fern. & Weath.]

Geum laciniatum Murr. ROUGH AVENS, HERB-BENNET
(G. laciniatum var. trichocarpum Fern.)

**Geum macrophyllum* Willd. YELLOW AVENS (Naturalized)

**Malus baccata* (L.) Borkh. SIBERIAN CRAB (Naturalized)
(Pyrus baccata L.)

**Malus pumila* Mill. COMMON APPLE, PARADISE APPLE (Naturalized)
(Pyrus malus of authors, not L.; Malus domestica Borkh.)

Physocarpus opulifolius (L.) Maxim. NINEBARK

**Potentilla argentea* L. SILVERY CINQUEFOIL, HOARY CINQUEFOIL (Naturalized)

Potentilla canadensis L. DWARF CINQUEFOIL, FIVE-FINGERS

Potentilla norvegica L. ROUGH OR THREE-LEAF CINQUEFOIL
ssp. *monspeliensis* (L.) Aschers. & Gräb.

**Potentilla recta* L. SULFER CINQUEFOIL, FIVE-FINGERS (Naturalized)

Potentilla simplex Michx. OLD-FIELD CINQUEFOIL
(P. simplex var. calvescens Fern.)

**Prunus avium* (L.) L. SWEET CHERRY, MAZZARD, BIRD CHERRY (Naturalized)

**Prunus domestica* L. PLUM (Rare Escape)

Prunus pensylvanica L. f. PIN-CHERRY, FIRE-CHERRY, WILD RED CHERRY, BIRD-CHERRY

**Prunus persica* (L.) Batsch PEACH (Rare Escape)

Prunus pumila L. SAND-CHERRY
var. *susquehanae* (Hort. ex Willd.) Jaeger
[P. pumila var. cuneata (Raf.) Bailey; P. susquehanae Hort.]

Prunus serotina Ehrh. BLACK CHERRY, WILD OR RUM CHERRY

Prunus virginiana L. CHOKE-CHERRY

**Pyrus communis* L. PEAR (Rare Escape)

**Rosa canina* L. DOG ROSE (Naturalized)

**Rosa multiflora* Thunb. ex Murr. MULTIFLORA ROSE (Naturalized)

Rosa palustris Marsh. SWAMP ROSE

Rosa setigera Michx. PRAIRIE ROSE, CLIMBING ROSE

Rosa virginiana Mill. WILD ROSE, PASTURE ROSE

Rubus allegheniensis Porter ex Bailey NORTHERN BLACKBERRY, SOW-TEAT BLACKBERRY, HIGHBUSH BLACKBERRY
(R. allegheniensis varieties; R. bracteoliferus Fern.; R. glandicaulis Blanch.; R. montpeleriensis Blanch.; R. inclinis Bailey; R. nigrobaccus Bailey; R. nuperus Bailey; R. pugnax Bailey)

Rubus enslenii Tratt. SOUTHERN OR SOFT-CANE DEWBERRY
(R. baileyanus Britt.)

Rubus flagellaris Willd. AMERICAN OR NORTHERN DEWBERRY, PRICKLY DEWBERRY *(Also Escaping)
[R. exsularis Bailey; R. invisus (Bailey) Britt.; R. jaysmithii Bailey; R. maltei Bailey; R. multifer Bailey; R. nefrens Bailey; R. roribaccus (Bailey) Rydb.; R. scambens Bailey; R. tetricus Bailey]

Rubus hispidus L. SWAMP DEWBERRY, RUNNING BLACKBERRY
(R. adjacens Fern.; R. botruosis Bailey; R. furtivus Bailey; R. jacens Blanch.; R. multiformis Blanch.; R. novanglicus Bailey; R. noveboracus Bailey; R. obsessus Bailey; R. paganus Bailey; R. permixtus Blanch.; R. rowlei Bailey; R. signatus Bailey; R. tardatus Blanch.; R. trifrons Blanch.)

Rubus idaeus L. RED RASPBERRY
ssp. *sachalinensis* (Levl.) Focke WILD RASPBERRY
(R. strigosus Michx.)

Rubus idaeus ssp. *sachalinense* x *occidentalis*
= *R.* x *neglectus* C. Peck PURPLE WILD RASPBERRY (Rare Hybrid)

**Rubus laciniatus* Willd. CUT-LEAF OR EVERGREEN BLACKBERRY (Naturalized)

Rubus occidentalis L. BLACK RASPBERRY, BLACK-CAP, BLACK THIMBLEBERRY

Rubus odoratus L. PINK THIMBLEBERRY, PURPLE FLOWERING RASPBERRY

Rubus pensilvanicus Poir. ex Lam. HIGH-BUSH BLACKBERRY
(R. bellobatus Bailey; R. heterophyllus Willd.; R. narus Bailey; R. honorus Bailey; R. independens Bailey; R. perfoliosus Bailey; R. pityophilus S. J. Smith ex Bailey; R. insons Bailey; R. insulanus Bailey; R. litoreus Bailey; R. recurvans Blanch.)

**Rubus phoenicolasius* Maxim. WINEBERRY (Naturalized)

Rubus pubescens Raf. DWARF RASPBERRY, PLUMBOY
(R. triphyllus Thunb.)

**Sorbaria sorbifolia* (L.) A. Br. FALSE SPIRAEA (Naturalized)

**Sorbus aucuparia* L. MOUNTAIN ASH, ROWAN, QUICKBEAM (Naturalized)
[Pyrus aucuparia (L.) Gaertn.]

Spiraea alba DuRoi MEADOW-SWEET

Spiraea latifolia (Ait.) Borkh. MEADOW-SWEET, CANADA TEA

Spiraea tomentosa L. HARDHACK, STEEPLE-BUSH, CANADA TEA

CAESALPINIACEAE (CAESALPINIA FAMILY)

Cassia nictitans L. DWARF PARTRIDGE-PEA, WILD SENSITIVE PLANT

FABACEAE (BEAN FAMILY)

**Amorpha fruticosa* L. FALSE INDIGO, INDIGO-BUSH (Naturalized)

Amphicarpaea bracteata (L.) Rickett & Stafleu HOG-PEANUT [Amphicarpa of authors; A. bracteata var. comosa (L.) Fern.; A. comosa (L.) G. Don]

Apios americana Medic. GROUNDNUT, WILD BEAN, POTATO-BEAN

Baptisia tinctoria (L.) Vent. (not R. Br.) WILD INDIGO, RATTLEWEED
var. *crebra* Fern.

**Cercis canadensis* L. REDBUD, JUDAS-TREE (Naturalized)

**Coronilla varia* L. CROWN-VETCH (Naturalized)

**Cytisus scoparius* (L.) Link SCOTCH-BROOM (Naturlalized)

Desmodium canadense (L.) DC. GIANT TICK-CLOVER OR TREFOIL, SHOWY TICK-TREFOIL, BEGGAR-TICKS

Desmodium ciliare (Muhl. ex Willd.) DC. TICK-CLOVER, TICK-TREFOIL
Rarity Status: State T; NYNHP G5, S3

Desmodium cuspidatum (Muhl. ex Willd.) DC. ex Loud. TICK-CLOVER, TICK-TREFOIL

Desmodium glutinosum (Muhl. ex Willd.) Wood STICKY TICK-CLOVER OR TICK-TREFOIL

Desmodium nudiflorum (L.) DC. TICK TREFOIL, TICK CLOVER

Desmodium paniculatum (L.) DC. TICK-TREFOIL, BEGGAR-TICKS (D. dillenii Darl.)

Desmodium rotundifolium DC. TICK-CLOVER, LOW TICK-TREFOIL

**Lathyrus latifolius* L. EVERLASTING-PEA (Naturalized)

Lathyrus palustris L. VETCHLING, MARSH-VETCH OR PEA
(L. palustris var. linearifolius Ser.)

Lespedeza capitata Michx. LESPEDEZA, BUSH-CLOVER
[L. capitata var. velutina (Bickn.) Fern.; L. capitata var. vulgaris Torr. & Gray]

Lespedeza hirta (L.) Hornem. LESPEDEZA, BUSH-CLOVER

Lespedeza intermedia (S. Wats.) Britt. LESPEDEZA, BUSH-CLOVER

Lespedeza procumbens Michx. TRAILING LESPEDEZA, BUSH-CLOVER

Lespedeza repens (L.) Barton TRAILING LESPEDEZA (Rare)

**Lespedeza stipulacea* Maxim. KOREAN CLOVER (Rare Introduction)
[Kummerowia stipulacea (Maxim.) Makino; L. striata of NY reports, not (Thunb.) H. & A.]

Lespedeza virginica (L.) Britt. LESPEDEZA, BUSH-CLOVER

**Lotus corniculata* L. BIRD'S-FOOT TREFOIL (Naturalized)

**Medicago lupulina* L. BLACK MEDICK, NONSUCH (Naturalized)
(M. lupulina var. glandulosa Neilr.)

**Melilotus alba* Desr. ex Lam. WHITE SWEET-CLOVER (Naturalized)

**Melilotus officinalis* (L.) Pallas (not Lam. or Desr.) YELLOW SWEET-CLOVER (Naturalized)

**Robinia pseudo-acacia* L. BLACK LOCUST, FALSE ACACIA (Naturalized)

Strophostyles helvula (L.) Ell. (not Britt.) WILD BEAN
(S. helvola of authors)

Tephrosia virginiana (L.) Pers. GOAT'S-RUE, CATGUT, RABBIT'S-PEA

**Trifolium arvense* L. RABBIT'S-FOOT CLOVER, OLD FIELD OR STONE-CLOVER (Naturalized)

**Trifolium aureum* Pollich YELLOW CLOVER, HOP-CLOVER (Naturalized)
(T. agrarium L., a *nomen ambiguum*)

**Trifolium campestre* Schreb. HOP-CLOVER, LOW HOP-CLOVER, SHAMROCK, COW-CLOVER (Naturalized)
(T. procumbens L., a nomen ambiguum)

**Trifolium dubium* Sibth. SMALL HOP-CLOVER (Naturalized)
(T. procumbens L. of some authors, a nomen ambiguum)

**Trifolium hybridum* L. ALSIKE CLOVER (Naturalized)
[T. hybridum var. elegans (Savi) Boiss.]

**Trifolium pratense* L. RED CLOVER (Naturalized)
[T. pratense var. sativum (Mill.) Schreb.]

**Trifolium repens* L. WHITE CLOVER, LAWN-CLOVER, DUTCH-CLOVER (Naturalized)

**Vicia cracca* L. COW-VETCH, TUFTED-VETCH, CANADA-PEA (Naturalized)

**Vicia tetrasperma* (L.) Schreb. LENTIL-VETCH, SPARROW-VETCH, SLENDER VETCH (Naturalized)

**Wisteria sinensis* (Sims) Sweet CHINESE WISTERIA (Rare Escape)

ELAEAGNACEAE (OLEASTER FAMILY)

**Elaeagnus angustifolia* L. RUSSIAN OLIVE, OLEASTER, ELAEAGNUS, SILVER-BERRY (Rare Escape)

**Elaeagnus umbellata* Thunb. OLEASTER, AUTUMN OLIVE, ELAEAGNUS (Rare Escape)

PODOSTEMACEAE (RIVERWEED FAMILY)

Podostemum ceratophyllum Michx. RIVERWEED, RIVER-MOSS, THREADFOOT
Rarity Status: State R; NYNHP G5, S2

HALORAGACEAE (WATER MILFOIL FAMILY)

Myriophyllum heterophyllum Michx. WATER MILFOIL

Myriophyllum humile (Raf.) Morong WATER MILFOIL

**Myriophyllum spicatum* L. EURASIAN MILFOIL, MOSS, WATER MILFOIL (Naturalized)

Proserpinaca palustris L. MERMAID-WEED
(P. intermedia Mackz.)

LYTHRACEAE (LOOSESTRIFE FAMILY)

Decodon verticillatus (L.) Ell. WATER-WILLOW, WATER-OLEANDER

Lythrum alatum Pursh WINGED LOOSESTRIFE

**Lythrum salicaria* L. PURPLE LOOSESTRIFE, SPIKED LOOSESTRIFE (Naturalized)

TRAPACEAE (WATER-CHESTNUT FAMILY)

**Trapa natans* L. WATER-CHESTNUT, WATER-CALTROP, WATER-NUT (Naturalized)

ONAGRACEAE (EVENING PRIMROSE FAMILY)

Circaea lutetiana L. ENCHANTER'S NIGHTSHADE
ssp. *canadensis* (L.) Aschers. & Magnus
[C. canadensis L.; C. quadrisulcata (Maxim.) Franch. & Sav.]

Epilobium ciliatum Raf. WILLOW-HERB
[E. adenocaulon Hausskn.; E. glandulosum var. adenocaulon (Hausskn.) Fern.]

Epilobium coloratum Biehl. PURPLE-LEAF WILLOW-HERB

Epilobium leptophyllum Raf. WILLOW-HERB, FIREWEED

Ludwigia palustris (L.) Ell. WATER OR MARSH PURSLANE
[L. palustris var. americana (DC.) Fern. & Grisc.]

Oenothera biennis L. COMMON EVENING-PRIMROSE
[O. biennis var. nutans (Atkins. & Bartl.) Wieg.; O. biennis var. pycnocarpa (Atkins. & Bartl.) Wieg.; O. biennis ssp. muricata (L.) Piper; O. muricata L.]

Oenothera cruciata (S. Wats.) Munz EVENING PRIMROSE
(O. parviflora of authors, not L.)

Oenothera perennis L. SUNDROPS
(O. perennis var. receptilis Blake)

MELASTOMATACEAE (MELASTOME FAMILY)

Rhexia virginica L. MEADOW-BEAUTY, DEERGRASS

NYSSACEAE (TUPELO FAMILY)

Nyssa sylvatica Marsh. BLACK GUM, TUPELO, PEPPERIDGE, SOUR GUM, TUPELO-GUM

CORNACEAE (DOGWOOD FAMILY)

Cornus alternifolia L. f. GREEN OSIER, PAGODA DOGWOOD
[Svida alternifolia (L. f.) Small]

Cornus amomum Mill. SILKY DOGWOOD, KINNIKINNIK
ssp. *obliqua* (Raf.) Wilson NARROW-LEAF DOGWOOD
[C. amomum var. schuetziana (Mey.) Rickett; C. obliqua Raf.; C. purpusii Koehne]

Cornus florida L. FLOWERING DOGWOOD

Cornus foemina Mill. STIFF DOGWOOD, GRAY DOGWOOD
ssp. *racemosa* (Lam.) J. Wilson GRAY DOGWOOD
(C. racemosa Lam.; C. paniculata L'Her)

Cornus sericea L. RED OSIER, RED DOGWOOD, AMERICAN DOGWOOD
[C. alba ssp. stolonifera (Michx.) Wang; C. stolonifera Michx.]

SANTALACEAE (SANDALWOOD FAMILY)

Comandra umbellata (L.) Nutt. BASTARD-TOADFLAX
(C. richardsiana Fern.; C. umbellata var. decumbens E. Hill)

CELASTRACEAE (STAFF-TREE FAMILY)

**Celastrus orbiculata* Thunb. ORIENTAL BITTERSWEET
(Naturalized)

**Euonymus alata* (Thunb.) Sieb. WINGED SPINDLE-TREE
(Naturalized)

AQUIFOLIACEAE (HOLLY FAMILY)

Ilex laevigata (Pursh) Gray SMOOTH WINTERBERRY

Ilex verticillata (L.) Gray BLACK ALDER, WINTERBERRY

Nemopanthus mucronatus (L.) Loesener ex Koehne
MOUNTAIN HOLLY, CATBERRY

EUPHORBIACEAE (SPURGE FAMILY)

Acalypha gracilens Gray THREE-SEEDED-MERCURY (Rare)

Acalypha virginica L. THREE-SEEDED-MERCURY
var. *rhomboidea* (Raf.) Cooperrider
(A. rhomboidea Raf.)

Chamaesyce glyptosperma (Engelm.) Small SPURGE, EYEBANE
(Euphorbia glyptosperma Engelm.)

Chamaesyce maculata (L.) Small EYEBANE, WARTWEED, SPOTTED SPURGE
(Euphorbia maculata L.; E. humistrata of NY reports, not Engelm.; E. supina Raf.)

Chamaesyce nutans (Lag.) Small EYEBANE
(Euphorbia maculata of authors in part; E. preslii Guss.)

Chamaesyce vermiculata (Raf.) House HAIRY SPURGE
(Euphorbia vermiculata Raf.)

**Euphorbia cyparissias* L. CYPRESS SPURGE (Naturalized)

**Euphorbia esula* L. WOLF'S-MILK, LEAFY SPURGE (Naturalized)

**Poinsettia dentata* (Michx.) Klotzsch & Garcke SPURGE, WILD POINSETTIA (Naturalized)
(Euphorbia dentata Michx.)

RHAMNACEAE (BUCKTHORN FAMILY)

Ceanothus americanus L. NEW JERSEY TEA, REDROOT

Rhamnus alnifolia L'Her. ALDER-LEAF BUCKTHORN

**Rhamnus cathartica* L. COMMON BUCKTHORN (Naturalized)

VITACEAE (GRAPE FAMILY)

**Ampelopsis brevipedunculata* (Maxim.) Trautv. PORCELAIN-BERRY (Naturalized)

Parthenocissus quinquefolia (L.) Planch. ex DC. (not Greene) VIRGINIA CREEPER, WOODBINE

**Parthenocissus tricuspidata* (Sieb. & Zucc.) Planch. BOSTON IVY, JAPANESE IVY, COTTAGE IVY (Rare Escape)

Parthenocissus vitacea (L.) Planch. VIRGINIA CREEPER, WOODBINE
[P. inserta (Knerr) Fritsch]

Vitis aestivalis Michx. SUMMER GRAPE, PIGEON GRAPE, SILVERLEAF GRAPE
[V. aestivalis var. argentifolia (Muns.) Fern.]

Vitis labrusca L. FOX GRAPE, SKUNK GRAPE
(V. labrusca var. subedentata Fern.; V. labruscana Bailey)

Vitis riparia Michx. FROST GRAPE, RIVERBANK GRAPE, DUNE GRAPE
(V. riparia var. syrticola (Fern. & Wieg.) Fern.; V. vulpina of old NY reports, not L.)

LINACEAE (FLAX FAMILY)

Linum medium (Planch.) Britt. WILD FLAX
Rarity Status: State T; NYNHP G5, S1

**Linum usitatissimum* L. FLAX, LINSEED (Rare Escape)

POLYGALACEAE (MILKWORT FAMILY)

Polygala paucifolia Willd. FRINGED MILKWORT, GAY-WINGS, FLOWERING WINTERGREEN, BIRD-ON-THE-WING

Polygala sanguinea L. ROSE MILKWORT, FIELD MILKWORT

Polygala senega L. SENECA SNAKEROOT, MOUNTAIN FLAX

Polygala verticillata L. WHORLED MILKWORT

STAPHYLEACEAE (BLADDERNUT FAMILY)

Staphylea trifolia L. BLADDERNUT

HIPPOCASTANACEAE (HORSE-CHESTNUT FAMILY)

**Aesculus hippocastanum* L. HORSE-CHESTNUT (Rare Escape)

ACERACEAE (MAPLE FAMILY)

Acer negundo L. BOX-ELDER, ASH-LEAF MAPLE
[A. negundo var. violaceum Mill.]

Acer nigrum Michx. f. BLACK MAPLE
[A. saccharum var. nigrum (Michx. f.) Britt., not Small]

Acer pensylvanicum L. STRIPED MAPLE, MOOSEWOOD, GREEN-STRIPED MAPLE, WHISTLEWOOD

**Acer platanoides* L. NORWAY MAPLE (Naturalized & Escaping)

**Acer pseudoplatanus* L. SYCAMORE-MAPLE (Rare Escape)

Acer rubrum L. RED MAPLE, SOFT MAPLE, SCARLET MAPLE, SWAMP MAPLE
var. *rubrum*
var. *trilobum* Torr. & Gray ex Koch

Acer rubrum x *saccharinum* = *A.* x *freemanii Murr.* SOFT MAPLE

Acer saccharinum L. SILVER MAPLE, RIVER MAPLE

Acer saccharum Marsh. SUGAR MAPLE, ROCK MAPLE, HARD MAPLE

ANACARDIACEAE (SUMAC FAMILY)

Rhus copallinum L. DWARF SUMAC, SHINING SUMAC, WINGED SUMAC
(R. copallina of authors; R. copallinum var. latifolia Engler)

Rhus glabra L. SMOOTH SUMAC, SMOOTH STAGHORN

Rhus typhina L. STAGHORN SUMAC, VELVET SUMAC

Toxicodendron radicans (L.) Kuntze POISON IVY, POISON OAK
(Rhus radicans L.; R. toxicodendron of NY reports, not L.)

Toxicodendron vernix (L.) Kuntze POISON SUMAC
(Rhus vernix L.)

SIMAROUBACEAE (QUASSIA FAMILY)

**Ailanthus altissima* (Mill.) Swingle TREE-OF-HEAVEN, COPAL TREE (Naturalized)

RUTACEAE (RUE FAMILY)

Zanthoxylum americanum Mill. PRICKLY ASH, TOOTH-ACHE TREE

OXALIDACEAE (OXALIS FAMILY)

Oxalis acetosella L. COMMON WOOD-SORREL, AMERICAN SHAMROCK
[O. acetosella var. montana (Raf.) Hultén ex D. Löve; O. montana Raf.]

**Oxalis corniculata* L. LADY'S-SORREL, CREEPING SORREL
(Rare Introduction)
(O. repens Thunb.)

Oxalis dillenii Jacq. WOOD-SORREL, WOOD-SHAMROCK
ssp. *filipes* (Small) Eiten
[O. florida Salisb., in part; O. filipes (Small) Small]

Oxalis stricta L. LADY'S-SORREL
(O. europaea of authors, not Jord.)

GERANIACEAE (GERANIUM FAMILY)

Geranium carolinianum L. CRANESBILL, WILD GERANIUM
(G. sphaerospermum Fern.)

Geranium maculatum L. WILD GERANIUM, SPOTTED GERANIUM, ALUMROOT, PURPLE CRANESBILL

Geranium robertianum L. HERB-ROBERT

**Geranium sibericum* L. CRANESBILL (Naturalized)

BALSAMINACEAE (TOUCH-ME-NOT FAMILY)

Impatiens capensis Meerb. SPOTTED JEWELWEED, TOUCH-ME-NOT, SNAPWEED
(I. biflora Walt., not Willd.)

Impatiens pallida Nutt. PALE JEWELWEED, TOUCH-ME-NOT, SNAPWEED

ARALIACEAE (GINSENG FAMILY)

Aralia hispida Vent. BRISTLY SARSAPARILLA, DWARF-ELDER

Aralia nudicaulis L. WILD SARSAPARILLA

Aralia racemosa L. SPIKENARD, PETTY-MORREL, LIFE-OF-MAN

Aralia spinosa L. HERCULES'-CLUB, DEVIL'S WALKING-STICK, ANGELICA-TREE, PRICKLY-ASH

Panax trifolius L. DWARF GINSENG, GROUND-NUT

APIACEAE (CARROT FAMILY)

**Aethusa cynapium* L. FOOL'S-PARSLEY (Naturalized)

Cicuta bulbifera L. WATER-HEMLOCK

Cicuta maculata L. WATER-HEMLOCK, SPOTTED COWBANE, MUSQUASH-ROOT, BEAVER-POISON, POISON HEMLOCK

Cryptotaenia canadensis (L.) DC. HONEWORT, WILD CHERVIL

**Daucus carota* L. QUEEN-ANNE'S-LACE, WILD CARROT
(Naturalized)

Hydrocotyle americana L. PENNYWORT, NAVELWORT

**Pastinaca sativa* L. WILD PARSNIP (Naturalized)

Sanicula canadensis L. SANICLE, SNAKEROOT
(S. canadensis var. grandis Fern.)

Sium suave Walt. WATER-PARSNIP

Zizia aptera (Gray) Fern. GOLDEN ALEXANDERS

Zizia aurea (L.) Koch GOLDEN ALEXANDERS

GENTIANACEAE (GENTIAN FAMILY)

Bartonia paniculata (Michx.) Muhl. SCREW-STEM
(B. paniculata var. intermedia Fern.)

Bartonia virginica (L.) BSP. BARTONIA

Gentiana clausa Raf. BLIND GENTIAN, CLOSED GENTIAN,
BOTTLE GENTIAN

Gentianopsis crinita (Froel.) Ma FRINGED GENTIAN
(Gentiana crinita Froel.)

APOCYNACEAE (DOGBANE FAMILY)

Apocynum androsaemifolium L. SPREADING DOGBANE, PINK
DOGBANE, INDIAN HEMP

Apocynum cannabinum L. INDIAN HEMP, DOGBANE
var. *cannabinum*
[A. cannabinum var. pubescens (Mitchell ex R. Br.) A. DC.]
var. *hypericifolium* Gray
(A. sibericum Jacq.)

**Vinca minor* L. COMMON PERIWINKLE, RUNNING MYRTLE,
LESSER PERIWINKLE (Naturalized)

ASCLEPIADACEAE (MILKWEED FAMILY)

Asclepias exaltata L. POKE MILKWEED

Asclepias incarnata L. SWAMP MILKWEED

Asclepias purpurascens L. PURPLE MILKWEED
Rarity Status: State T; NYNHP G4G5, S2

Asclepias quadrifolia Jacq. FOUR-LEAF MILKWEED

Asclepias syriaca L. COMMON MILKWEED

**Vincetoxicum nigrum* (L.) Moench BLACK SWALLOW-WORT (Naturalized)
[Cynanchum nigrum (L.) Pers.]

SOLANACEAE (NIGHTSHADE FAMILY)

**Physalis alkekengi* L. CHINESE-LANTERN, JAPANESE-LANTERN, WINTER-CHERRY, ALKAKENGI, STRAWBERRY TOMATO (Rare Escape)

Physalis heterophylla Nees CLAMMY GROUND-CHERRY

Solanum carolinense L. HORSE-NETTLE, BALL NIGHTSHADE

**Solanum dulcamara* L. CLIMBING OR TRAILING NIGHTSHADE, BITTERSWEET (Naturalized)

**Solanum nigrum* L. BLACK NIGHTSHADE, POISONBERRY (Naturalized)
(S. americanum of NY reports, not Mill.; S. nigrum var. vulgare L.; S. ptycanthum Dun. ex DC.)

CONVOLVULACEAE (MORNING-GLORY FAMILY)

Calystegia sepium (L.) R. Br. HEDGE-BINDWEED, WILD MORNING-GLORY, TRAINLING HEDGE-BINDWEED (Convolvulus sepium L.)

**Convolvulus arvensis* L. FIELD BINDWEED (Naturalized)

CUSCUTACAEAE (DODDER FAMILY)

Cuscuta compacta Juss. ex Choisy DODDER, STRANGLEWEED

Cuscuta gronovii Willd. ex Schultz DODDER, LOVE-VINE, STRANGLEWEED, GOLDTHREAD-VINE

Cuscuta pentagona Engelm. FIELD-DODDER
Rarity Status: State R; NYNHP G5 S1

MENYANTHACEAE (BUCKBEAN FAMILY)

Nymphoides cordata (Ell.) Fern. FLOATING-HEART

POLEMONIACEAE (PHLOX FAMILY)

Phlox paniculata L. FALL OR SUMMER PHLOX, GARDEN PHLOX

BORAGINACEAE (BORAGE FAMILY)

**Echium vulgare* L. BLUE-DEVIL, BLUE-WEED, VIPER'S BUGLOSS (Naturalized)

Hackelia virginiana (L.) Johnst. STICKSEED, BEGGAR-LICE

**Myosotis scorpioides* L. FORGET-ME-NOT (Naturalized)

VERBENACEAE (VERBENA FAMILY)

Phryma leptostachya L. LOPSEED
(P. leptostachya var. confertifolia Fern.)
Note: This species has traditionally been assigned to the monotypic family Phrymaceae.

Verbena hastata L. BLUE VERVAIN, BLUE VERBENA, SIMPLER'S-JOY

Verbena urticifolia L. WHITE VERVAIN

LAMIACEAE (MINT FAMILY)

**Calamintha nepeta* (L.) Savi CALAMINT (Rare Escape)
[Satureja calamintha var. nepeta (L.) Briq.; S. nepeta (L.) Scheele]

**Clinopodium vulgare* L. BASIL, WILD BASIL, BASIL-WEED, DOG-MINT (Naturalized)
[Satureja vulgaris (L.) Fritsch]

Collinsonia canadensis L. RICHWEED, STONEROOT

Cunila origanoides (L.) Britt. DITTANY
Rarity Status: NYNHP G5, S3

**Galeopsis tetrahit* L. HEMP-NETTLE (Naturalized)

**Glechoma hederacea* L. GROUND-IVY, GILL-OVER-THE-GROUND (Naturalized)
[Nepeta hederacea (L.) Trev.]

Hedeoma pulegioides (L.) Pers. MOCK-PENNYROYAL

**Lamium amplexicaule* L. HENBIT, DEAD-NETTLE (Naturalized)

**Leonurus cardiaca* L. MOTHERWORT (Naturalized)

Lycopus americanus Muhl. ex Bart. WATER-HOREHOUND, BUGLEWEED
(L. americanus var. longii Benner)

Lycopus rubellus Moench GYPSY-WORT, WATER-HOREHOUND, BUGLEWEED
Rarity Status: State E pending; NYNHP G5, SH

Lycopus virginicus L. WATER-HOREHOUND, BUGLE-WEED

Mentha arvensis L. FIELD MINT
*ssp. *arvensis* (Naturalized)

**Mentha spicata* L. SPEARMINT, CURLY MINT (Naturalized)
[M. aquatica var. crispa (L.) Benth.; M. crispa L.; M. xpiperita var. crispa (L.) Koch; M. viridis L.]

Monarda fistulosa L. WILD BERGAMOT, HORSEMINT

**Nepeta cataria* L. CATNIP, CATMINT (Naturalized)

**Origanum vulgare* L. MARJORAM, OREGANO (Naturalized)

**Perilla frutescens* (L.) Britt. PERILLA (Rare Introduction)
[P. frutescens var. crispa (Benth.) Deane]

**Prunella vulgaris* L. SELF-HEAL, HEAL-ALL (Naturalized)

Pycnanthemum incanum (L.) Michx. MOUNTAIN-MINT

Pycnanthemum muticum (Michx.) Pers. MOUNTAIN-MINT (Rare)

Pycnanthemum tenuifolium Schrad. MOUNTAIN-MINT
[P. flexuosum of some authors, not (Walt.) BSP.]

Pycnanthemum virginianum (L.) Dur. & Jacks. ex Fern. & Rob. MOUNTAIN-MINT

Scutellaria galericulata L. COMMON SKULLCAP
(S. x churchilliana of NY report, not Fern., S. epilobiifolia Hamilt.)

Scutellaria lateriflora L. MAD-DOG SKULLCAP

Teucrium canadense L. WILD GERMANDER, WOOD-SAGE
var. *boreale* (Bickn.) Shinners NORTHERN GERMANDER
[T. occidentale Gray; T. canadense var. occidentale (Gray) McClintock & Epling]

Trichostema dichotomum L. BASTARD-PENNYROYAL, BLUE-CURLS

CALLITRICHACEAE (WATER-STARWORT FAMILY)

Callitriche heterophylla Pursh WATER-STARWORT

**Callitriche stagnalis* Scop. WATER-CHICKWEED OR STARWORT (Rare Introduction)

Callitriche terrestris Raf. STARWORT
Rarity Status: State E pending; NYNHP G5, SH
[C. austinii Engelm.; C. deflexa A. Br.; C. deflexa var. austinii (Engelm.) Hegelm.]

PLANTAGINACEAE (PLANTAIN FAMILY)

**Plantago arenaria* Waldst. & Kit. FLAXSEED PLANTAIN, FLEAWORT, PSYLLIUM (Naturalized)
(P. indica L., a *nomen illeg.*; P. psyllium L.; a *nomen ambiguum*)

**Plantago aristata* Michx. RAT-TAIL PLANTAIN, BRACTED PLANTAIN, WESTERN RIPPLEGRASS (Naturalized)

**Plantago lanceolata* L. BUCK-HORN PLANTAIN, RIB-GRASS, RIPPLEGRASS, RIBWORT, NARROW-LEAF PLANTAIN, ENGLISH PLANTAIN (Naturalized)
(P. lanceolata var. sphaerostachya Mert. & Koch)

**Plantago major* L. COMMON PLANTAIN, DOORYARD PLANTAIN, BROAD-LEAF PLANTAIN, CAR(T)-TRACK PLANT, WHITE-MAN'S FOOT (Naturalized)

**Plantago pusilla* Nutt. DWARF PLANTAIN, SLENDER PLANTAIN (Rare Introduction)

Plantago rugelii Dcne. PALE PLANTAIN, GRAND PLANTAIN, RUGEL'S PLANTAIN, WHITE-MAN'S FOOT

Plantago virginica L. HOARY PLANTAIN, PALE-SEEDED PLANTAIN

OLEACEAE (OLIVE FAMILY)

Fraxinus americana L. WHITE ASH, AMERICAN ASH
(F. americana var. microcarpa Gray)

Fraxinus nigra Marsh. BLACK ASH

Fraxinus pennsylvanica Marsh. RED ASH, GREEN ASH

**Ligustrum obtusifolium* Sieb. & Zucc. PRIVET (Rare Escape)

**Ligustrum vulgare* L. PRIVET, HEDGE-PRIVET, PRIM (Rare Escape)

**Syringa vulgaris* L. LILAC, PURPLE OR WHITE LILAC (Rare Escape)

SCROPHULARIACEAE (FIGWORT FAMILY)

Agalinis tenuifolia (Vahl) Raf. GERARDIA, FALSE-FOXGLOVE

**Antirrhinum majus* L. SNAPDRAGON (Rare Escape)

Aureolaria flava (L.) Farw. YELLOW FALSE-FOXGLOVE (Gerardia flava L.)

**Chaenorrhinum minus* (L.) Lange DWARF SNAPDRAGON (Naturalized)

Chelone glabra L. TURTLE-HEADS, BALMONY, SNAKE-HEADS

**Cymbalaria muralis* Gaertn., Mey. & Sherb. KENILWORTH-IVY, COLISEUM-IVY (Rare Escape)

**Digitalis lutea* L. YELLOW FOXGLOVE (Rare Escape)

Gratiola neglecta Torr. MUD-HYSSOP, HEDGE-HYSSOP (G. virginiana of NY reports, not L.)

Limosella australis R. Br. MUDWORT (L. subulata Ives)

**Linaria vulgaris* Mill. BUTTER-AND-EGGS, WILD SNAPDRAGON, COMMON TOADFLAX (Naturalized)

Lindernia dubia (L.) Pennell FALSE-PIMPERNEL

Mimulus ringens L. COMMON MONKEYFLOWER, PURPLE OR ALLEGHENY MONKEYFLOWER

Pedicularis canadensis L. LOUSEWORT, WOOD-BETONY (P. canadensis var. dobbsii Fern.)

**Penstemon digitalis* Nutt. FALSE-FOXGLOVE, BEARD-TONGUE (Naturalized)
[P. laevigatus of NY reports, not (L.) Ait.]

Penstemon hirsutus (L.) Willd. PENSTEMON, BEARD-TONGUE

Scrophularia marilandica L. CARPENTER'S-SQUARE, FIGWORT

**Verbascum blattaria* L. MOTH-MULLEIN (Naturalized)

**Verbascum phlomoides* L. MULLEIN (Rare Introduction)

**Verbascum thapsus* L. MULLEIN, MULE'S-EAR, FLANNEL-PLANT, DEVIL'S-TOBACCO (Naturalized)

Veronica anagallis-aquatica L. WATER SPEEDWELL, BROOK OR WATER PIMPERNELL

**Veronica arvensis* L. CORN SPEEDWELL (Naturalized)

**Veronica chamaedrys* L. BIRD'S-EYE SPEEDWELL (Naturalized)

**Veronica officinalis* L. SPEEDWELL, GYPSY-WEED (Naturalized)

Veronica peregrina L. NECKWEED, PURSLANE-SPEEDWELL

Veronica scutellata L. MARSH SPEEDWELL
(V. scutellata var. villosa Schum.)

**Veronica serpyllifolia* L. THYME-LEAF SPEEDWELL (Naturalized)

OROBANCHACEAE (BROOM-RAPE FAMILY)

Conopholis americana (L.f.) Wallr. SQUAWROOT, CANCER-ROOT

Epifagus virginana (L.) Bartr. BEECH-DROPS, CANCER ROOT

Orobanche uniflora L. ONE-FLOWERED CANCER-ROOT

BIGNONIACEAE (BIGNONIA FAMILY)

**Campsis radicans* (L.) Seem. ex Bureau TRUMPET-CREEPER, TRUMPET-VINE, TRUMPET-FLOWER (Naturalized)
[Tecoma radicans (L.) Juss.]

**Catalpa ovata* G. Don CHINESE CATALPA (Rare Escape)

**Catalpa speciosa* (Warder ex Barney) Engelm. CATALPA, INDIAN-BEAN, CATAWBA, CIGAR-TREE (Naturalized)

**Paulownia tomentosa* (Thunb.) Sieb. & Zucc. ex Steud. PRINCESS TREE, EMPRESS TREE, KARRI TREE, PAULOWNIA (Naturalized)

LENTIBULARIACEAE (BLADDERWORT FAMILY)

Utricularia biflora Lam. TWO-FLOWERED BLADDERWORT
Rarity Status: State R; NYNHP G5, S1
(U. pumila Walt.)

Utricularia cornuta Michx. HORNED BLADDERWORT

Utricularia geminiscapa Benj. BLADDERWORT
Rarity Status: State R; NYNYP G4G5, S2S3

Utricularia macrorhiza LeConte COMMON BLADDERWORT
[U. vulgaris of American authors, not L.]

Utricularia purpurea Walt. PURPLE BLADDERWORT

Utricularia radiata Small SMALL FLOATING BLADDERWORT
Rarity Status: State R; NYNHP G4, S2
(U. inflata var. minor Chapm.)

CAMPANULACEAE (BLUEBELL FAMILY)

Campanula aparinoides Pursh MARSH BELLFLOWER
[C. aparinoides var. grandiflora Holz; C. aparinoides var. uliginosa (Rydb.) Gleason; C. uliginosa Rydb.]

**Campanula persicifolia* L. WILLOW BELLFLOWER, PEACH-BELLS (Rare Escape)

**Campanula rapunculoides* L. CREEPING BELLFLOWER, ROVING BELLFLOWER (Naturalized)
[C. rapunculoides var. ucranica (Bess.) Koch]

Campanula rotundifolia L. HAREBELL, BLUEBELL

Lobelia cardinalis L. CARDINAL-FLOWER, INDIAN-PINK

Lobelia inflata L. INDIAN-TOBACCO

Lobelia siphilitica L. GREAT LOBELIA, BLUE CARDINAL-FLOWER

Lobelia spicata Lam. PALE-SPIKED LOBELIA

Triodanis perfoliata (L.) Nieuwl. VENUS' LOOKING-GLASS
[Specularia perfoliata (L.) A. DC.]

RUBIACEAE (MADDER FAMILY)

Cephalanthus occidentalis L. BUTTONBUSH

Galium aparine L. BEDSTRAW, CLEAVERS, GOOSEGRASS

Galium circaezans Michx. WILD LICORICE

Galium lanceolatum Torr. WILD-LICORICE

Galium mollugo L. WHITE BEDSTRAW, FALSE BABY'S-BREATH, WILD MADDER (Naturalized)
(G. erectum Huds.)

Galium palustre L. DITCH BEDSTRAW, MARSH BEDSTRAW

Galium tinctorium L. BEDSTRAW, CLEAVERS
[G. trifidum var. tinctorium (L.) Torr. & Gray]

Galium trifidum L. SMALL BEDSTRAW, CLEAVERS
(G. brandegei Gray in part)

Galium triflorum Michx. SWEET-SCENTED BEDSTRAW
(G. triflorum var. asprelliforme Fern.)

Galium verum L. YELLOW OR GOLDEN BEDSTRAW, OUR-LADY'S BEDSTRAW (Naturalized)

Mitchella repens L. PARTRIDGE-BERRY, TWIN-BERRY, RUNNING-BOX, TWO-EYED BERRY, MITCHELLA

CAPRIFOLIACEAE (HONEYSUCKLE FAMILY)

Diervilla lonicera Mill. BUSH HONEYSUCKLE

Linnaea borealis L. TWINFLOWER, LINNAEA
ssp. *americana* (Forbes) Hultén
[L. borealis var. americana (Forbes) Rehd.]

Lonicera japonica Thunb. JAPANESE HONEYSUCKLE, GOLD-AND-SILVER-FLOWER (Naturalized)

Lonicera morrowii x *tatarica* = *L.* x *bella* Zabel FLY HONEYSUCKLE (Rare Escape)

Lonicera sempervirens L. TRUMPET HONEYSUCKLE, CORAL OR RED HONEYSUCKLE
(L. sempervirens var. minor Ait.)

Lonicera tatarica L. TARTARIAN HONEYSUCKLE (Naturalized)

Sambucus canadensis L. BLACK ELDERBERRY, COMMON ELDER

Sambucus racemosa L. RED ELDERBERRY, STINKING ELDERBERRY
ssp. *pubens* (Michx.) House
(S. pubens Michx.)

Viburnum acerifolium L. MAPLE-LEAF VIBURNUM, ARROWWOOD, DOCKMACKIE

Viburnum cassinoides L. WITHE-ROD, APPALACHIAN TEA, WILD RAISIN, SWAMP-HAW, TEA-BERRY
[V. nudum var. cassinoides (L.) Torr. & Gray]

**Viburnum dilatatum* Thunb. VIBURNUM (Rare Escape)

Viburnum lentago L. SHEEPBERRY, SWEETBERRY, NANNYBERRY, BLACK HAW, COWBERRY, WILD RAISIN, WILD TEA

Viburnum prunifolium L. BLACK-HAW, SWEET-HAW, STAGBUSH

Viburnum rafanisquianum Schultes DOWNY ARROWWOOD
[V. rafanisquianum var. affine (Bush) House]

Viburnum recognitum Fern. ARROWWOOD
(V. dentatum var. lucidum Ait.)

**Weigela floribunda* (Sieb. & Zucc.) Koch WEIGELA, WEIGELIA (Rare Escape)
(Weigelia Pers. of some authors = Weigela Thunb.)

DIPSACACEAE (TEASEL FAMILY)

**Dipsacus fullonum* L. COMMON TEASEL, FULLER'S TEASEL, WILD TEASEL (Naturalized)
(D. sylvestris Huds.)

ASTERACEAE (ASTER FAMILY)

**Achillea millefolium* L. COMMON YARROW, MILFOIL (Naturalized)

Ambrosia artemisiifolia L. RAGWEED, HOGWEED, BITTERWEED

Ambrosia trifida L. GIANT RAGWEED, GREAT RAGWEED, BUFFALO-WEED

Anaphalis margaritacea (L.) Benth. & Hook. f. ex Clarke PEARLY-EVERLASTING
(A. margaritacea subspecies and varieties)

Antennaria neglecta Greene EVERLASTING, PUSSY'S-TOES
(A. petaloidea Fern.)

Antennaria plantaginifolia (L.) Richards. EVERLASTING, PUSSY'S-TOES, LADY'S TOBACCO

**Anthemis arvensis* L. CORN-CHAMOMILE (Naturalized)

**Arctium lappa* L. BURDOCK, GREAT BURDOCK (Naturalized)

**Arctium minus* (Hill) Bernh. (not Schkuhr) COMMON BURDOCK
(Naturalized)
(A. nemorosum of authors, not Lej. & Court.)

Artemisia campestris L. WILD SAGE, TALL WORMWOOD (Rare)
ssp. *caudata* (Michx.) Hall & Clem.
(A. caudata Michx.; A. canadensis of NY reports, not Michx.)

**Artemisia vulgaris* L. FELON-HERB (Naturalized)

Aster acuminatus Michx. MOUNTAIN ASTER, WOOD ASTER

Aster cordifolius L. BLUE WOOD ASTER

Aster divaricatus L. WHITE WOOD ASTER

Aster dumosus L. RICE-BUTTON ASTER, BUSHY ASTER

Aster ericoides L. WHITE WREATH ASTER, HEATH ASTER
[A. ericoides var. prostratus (Kuntze) Blake]

Aster lateriflorus (L.) Britt. CALICO ASTER

Aster linariifolius L. STIFF-LEAF ASTER

Aster lowrieanus Porter LOWRIE'S ASTER
(A. lowrieanus var. lanceolatus Porter)

Aster macrophyllus L. BIGLEAF ASTER

Aster novi-belgii L. NEW YORK ASTER
(A. crenifolius of NY reports; A. tardiflorus L.)

Aster patens Ait. LATE PURPLE ASTER
[A. patens var. phlogifolius (Muhl.) Nees]

Aster paternus Cronq. WHITE-TOPPED ASTER
[Sericocarpus asteroides (L.) BSP.]

Aster pilosus Willd. HEATH ASTER
[A. ericoides of authors, not L.; A. pilosus var. demotus Blake]

Aster praealtus Poir. WILLOW ASTER
(A. salicifolius Ait.)

Aster schreberi Nees LARGE-LEAF ASTER, SCHREBER'S ASTER
Rarity Status: State T pending; NYNHP G5, S2
(A. glomeratus Bernh. ex Nees)

Aster umbellatus Mill. FLAT-TOP WHITE ASTER

Aster undulatus L. WAVY-LEAF ASTER
(A. undulatus var. loriformis Burgess)

Aster vimineus Lam. SMALL WHITE ASTER
Rarity Status: State E pending; NYNHP G5, SH

Bidens bipinnata L. SPANISH-NEEDLES

Bidens cernua L. STICK-TIGHTS, BUR-MARIGOLD

Bidens discoidea (Torr. & Gray) Britt. SMALL BEGGAR-TICKS

Bidens frondosa L. BEGGAR-TICKS, STICK-TIGHTS

Bidens laevis (L.) BSP. BUR-MARIGOLD, BEGGAR-TICKS
Rarity Status: State R; NYNHP G5, S2

**Bidens tripartita* L. BEGGAR-TICKS, STICK-TIGHTS (Naturalized)
[B. comosa (Gray) Wieg.; B. connata Muhl. ex Willd.]

**Centaurea americana* Nutt. BASKET-FLOWER, THORNLESS THISTLE (Rare Introduction)

**Centaurea cyanus* L. BLUEBOTTLE, BACHELOR'S- BUTTON, CORN-FLOWER (Naturalized & Escaping)

**Centaurea jacea* L. BROWN KNAPWEED (Naturalized)

**Centaurea maculosa* Lam. BUSHY KNAPWEED (Naturalized)

**Centaurea nigra* L. BLACK KNAPWEED, SPANISH-BUTTONS, HARDHEADS (Naturalized)
(C. nigra var. radiata DC.)

**Cichorium intybus* L. CHICORY, BLUE-SAILORS, CORNFLOWER, SUCCORY, WITLOOF (Naturalized)

**Cirsium arvense* (L.) Scop. CANADA THISTLE (Naturalized)

Cirsium discolor (Muhl. ex Willd.) Spreng. FIELD-THISTLE

Conyza canadensis (L.) Cronq. HORSEWEED, HOGWEED, BUTTERWEED
(Erigeron canadensis L.)

**Coreopsis lanceolata* L. COREOPSIS (Rare Escape)
(C. heterogyna Fern.; C. lanceolata var. villosa Michx.)

Erechtites hieracifolia (L.) Raf. ex DC. FIREWEED, PILEWORT
(E. hieracifolia var. intermedia Fern.)

Erigeron annuus (L.) Pers. DAISY-FLEABANE, DAISY, WHITETOP, WHITE SCABIOUS, SWEET SCABIOUS

Erigeron philadelphicus L. FLEABANE, DAISY

Erigeron pulchellus Michx. ROBIN'S-PLANTAIN, POOR-ROBIN'S-PLANTAIN

Erigeron strigosus Muhl. ex Willd. DAISY-FLEABANE, WHITETOP

Eupatorium fistulosum Barratt ex Hook. JOE-PYE-WEED, TRUMPETWEED

Eupatorium perfoliatum L. THOROUGHWORT, BONESET

Eupatorium purpureum L. SWEET JOE-PYE-WEED, GREEN-STEMMED JOE-PYE-WEED
[Eupatoriadelphus purpureus (L.) King & Robins.]

Eupatorium rugosum Houtt. WHITE SNAKEROOT, WHITE SANICLE
[Ageratina rothrockii (Gray) King & Robins.]

Eupatorium sessilifolium L. UPLAND BONESET

Euthamia graminifolia (L.) Nutt. ex Cass. BUSH OR FLAT-TOP GOLDENROD
[Euthamia galetorum of NY reports, not Greene; E. graminifolia var. nuttallii (Greene) Stone; Solidago graminifolia (L.) Salisb.; S. graminifolia var. nuttallii (Greene) Fern.; S. graminifolia var. polycephala (Fern.) Fern.]

Euthamia tenuifolia (Pursh) Nutt. BUTTONHEAD GOLDENROD
[Solidago microcephala (Greene) Bush of NY reports; S. tenuifolia Pursh]

**Galinsoga ciliata* (Raf.) Blake QUICKWEED, GARDENER'S-BLIGHT (Naturalized)
[G. bicolorata St. John & White; G. caracasana (DC.) Schultz; G. quadriradiata of some authors, not Ruiz & Pavon]

**Galinsoga parviflora* Cav. QUICKWEED (Naturalized)

Gnaphalium obtusifolium L. CATFOOT, CUDWEED, RABBIT-TOBACCO

Gnaphalium uliginosum L. LOW CUDWEED OR EVERLASTING
[Filaginella uliginosa (L.) Opiz]

Helenium autumnale L. SNEEZEWEED
[H. autumnale var. canaliculatum (Lam.) Torr. & Gray; H. latifolium Mill.]

**Helenium flexuosum* Raf. SNEEZEWEED (Naturalized)
(H. nudiflorum Nutt.)

**Helianthus annuus* L. COMMON SUNFLOWER, MIRASOL
(Rare Escape)

Helianthus divaricatus L. WOODLAND SUNFLOWER
(H. divaricatus var. angustifolius Kuntze)

**Hieracium caespitosum* Dumort. KING-DEVIL (Naturalized)
(H. pratense Tausch)

Hieracium kalmii L. CANADA HAWKWEED
(H. canadense Michx.)

**Hieracium lachenalii* Gmel. HAWKWEED (Naturalized)
(H. vulgatum Fries)

Hieracium paniculatum L. HAWKWEED

**Hieracium pilosella* L. MOUSE-EAR HAWKWEED (Naturalized)

Hieracium venosum L. RATTLESNAKE-WEED, POOR-ROBIN'S-PLANTAIN
[H. venosum var. nudicaule (Michx.) Farw.]

**Inula helenium* L. ELECAMPANE, INULA (Naturalized)

Krigia biflora (Walt.) Blake DWARF DANDELION, TWO-FLOWERED CYNTHIA

Krigia virginica (L.) Willd. DWARF DANDELION

Lactuca canadensis L. WILD LETTUCE

**Lactuca serriola* L. PRICKLY LETTUCE (Naturalized)
(L. scariola L.)

**Lapsana communis* L. NIPPLEWORT (Naturalized)

**Leucanthemum vulgare* Lam. OX-EYE DAISY, WHITE DAISY, WHITEWEED, MARGUERITE, FIELD DAISY (Naturalized)
(Chrysanthemum leucanthemum L.)

**Matricaria matricarioides* (Less.) Porter PINAPPLE-WEED (Naturalized)
[Chamomila suaveolens (Pursh) Rydb.]

Megalodonta beckii (Torr. ex Spreng.) Greene WATER-MARIGOLD
(Bidens beckii Torr. ex Spreng.)

Mikania scandens (L.) Willd. CLIMBING BONESET, CLIMBING HEMPWEED

Prenanthes alba L. WHITE LETTUCE, RATTLESNAKE-ROOT

Prenanthes altissima L. RATTLESNAKE-ROOT

Prenanthes trifoliolata (Cass.) Fern. GALL-OF-THE-EARTH

Rudbeckia hirta L. BLACK-EYED-SUSAN, YELLOW DAISY
*var. *pulcherrima* Farw. GLORIOSA DAISY (Naturalized)
(R. serotina Nutt.)

**Rudbeckia laciniata* L. CUT-LEAF CONEFLOWER, GOLDEN-GLOW (Naturalized)
(R. laciniata var. hortensis Bailey)

Senecio aureus L. GOLDEN RAGWORT OR GROUNDSEL, SQUAW-WEED

Senecio obovatus Muhl. ex Willd. RAGWORT, GROUNDSEL, SQUAW-WEED

**Senecio vulgaris* L. COMMON GROUNDSEL (Naturalized)

Solidago arguta Ait. CUTLEAF GOLDENROD

Solidago bicolor L. WHITE GOLDENROD, SILVER-ROD

Solidago caesia L. WREATH GOLDENROD, BLUE-STEM GOLDENROD

Solidago canadensis L. CANADA GOLDENROD, COMMON GOLDENROD
var. *canadensis*
var. *scabra* (Muhl.) Torr. & Gray TALL GOLDENROD
(S. altissima L.)

Solidago flexicaulis L. ZIG-ZAG GOLDENROD

Solidago juncea Ait. EARLY GOLDENROD

Solidago nemoralis Ait. ROUGH GOLDENROD, GRAY GOLDENROD, OLD-FIELD GOLDENROD
[S. nemoralis var. decemflora (DC.) Fern.; S. nemoralis var. longipetiolata of New York reports, not (Mackz. & Bush) Palmer & Steyerm.]

Solidago odora Ait. SWEET GOLDENROD

Solidago patula Muhl. ex Willd. SPREADING GOLDENROD

Solidago puberula Nutt. DOWNY GOLDENROD
(S. erecta of NY reports, not Pursh)

Solidago rugosa Mill. TALL HAIRY GOLDENROD, BUTTERWEED

**Sonchus asper* (L.) Hill SPINY SOW-THISTLE (Naturalized)

**Sonchus oleraceus* L. SOW-THISTLE, MILK-THISTLE (Naturalized)

**Taraxacum officinale* Weber ex Wiggers COMMON DANDELION (Naturalized)

**Tragopogon pratensis* L. YELLOW GOAT'S-BEARD (Naturalized)

**Tussilago farfara* L. COLTSFOOT (Naturalized)

Vernonia noveboracensis (L.) Michx. IRONWEED, NEW YORK IRONWEED

Xanthium strumarium L. COMMON COCKLEBUR, CLOTBUR

ALISMATACEAE (WATER-PLANTAIN FAMILY)

Alisma plantago-aquatica L. WATER-PLANTAIN
(A. subcordatum Raf.; A. triviale Pursh)

Sagittaria engelmanniana Sm. ENGELMANN'S ARROWHEAD

Sagittaria latifolia Willd. WAPATO, DUCK-POTATO
[S. engelmanniana ssp. longirostra (Micheli) Bogin]

Elodea canadensis Rich. ex Michx. WATERWEED, ELODEA, DITCH-MOSS
[Anacharis canadensis (Rich. ex Michx.) Planch.]
Note: Many incorrect permutations of these authorities are to be found in the literature.

Elodea nuttallii (Planch.) St. John WATERWEED, ELODEA
(Anacharis nuttallii Planch.)

Vallisneria americana Michx. TAPEGRASS, WILD CELERY

**Potamogeton crispus* L. PONDWEED, CURLY MUCKWEED (Naturalized)

Potamogeton diversifolius Raf. PONDWEED (Rare)

Potamogeton epihydrus Raf. PONDWEED
var. *ramosus* (Peck) House
[P. epihydrus var. nuttallii (Cham. & Schlect.) Fern.]

Potamogeton foliosus Raf. PONDWEED
(P. foliosus var. macellus Fern.)

Potamogeton gramineus L. GRASS-LEAF PONDWEED

Potamogeton natans L. PONDWEED

Potamogeton pectinatus L. SAGO PONDWEED

Potamogeton pulcher Tuckerm. PONDWEED
Rarity Status: State E pending; NYNHP G5, SH

Potamogeton pusillus L. PONDWEED

Potamogeton spirillus Tuckerm. PONDWEED

NAJADACEAE (NAIAD FAMILY)

Najas flexilis (Willd.) Rostk. & Schmidt NAIAD

ARACEAE (ARUM FAMILY)

Acorus americanus (Raf.) Raf. SWEETFLAG, FLAGROOT
(A. calamus of American authors, not L.)

Arisaema triphyllum (L.) Schott ex Schott & Endl. JACK-IN-THE-PULPIT, INDIAN-TURNIP
ssp. *stewardsonii* (Britt.) Huttleston
[A. stewardsonii Britt.; A. triphyllum var. stewardsonii (Britt.)Stevens.]
ssp. *triphyllum*
[A. atrorubens (Ait.) Blume]

Calla palustris L. WATER ARUM, WILD CALLA

Peltandra virginica (L.) Schott ex Schott & Endl. ARROWLEAF, TUCKAHOE

Symplocarpus foetidus (L.) Salisb. ex Nutt. SKUNK-CABBAGE

LEMNACEAE (DUCKWEED FAMILY)

Lemna minor L. DUCKWEED

Spirodela polyrhiza (L.) Schleid. GIANT DUCKWEED, WATER-FLAXSEED, GREATER DUCKWEED

Wolffia columbiana Karst. WATERMEAL

XYRIDACEAE (YELLOW-EYED GRASS FAMILY)

Xyris difformis Chapm. YELLOW-EYED GRASS
(X. caroliniana of authors, not Walt.)

Xyris montana Ries NORTHERN YELLOW-EYED GRASS

COMMELINACEAE (DAYFLOWER FAMILY)

**Commelina communis* L. DAYFLOWER (Naturalized)
var. *ludens* (Miq.) Pennell

ERIOCAULACEAE (HATPIN FAMILY)

Eriocaulon aquaticum (Hill) Druce WHITE-BUTTONS, HATPINS, PIPEWORT
(E. pellucidum Michx.; E. septangulare With.)

JUNCACEAE (RUSH FAMILY)

Juncus acuminatus Michx. SHARP-FRUITED RUSH
(J. acuminatus var. legitimus Engelm. in A. Gray; J. pallescens E. Mey.; J. paradoxus E. Mey.; J. pondii Wood)

Juncus articulatus L. JOINTED RUSH
(J. articulatus var. obtusatus Engelm.; J. lampocarpus Ehrb. ex Hoffm.)

Juncus brevicaudatus (Engelm.) Fern. NARROW-PANICLED RUSH
[J. acuminatus of Amer. authors, not Engelm., not Michx.]

Juncus bufonius L. TOAD-RUSH

Juncus canadensis J. Gay in Laharpe CANADA RUSH
[J. canadensis var. longicaudatus Engelm.; J. canadensis var. sparsiflorus Fern.; J. longicaudatus (Engelm.) Mackz.]

Juncus debilis Gray WEAK RUSH
Rarity Status: State T; NYNHP G5, S1
[J. acuminatus var. debilis (Gray) Engelm. in Gray]

Juncus effusus L. COMMON RUSH, SMOOTH RUSH, SOFT RUSH
var. *pylaei* (Laharpe) Fern. & Wieg.
(J. effusus var. costulatus Fern.; J. effusus var. decipiens of Amer. authors, not Buch., J. pylaei Laharpe)

Juncus marginatus Rostk. GRASS-LEAVED RUSH
(J.marginatus var. vulgaris Engelm.; J. marginatus var. paucicapitatus Engelm.)

Juncus nodosus L. KNOTTED RUSH
(J. paradoxus E. Mey.)

Juncus tenuis Willd. SLENDER YARD-RUSH
[J. bicornis Michx.; J. bicornis var. williamsii (Fern.) Vict.; J. macer S. F. Gray; J. macer var. williamsii Fern.; J. tenuis var. williamsii Fern.]

Luzula campestris (L.) DC. in Lam. & DC. COMMON WOOD-RUSH
var. *multiflora* (Retz.) Lej.
[Juncus intermedius Thuill.; J. multiflorus Ehrh.; J. multiflorus Retz.; Luzula campestris ssp. multiflora (Retz.) Buch.; L. erecta Desv.; L. intermedia var. multiflora Spenner; L. multiflora (Retz.) Lej.; L. multiflora var. frigida Buch.]

CYPERACEAE (SEDGE FAMILY)

Bulbostylis capillaris (L.) Clarke SAND-RUSH

Carex alopecoidea Tuckerm. SEDGE

Carex amphibola Steud. SEDGE
var. *turgida* Fern.
(C. grisea Wahl.)

Carex artitecta Mackz. SEDGE
[C. nigromarginata var. muhlenbergii (Gray) Gleason]

Carex atlantica Bailey SEDGE
[C. atlantica var. incomperta (Bickn.) Herm.; C. atlantica ssp. capillacea (Bailey) Rezn.; C. howei Mackz., C. incomperta Bickn.]

Carex baileyi Britt. SEDGE

Carex bushii Mackz. SEDGE
Rarity Status: State R; NYNHP G4, S2

Carex canescens L. SEDGE
(C. canescens var. disjuncta Fern.)

Carex cephalophora Muhl. ex Willd. SEDGE

Carex communis Bailey SEDGE

Carex comosa Boott SEDGE

Carex conoidea Schkuhr ex Willd. SEDGE

Carex crinita Lam. SEDGE
[C. crinita var. minor Boott; C. crinita var. porteri (Olney) Fern.; C. crinita var. simulans Fern.; C. nigromarginata var. minor (Boott) Gleason]

Carex cristatella Britt. ex Britt. & Brown SEDGE

Carex cumulata (Bailey) Mackz. (not Fern.) SEDGE
Rarity Status: State R; NYNHP G3G4, S2

Carex digitalis Willd. SEDGE

Carex disperma Dewey SEDGE

Carex echinata Murr. SEDGE
[C. angustior Mackz. ex Rydb.; C. cephalantha (Bailey) Bickn.; C. muricata of American authors, not L.]

Carex emmonsii Dewey ex Torr. SEDGE
Rarity Status: State R; NYNHP G5, S1

Carex flava L. SEDGE
[C. flava var. laxior (Kuk.) Gleason; C. laxior (Kuk.) Mackz.]

Carex folliculata L. SEDGE

Carex gracillima Schwein. SEDGE

Carex granularis Muhl. ex Willd. SEDGE

Carex hirsutella Mackz. SEDGE
[C. complanata var. hirsuta (Bailey) Gleason]

Carex hystericina Muhl. ex Willd. SEDGE
(C. hystricina of authors)

Carex intumescens Rudge SEDGE
(C. intumescens var. fernaldii Bailey)

Carex lacustris Willd. SEDGE

Carex laevivaginata (Kük.) Mackz. ex Britt. & Brown SEDGE

Carex lasiocarpa Ehrh. SEDGE
ssp. *americana* (Fern.) Hultén
(C. lasiocarpa var. americana Fern.)

Carex laxiculmis Schwein. SEDGE

Carex laxiflora Lam. SEDGE

Carex leptalea Wahl. SEDGE

Carex leptonervia (Fern.) Fern. SEDGE

Carex lupulina Muhl. ex Willd. SEDGE
(C. x macounii Dewey; C. lupulina var. pedunculata Gray)

Carex lurida Wahl. SEDGE

Carex normalis Mackz. SEDGE

Carex pallescens L. SEDGE
(C. pallescens var. neogea Fern.)

Carex pensylvanica Lam. SEDGE

Carex plantaginea Lam. PLANTAIN-SEDGE

Carex platyphylla Carey BROAD-LEAF SEDGE

Carex prasina Wahl. SEDGE

Carex retrorsa Schwein. SEDGE

Carex rosea Schkuhr ex Willd. SEDGE
(C. convoluta Mackz.; C. flaccidula Steud.)

Carex scabrata Schwein. SEDGE

Carex seorsa Howe ex Gord. & Howe SEDGE
Rarity Status: State R; NYNHP G4, S1

Carex sparganioides Muhl. ex Willd. SEDGE

Carex squarrosa L. SEDGE

Carex stipata Muhl. ex Willd. SEDGE

Carex straminea Willd. ex Schkuhr SEDGE
Rarity Status: State E pending; NYNHP G5, SH
[C. albolutescens of NY reports, not Schwein.; C. richii (Fern.) Mackz.]

Carex striatula Michx. SEDGE
Rarity Status: State E pending; NYNHP G4G5, SH
(C. laxiflora var. angustifolia Dewey)

Carex stricta Lam. TUSSOCK-SEDGE

Carex swanii (Fern.) Mackz. SEDGE

Carex tenera Dewey SEDGE
[C. tenera var. echioides (Fern.) Wieg.]

Carex tonsa (Fern.) Bickn. SEDGE
(C. umbellata Schkuhr ex Willd. in part)

Carex torta Boott ex Tuckerm. SEDGE

Carex tribuloides Wahl. SEDGE

Carex trisperma Dewey SEDGE

Carex virescens Muhl. ex Willd. SEDGE

Carex vulpinoidea Michx. SEDGE
(C. setacea Dewey)

Cladium mariscoides (Muhl.) Torr. BOG-RUSH, TWIG-RUSH

Cyperus bipartitus Torr. CYPERUS, FLAT SEDGE
(C. rivularis Kunth)

Cyperus erythrorhizos Muhl. CYPERUS, FLAT SEDGE
Rarity Status: State R; NYNHP G5, S1

Cyperus esculentus L. YELLOW NUT-GRASS

‡*Cyperus houghtonii* Torr. CYPERUS, FLAT-SEDGE
(historical voucher specimen only, NYS)
Rarity Status: State R; NYNHP G4 S1

Cyperus lupulinus (Spreng.) Marcks CYPERUS, FLAT SEDGE
(C. filiculmis of authors, not Vahl.)

Cyperus odoratus L. CYPERUS, FLAT SEDGE
Rarity Status: State R pending; NYNHP G5, S2S3
(C. engelmannii Steud.; C. ferruginescens Boeckl.)

Cyperus strigosus L. GALINGALE, CYPERUS, FLAT SEDGE

Dulichium arundinaceum (L.) Britt. THREE-WAY SEDGE

Eleocharis acicularis (L.) R. & S. HAIRGRASS, SLENDER OR NEEDLE SPIKERUSH

Eleocharis elliptica Kunth SLENDER SPIKERUSH
[E. acuminata (Muhl.) Nees; E. capitata (L.) R. Br.; E. compressa Sulliv.; E. tenuis of NY reports, not (Willd.) Schultes]

Eleocharis erythropoda Steud. SPIKERUSH
(E. calva Torr.)

Eleocharis flavescens (Poir.) Urban. SPIKERUSH
[E. flavescens var. olivacea (Torr.) Gleason; E. olivacea Torr.]

Eleocharis intermedia Schultes (not Muhl.) SPIKERUSH

Eleocharis obtusa (Willd.) Schultes SPIKERUSH
(E. diandra Wright)

Eleocharis palustris (L.) R. & S. CREEPING SPIKERUSH

Eleocharis robbinsii Oakes SPIKERUSH (Rare)

Eriophorum virginicum L. TAWNY COTTONGRASS

Fimbristylis autumnalis (L.) R. & S. SEDGE, RUSH, FIMBRY

Rhynchospora alba (L.) Vahl WHITE BEAKRUSH

Rhynchospora capitellata (Michx.) Vahl BEAKRUSH
[R. glomerata of NY reports, not (L.) Vahl]

Scirpus atrocinctus Fern. NORTHERN BULRUSH

Scirpus atrovirens Willd. (not Muhl.) BULRUSH

Scirpus cyperinus (L.) Kunth WOOLGRASS, BULRUSH
(S. cyperinus var. pelius Fern.; S. rubricosus Fern.)

Scirpus georgianus Harper BULRUSH
Rarity Status: State E pending; NYNHP G5, SH
[S. atrovirens var. georgianus (Harper) Fern.]

Scirpus hattorianus Makino BULRUSH

Scirpus microcarpus Presl BULRUSH
(S. rubrotinctus Fern.)

Scirpus pedicellatus Fern. BULRUSH

Scirpus pendulus Muhl. BULRUSH
(S. lineatus of authors, not Michx.)

Scirpus polyphyllus Vahl LEAFY BULRUSH

Scirpus pungens Vahl CHAIRMAKER'S RUSH, THREE-SQUARE
(S. americanus Pers. in part)

Scirpus smithii Gray BULRUSH

Scirpus tabernaemontanii Gmel. SOFT-STEM BULRUSH, TULE, GREAT OR SOUTHERN BULRUSH
[S. lacustris ssp. tabernaemontanii (Gmel.) Syme; S. validus Vahl]

Scirpus torreyi Olney TORREY'S BULRUSH (J.W. Bailey, 1836)

Scirpus verecundus Fern. CLUBRUSH

POACEAE (GRASS FAMILY)

**Agropyron repens* (L.) Beauv. QUACKGRASS, WITCH-GRASS, QUICK-GRASS (Naturalized)
[Elymus repens (L.) Gould]

**Agrostis capillaris* L. COLONIAL BENT, RHODE ISLAND BENT (Naturalized)
(A. tenuis Sibth.)

**Agrostis gigantea* Roth REDTOP, BLACK BENT (Naturalized)
[A. gigantea var. dispar (Michx.) Philipson; A. stolonifera var. major (Gaud.) Farw.; A. alba of authors, not L.]

Agrostis hiemalis (Walt.) BSP. SOUTHERN HAIRGRASS, TICKLEGRASS

Agrostis perennans (Walt.) Tuckerm. AUTUMN OR UPLAND BENT

Agrostis scabra Willd. HAIRGRASS, FLY-AWAY GRASS, TICKLEGRASS

Agrostis stolonifera L. CREEPING OR CARPET BENT

Alopecurus aequalis Sobol. SHORT-AWN FOXTAIL

**Alopecurus pratensis* L. MEADOW FOXTAIL (Naturalized)

Andropogon gerardii Vitm. BIG BLUESTEM

Andropogon virginicus L. BROOM-SEDGE

**Anthoxanthum odoratum* L. SWEET VERNALGRASS (Naturalized)

Aristida dichotoma Michx. POVERTY GRASS, THREE-AWN

**Aristida oligantha* Michx. PRAIRIE THREE-AWN (Naturalized)

***Arrhenatherum elatius** (L.) Beauv. ex Presl & Presl (not Mert. & Koch ex Roehm.) TALL OATGRASS (Naturalized)
[A. elatius var. bulbosum (Willd.) Spenner]

Brachyelytrum erectum (Schreb. ex Spreng.) Beauv. BEARDED-SHORTHUSK

Brachyelytrum septentrionale (Babel) G. Tucker NORTHERN SHORTHUSK
[B. erectum var. septentrionale Babel]

Bromus ciliatus L. FRINGED BROME

***Bromus inermis** Leyss. SMOOTH BROME, HUNGARIAN BROME, AWNLESS BROME (Naturalized)
(B. inermis var. divaricatus Rohl.)

***Bromus japonicus** Thunb. ex Murr. JAPANESE CHESS (Naturalized)

Bromus kalmii Gray BROME

Bromus pubescens Muhl. ex Willd. CANADA BROME
(B. purgans of authors, not L.)

***Bromus sterilis** L. BARREN BROME (Naturalized)

***Bromus tectorum** L. DOWNY CHESS (Naturalized)

Calamagrostis canadensis (Michx.) Beauv. BLUEJOINT GRASS
(C. canadensis var. robusta Vasey)

***Calamagrostis epigeios** (L.) Roth FEATHERTOP, BUSHGRASS (Naturalized)
[C. epigeios var. georgica (Koch) Ledeb.]

Cinna arundinacea L. STOUT WOODREED, WOOD REEDGRASS

Cinna latifolia (Trev. ex Goepp.) Griseb. ex Ledeb. DROOPING WOODREED

***Dactylis glomerata** L. ORCHARD GRASS (Naturalized)

Danthonia compressa Aust. NORTHERN OATGRASS

Danthonia spicata (L.) Beauv. ex R. & S. POVERTY-GRASS, JUNEGRASS, WHITE OATGRASS
(D. spicata var. longipila Scribn. & Merr.)

Deschampsia cespitosa (L.) Beauv. TUFTED HAIRGRASS

Deschampsia flexuosa (L.) Trin. COMMON HAIRGRASS

Digitaria filiformis (L.) Koeler SLENDER CRABGRASS
Rarity Status: State R; NYNHP G5, S1S2

Digitaria ischaemum (Schreb. ex Schweig.) Schreb. ex Muhl.
SMOOTH CRABGRASS (Naturalized)
[D. ischaemum var. mississippiensis (Gatt.) Fern.]

**Digitaria sanguinalis* (L.) Scop. TALL CRABGRASS (Naturalized)
[D. adscendens (Kunth) Henr.]

**Echinochloa crusgalli* (L.) Beauv. BARNYARD GRASS
(Naturalized)

Echinochloa muricata (Beauv.) Fern. COCKSPUR GRASS,
BARNYARD GRASS
[E. pungens (Poir.) Rydb.]

Echinochloa walteri (Pursh) Heller (not Nash ex Britt.) WATER-
MILLET, COCKSPUR GRASS

**Eleusine indica* (L.) Gaertn. GOOSEGRASS, YARDGRASS,
WIREGRASS (Naturalized)

Elymus hystrix L. BOTTLEBRUSH, HYSTRIX
(Hystrix patula Moench)

Elymus riparius Wieg. MARSH WILD-RYE

Elymus villosus Muhl. ex Willd. WILD-RYE

Elymus virginicus L. VIRGINIA WILD-RYE
[E. virginicus var. glabriflorus (Vasey) Bush; E. virginicus var.
jejunus (Ramaley) Bush]

**Eragrostis cilianensis* (All.) Mosher
STINKGRASS, SKUNK-GRASS, SNAKEGRASS
(Naturalized)
[E. megastachya (Koel.) Link]

**Eragrostis minor* Host LOVEGRASS (Naturalized)
(E. poaeoides R. & S.)

Eragrostis pectinacea (Michx.) Nees LOVEGRASS

Eragrostis spectabilis (Pursh) Steud. PURPLE LOVEGRASS,
TUMBLEGRASS
[E. pectinacea of American authors, not (Michx.) Nees;
E. spectabilis var. sparsihirsuta Farw.]

**Festuca arundinacea* Schreb. TALL FESCUE, REED FESCUE, ALTA FESCUE, MEADOW FESCUE (Naturalized)
[F. elatior var. arundinacea (Schreb.) Wimmer]

**Festuca filiformis* Pourret HAIR FESCUE (Naturalized)
[F. brachyphylla of NY report, not Schultes, F. capillata Lam.; F. ovina var. capillata (Lam.) Alef., F. tenuifolia Sibth.]

**Festuca ovina* L. SHEEP FESCUE (Naturalized)

**Festuca pratensis* Hudson MEADOW FESCUE, ENGLISH BLUEGRASS (Naturalized)
(F. elatior L., a *nomen confusum*)

Festuca subverticillata (Pers.) Alexeev NODDING FESCUE
(Festuca obtusa Biehl.)

Glyceria canadensis (Michx.) Trin. RATTLESNAKE GRASS

Glyceria melicaria (Michx.) Hubb. SLENDER MANNAGRASS

Glyceria septentrionalis Hitchc. FLOATING MANNAGRASS
[G. striata var. stricta (Scribn.) Fern.]

Glyceria striata (Lam.) Hitchc. FOWL MANNAGRASS

**Holcus lanatus* L. VELVET GRASS (Naturalized)

Leersia oryzoides (L.) Sw. RICE CUTGRASS

Leersia virginica Willd. WHITEGRASS, CUTGRASS
[L. virginica var. ovata (Poir.) Fern.]

**Lolium perenne* L. ENGLISH OR PERENNIAL RYEGRASS (Naturalized)

Muhlenbergia frondosa (Poir.) Fern. WIRESTEM MUHLY
[M. mexicana of some authors, not (L.) Trin.]

Muhlenbergia schreberi Gmel. NIMBLE-WILL, DROPSEED

Muhlenbergia sobolifera (Muhl.) Trin. CREEPING MUHLY

Muhlenbergia sylvatica (Torr.) Torr. ex Gray WOODLAND DROPSEED, MUHLY
(M. sylvatica var. attenuata Carpenter)

Muhlenbergia tenuiflora (Willd.) BSP. WOODLAND DROP-SEED, MUHLY

Oryzopsis racemosa (Sm.) Ricker ex Hitchc. RICEGRASS

Panicum acuminatum Sw. PANIC GRASS
[Dichanthelium acuminatum (Sw.) Gould & Clark; P. auburne Ashe; P. implicatum Scribn.; P. lanuginosum Ell., in part; P. lindheimeri Nash; P. meridionale Ashe; P. nitidum Lam.; P. spretum Schultes; P. subvillosum Ashe; P. villosissimum Nash.; P. wrightianum Scribn.]

Panicum boscii Poir. ex Lam. PANIC GRASS
[P. latifolium L. in part]

Panicum clandestinum L. DEER-TONGUE, PANIC GRASS

Panicum depauperatum Muhl. POVERTY PANIC GRASS
(P. depauperatum var. psilophyllum Fern.)

Panicum dichotomiflorum Michx. SMOOTH PANIC GRASS
[P. dichotomiflorum var. geniculatum (Wood) Fern.]

Panicum dichotomum L. PANIC GRASS
[P. annulum Ashe; P. dichotomum var. barbulatum (Michx.) Wood; P. clutei Nash; P. lucidum Ashe; P. mattamuskeetense Ashe; P. microcarpon Muhl. ex Ell.; P. nitidum Lam.; P. roanokense Ashe]

Panicum latifolium L. PANIC GRASS

Panicum linearifolium Scribn. ex Nash in Britt. & Brown PANIC GRASS
[P. linearifolium var. werneri (Scribn.) Fern.; P. perlongum Nash]

Panicum rigidulum Bosc ex Nees PANIC GRASS
(P. agrostoides Spreng.; P. longifolium Torr.)

Panicum virgatum L. SWITCHGRASS

Panicum xanthophysum Gray PANIC GRASS

Phalaris arundinacea L. REED CANARY-GRASS

**Phleum pratense* L. TIMOTHY, HERD-GRASS (Naturalized)
[P. pratense var. nodosum (L.) Huds.]

(*)Phragmites australis (Cav.) Trin. ex Steud. COMMON REED, REEDGRASS (Naturalized & Native)
(P. communis Trin.)

Piptochaetium avenaceum (L.) Parodi BLACK OATGRASS
(Stipa avenacea L.)

Poa alsodes Gray SPEARGRASS, WOODLAND BLUEGRASS

**Poa annua* L. SPEARGRASS, ANNUAL BLUEGRASS
(Naturalized)

**Poa compressa* L. CANADA BLUEGRASS, WIREGRASS
(Naturalized)

**Poa nemoralis* L. WOOD BLUEGRASS (Naturalized)

Poa palustris L. FOWL BLUEGRASS OR MEADOWGRASS

**Poa pratensis* L. KENTUCKY BLUEGRASS (Naturalized)

**Poa trivialis* L. ROUGH BLUEGRASS (Naturalized)

Schizachyrium scoparium (Michx.) Nash LITTLE BLUE-STEM,
BEARDGRASS, BROOMSEDGE
(Andropogon scoparius Michx.)

Setaria geniculata (Lam.) Beauv. BRISTLEGRASS, KNOTROOT

**Setaria glauca* (L.) Beauv. FOXTAIL, PIGEONGRASS
(Naturalized)
[S. lutescens (Weigel) Hubbard]

**Setaria viridis* (L.) Beauv. GREEN FOXTAIL OR BOTTLEGRASS
(Naturalized)
[S. viridis var. weinmannii (R. & S.) Borbas]

Sorghastrum nutans (L.) Nash INDIAN GRASS

Spartina pectinata Link FRESHWATER OR PRAIRIE
CORDGRASS
[S. pectinata var. suttiei (Farw.) Fern.]

Sphenopholis obtusata (Michx.) Scribn. PRAIRIE WEDGEGRASS
var. *major* (Torr.) Erdm. SLENDER WEDGEGRASS
[S. intermedia (Rydb.) Rydb.]

Sporobolus vaginiflorus (Torr. ex Gray) Wood POVERTY-
GRASS, SHEATHED RUSHGRASS
(S. vaginiflorus var. inaequalis Fern.)

Tridens flavus (L.) Hitchc. PURPLETOP, TALL REDTOP
[Triodea flava (L.) Smyth]

**Triticum aestivum* L. WHEAT (Naturalized)
(T. vulgare Vill.)

**Zea mays* L. CORN, SWEETCORN, MAIZE (Rare Escape)

Zizania aquatica L. WILD RICE, INDIAN RICE

SPARGANIACEAE (BUR-REED FAMILY)

Sparganium americanum Nutt. BUR-REED

Sparganium androcladum (Engelm.) Morong BUR-REED

Sparganium chlorocarpum Rydb. BUR-REED

Sparganium eurycarpum Engelm. ex Gray BUR-REED

TYPHACEAE (CAT-TAIL FAMILY)

Typha angustifolia L. NARROW-LEAF CAT-TAIL

Typha latifolia L. COMMON CAT-TAIL, BROAD-LEAF CAT-TAIL

PONTEDERIACEAE (PICKEREL-WEED FAMILY)

Pontederia cordata L. PICKEREL-WEED
[P. cordata var. lancifolia (Muhl.) Torr.; P. lanceolata Nutt.]

LILIACEAE (LILY FAMILY)

Allium tricoccum Ait. WILD LEEK, RAMP

**Allium vineale* L. FIELD GARLIC, SCALLION (Naturalized)

**Asparagus officinalis* L. ASPARAGUS (Naturalized & Escaping)

**Convallaria majalis* L. LILY-OF-THE-VALLEY (Rare Escape)

Erythronium americanum Ker YELLOW ADDER'S-TONGUE, TROUTLILY, DOG-TOOTH VIOLET
[E. umbilicatum of NY reports]

**Hemerocallis fulva* (L.) L. ORANGE DAY-LILY (Escape)

Lilium canadense L. CANADA LILY, WILD YELLOW LILY

Lilium philadelphicum L. WOODLILY, ORANGE-RED LILY

Maianthemum canadense Desf. FALSE LILY-OF-THE-VALLEY, TWO-LEAF SOLOMON'S-SEAL, WILD LILY-OF-THE-VALLEY

Medeola virginiana L. INDIAN CUCUMBER-ROOT

**Muscari neglectum* Guss. ex Tenori GRAPE HYACINTH, BLUE-BOTTLE (Rare Escape)
[M. atlanticum Boiss. & Reut.; M. racemosum of authors, not (L.) Mill.]

**Ornithogalum umbellatum* L. STAR-OF-BETHLEHEM (Rare Escape)

Polygonatum biflorum (Walt.) Ell. SMALL SOLOMON'S-SEAL
[P. canaliculatum of authors, not (Muhl.) Pursh]

Polygonatum commutatum (Schultes & Schultes) Dietr. LARGE SOLOMON'S-SEAL
[P. biflorum var. commutatum (Schultes & Schultes) Morong]

Polygonatum pubescens (Willd.) Pursh SOLOMON'S-SEAL

**Scilla siberica* Haw. ex Andr. SCILLA, SQUILL (Naturalized)

Smilacina racemosa (L.) Desf. FALSE SOLOMON'S-SEAL OR SPIKENARD
(S. racemosa var. cylindrata Fern.)

Trillium erectum L. PURPLE TRILLIUM, STINKING BENJAMIN

Uvularia perfoliata L. STRAWBELL, BELLWORT

Uvularia sessilifolia L. WILD-OATS, BELLWORT

Veratrum viride Ait. FALSE OR WHITE HELLEBORE, INDIAN-POKE

IRIDACEAE (IRIS FAMILY)

Hypoxis hirsuta (L.) Cov. STARGRASS, HYPOXIS
[H. leptocarpa (Engelm. & Gray) Small]

**Iris × germanica* L. IRIS, FLEUR-DE-LIS, FLAG (Rare Escape)

**Iris pseudacorus* L. YELLOW IRIS, YELLOW FLAG (Naturalized)

**Iris sibirica* L. SIBERIAN OR RUSSIAN IRIS (Rare Escape)

Iris versicolor L. BLUE FLAG, WILD IRIS, POISON FLAG

Sisyrinchium angustifolium Mill. BLUE-EYED GRASS
(S. graminoides Bickn.)

AGAVACEAE (AGAVE FAMILY)

**Yucca flaccida* Haw YUCCA, ADAM'S-NEEDLE (Rare Escape)
(Y. filamentosa of authors, not L.; Y. smalliana Fern.)

SMILACACEAE (GREENBRIER FAMILY)

Smilax herbacea L. JACOB'S-LADDER, CARRION-FLOWER

Smilax rotundifolia L. GREENBRIER, HORSE-BRIER, BULL-BRIER

DIOSCOREACEAE (YAM FAMILY)

Dioscorea villosa L. WILD YAM
[D. quaternata of old NY reports in part]

ORCHIDACEAE (ORCHID FAMILY)

Corallorhiza maculata (Raf.) Raf. SPOTTED CORALROOT

Corallorhiza trifida Chat. [not (L.) Chat.] PALE CORAL-ROOT, EARLY CORALROOT
[C. trifida var. verna (Nutt.) Fern.]

Cypripedium acaule Ait. PINK LADYSLIPPER, MOCCASIN FLOWER

**Epipactis helleborine* (L.) Crantz HELLEBORINE, WEED-ORCHID (Naturalized)
[E. latifolia (L.) All.]

Galearis spectabilis (L.) Raf. SHOWY ORCHIS
(Orchis spectabilis L.)

Goodyera pubescens (Willd.) R. Br. DOWNY RATTLESNAKE-PLANTAIN

Goodyera repens (L.) R. Br. DWARF RATTLESNAKE-PLANTAIN
(G. repens var. ophioides Fern.)

Platanthera lacera (Michx.) G. Don RAGGED FRINGED ORCHID
[Habenaria lacera (Michx.) R. Br.]

Spiranthes cernua (L.) Rich. NODDING LADY'S-TRESSES

Spiranthes ochroleuca (Rydb. ex Britt.) Rydb. CREAMY LADY'S-TRESSES
[S. cernua var. ochroleuca (Rydb. ex Britt.) Ames]

Appendix 1. Excluded Taxa

The following species have been reported from the study area, but are not known to occur there (or they are found only in cultivation) so far as the authors have been able to determine. In each case, the reason for exclusion is given in parentheses.

Asclepias tuberosa L. [Clemants & Barringer specimen was *A. syriaca*]

Corylus maxima Mill. var. *purpurea* (Loud.) Rehder [cultivated only]

Cryptomeria japonica (L. f.) G. Don [cultivated only]

Euonymus alata (Thunb.) Sieb. [cultivated only]

Euthamia galetorum Greene [Clemants & Barringer specimen was *E. tenuifolia*]

Forsythia viridissima Lindl. [cultivated only]

Ginkgo biloba L. [cultivated only]

Picea glauca (Moench) Voss [cultivated only]

Platanthera blephariglottis (Willd.) Lindl. [Clemants & Barringer specimen was *P. lacera*]

Polygonum amphibium L. var. *amphibium* [the typical variety is Eurasian only; Clemants & Barringer's specimen was var. *stipulaceum*]

Rhodotypos scandens (Thunb.) Makino [cultivated only]

Taraxacum laevigatum (Willd.) DC. [Clemants & Barringer specimen was *T. officinale*]

Thalictrum dasycarpum Fisch. & Llal. [Clemants & Barringer specimen was *T. revolutum*]

Mosses, Liverworts and Lichens of USMA			
Mosses		Liverworts	Lichens
Anomodon rostratus	Plagiothecium cavifolium	Bazzania trilobata	Lasallia papulosa
Atrichum angustatum	Polytrichastrum ohioense	Blasia pusilla	Lasallia pensylvanica
Bartramia pomiformis	Polytrichum commune	Conocephalum conicum	Placynthium nigrum
Brachythecium plumosum	Porella pinnata	Frullania eboracensis	Umbilicaria mammulata
Brachythecium rutabulum	Porella platyphylla	Lophocolea bidentata	Umbilicaria muhlenbergii
Brachythecium salebrosum	Rhizomnium punctatum	Lophocolea heterophylla	
Brotherella recurvans	Sphagnum affine	Metzgeria conjugata	
Bryum argenteum	Sphagnum bartlettianum	Plectocolea hyalina	
Bryum sp.	Sphagnum cuspidatum	Ptilidium pulcherrimum	
Calliergon cordifolium	Sphagnum fallax	Riccia fluitans	
Calypogeia sp.	Sphagnum fimbriatum	Scapania nemorosa	
Dicranum fulvum	Sphagnum flavicomans	Scapania undulata	
Dicranum scoparium	Sphagnum flexuosum		
Drepanocladus aduncus	Sphagnum girgensohnii		
Drepanocladus fluitans	Sphagnum henryense		
Fissidens taxifolius	Sphagnum isoviitae		
Hypnum imponens	Sphagnum lescurii		
Isopterygium elegans	Sphagnum magellanicum		
Mnium hornum	Sphagnum palustre		
Odontoschisma prostratum	Sphagnum russowii		
Pallavicinia lyellii	Sphagnum subtile		
Pellia epiphylla	Sphagnum torreyanum		
Pellia sp.	Sphagnum viridum		
Philonotis fontana	Thuidium delicatulum		
Plagiomnium ciliare			

Source: Compiled from unpublished data from independent limited surveys by G. Tucker and J. Bridges.

APPENDIX H

West Point Rare Plant Management Plan

Rare Plant Management Plan, West Point Military Reservation

United States Military Academy, West Point, NY

August 8, 2002

Introduction: The 2002 Rare Plant Management Plan is similar to the 1996 five-year management plan in that it is comprised of a cover sheet and a matrix of rare plant information and management actions. However, this version is different in that there is now more than ten years of study invested in the rare plant community of the West Point Military Reservation (WPMR), and this management plan incorporates the history of each rare plant site. Data for this plan is based upon the fieldwork and management suggestions by J.G. Barbour, an ecological consultant who has been contracted by the Natural Resources Branch (NRB) since 1994 to monitor West Point's rare plant community. This work stemmed from two separate field surveys. The first, conducted by The Brooklyn Botanic Garden in 1990, initially documented part of the flora of West Point. In the 1991and 92 field seasons, Richard Mitchell and Gordon Tucker, of The New York State Museum, added to the West Point plant list nearly completing it.

Status: There are no federally threatened or endangered plant species found, or likely to be found on the WPMR. There are, however, 84 plant species monitored at West Point because of their state or regional rarity. State rare plants are plants considered rare by the New York State Natural Heritage Program (NYNHP), which presents an annual report on plant diversity based upon the collected effort of botanists statewide. Many of the plants listed by the NYNHP are protected by New York State law because they are considered to have a potential for extinction within the state or are species vulnerable to extinction.

Purpose: The U.S. Military Academy's interest in rare plants is predominately a matter of good stewardship. The NYNH ranking does not automatically indicate any legal protection for rare species, and the legal protection provided by a New York State listing does not prohibit disturbance by the property owner. However, the WPMR has proven to be a haven for many rare species due to its unique topography and land use history. The Academy considers the care of these species akin to taking pride in the property of the reservation, and an extension of the stated purpose of the federal government to act as a steward of the public lands.

Management Actions: The intensity of management devoted to any given rare plant species is in relation to its NYNH ranking, or 'S' (state) number. NYNHP state ranks for extant species range from **S1**, 5 or fewer sites statewide and extremely vulnerable to extinction, to S5, demonstrably secure in NYS. This list is fluid in that plant rankings change over time as new information is acquired. Usually, a species whose rank is changed is downgraded in rarity as more sites are discovered, but species do occasionally become more rare as populations disappear. Other ranking changes occur when taxonomic distinctions are reevaluated and a subspecies, or a variety of a species, proves to be a separate species, or vice-versa. The NRB manages plants with a NYNHP ranking of **S1**, **S2**, or **S3**. We also keep records for plant species that are regionally (Hudson Valley) rare (code = **RR**), West Point rare (**WP**), and de-listed (**ex**), but these are protected only as part of a unique habitat. NRB records are updated annually to reflect new species rankings. This may result in changes to future management actions, but will not remove a plant from this plan. However, these may indeed be removed in the next major plan revision in five years. Other interim changes to the plan are likely as new rare plant locations are discovered each year both for plants currently incorporated in the plan, and for species currently unknown at West Point.

The rare plant management matrix lists 11 possible management actions for any given rare plant site. The first on the list, and the primary action, is **Project Review**. Proposed actions and

activities on the WPMR will be checked against an ArcView GIS shapefile maintained by the NRB. If it appears that the proposed action might affect a rare plant, then the NRB may make recommendations to modify the activity to protect the plant.

For plants that occur at locations under the direction of a site manager, one NRB management action is **Notify Manager**. The NRB will, in this case, alert the manager to the presence of the rare plant, provide maps of the area, notify the manager of what management actions the NRB has initiated, and make recommendations to prevent disturbance.

Fire is a major factor in the ecology of certain portions of West Point. Many of the rare plants found on the reservation depend upon occasional fires to provide the habitat they require. However, brush fire locations will be checked against the rare plant map, and for species unlikely to survive a fire, the location may be protected if possible and prudent. The plan matrix field for this is **Fire Protection**.

Some rare plants occur in locations likely to be accidentally disturbed. In these cases, the NRB may elect to construct a barrier to prevent damage to the site. The matrix allows two possible actions. **Passive Barrier** refers to the construction of a naturalistic barrier such as a rock pile or log. This is used in situations where esthetics is important (like a hiking trail), or where it would be unwise to call attention to the site for fear of vandalism. The other option is the installation of a **Fence**. This is used where the possibility of vandalism is low, and the NRB desires no entry at all to the site (as with deer or a mower).

For species in decline, the NRB may initiate actions to manipulate the environment found at the rare plant site. This may include the control of competing vegetation, or limiting drainage to keep the ground moist. The matrix field for this is **Habitat Management**. In cases where the entire West Point population of a rare plant occurs in one place and the species is in danger of disappearing, the NRB may decide to establish a second population at another West Point site to remove the species from danger (**Transplant\Bank Seed**).

As current information is essential for making informed management decisions, the matrix calls for regular observation of the rare plant sites. For sites vulnerable to disturbance, an annual check may be called for (**Annual Monitor**). This will be done by NRB staff. A more formal survey will be conducted in 2003 and again in 2006 (**2003 Survey** and **2006 Survey**). Formal surveys will be conducted by a contractor, and will culminate in a report delivered to the NRB. When and if a site will be visited is a function of a plant's rarity and the plant's persistence at a site.

For many sites, the management option of choice is **No Action**. These are places of little management interest providing conditions there remain the same. This action may be chosen for a variety of reasons: The rare plant population at a site may no longer be considered extant; a species may be only marginally rare and so widespread at WPMR that monitoring each site is not necessary; or, No Action is appropriate when a formally rare species has been de-listed by the NYNHP so little further management is needed. All of these sites still require a project review for any activity likely to disturb the habitat.

Plan Monitoring: The management plan matrix will serve as a checklist for plan monitoring. The results of these actions will guide further actions, and changes to the plan will be made as appropriate. A revision to the plan is scheduled for 2007.

Key to the Matrix:

The matrix is made up of 30 fields. Descriptions of the field and a description of acceptable replies follow. Each entry represents a location where a rare plant is found. The table is arranged by rarity with the rarest species listed first.

Map Reference #: Each species has a numerical code that applies only to that species. As of 2002, there are 84 listed species.

Species Name: The scientific binomial for the species. In cases where there has been a recent change in the accepted scientific name the old species name follows i.e. *Crassula aquatica* (*tillaea*).

Common Name: Common names are those as supplied by Barbour. Generally, they match Gray's Manual of Botany.

Location: A brief description of the rare plant location.

GIS ID #: Each site has been plotted in an ArcView shapefile, and bears a unique ID number. There are currently 231 identified rare plant locations.

Rarity: 'S' rankings are the New York Natural Heritage Program rarity ranking for the state. NRB also tracks species considered rare to the region and the reservation as considered by Barbour.

S1 = Critically imperiled in New York State because of extreme rarity (5 or fewer sites or very few remaining individuals) or extremely vulnerable to extirpation from New York State due to biological factors.

S2 = Imperiled in New York State because of rarity (6 - 20 sites or few remaining individuals) or highly vulnerable to extirpation from New York State due to biological factors.

S3 = Rare in New York State (usually 21 - 100 extant sites).

DOUBLE RANKS *(i.e.* S1S2, S2S3, S1S3)
The first rank indicates rarity based upon current documentation. The second rank indicates the probable rarity after all historical records and likely habitat have been checked.

(ex) = A de-listed species.

RR = Regionally (Hudson Valley Highlands) rare.

WR = West Point rare.

NYS Status: The legal status of the species.

E = Endangered Species: listed species are those with
1) 5 or fewer extant sites, or
2) fewer than 1,000 individuals, or
3) restricted to fewer than 4 U.S.G.S. 7 1/2 minute topographical maps, or
4) species listed as endangered by the U. S. Department of Interior, as enumerated in the Code of Federal Regulations 50 CFR 17.11.

T = Threatened: listed species are those with

1) 6 to fewer than 20 extant sites, or
2) 1,000 to fewer than 3,000 individuals, or
3) restricted to not less than 4 or more than 7 U.S.G.S. 7 1/2 minute topographical maps, or
4) listed as threatened by the U. S. Department of the Interior, as enumerated in the Code of Federal Regulations 50 CFR 17.11.

R = Rare: listed species have
1) 20 to 35 extant sites, or
2) 3,000 to 5,000 individuals statewide.

V = Exploitably vulnerable: listed species are likely to become threatened in the near future throughout all or a significant portion of their range within the state if causal factors continue unchecked.

U = Unprotected

Years **90 – 02** (11 fields): Demonstrates the survey history of the site. If a site was visited, an entry is made in this column showing the outcome of that survey.

y = a successful search, that is, the plant was found.

n = an unsuccessful attempt. The plant was not found. This does not mean that the plant has disappeared from this location. Plants may appear to be absent from an area for a single season, or even many years, only to reappear at a later date.

No entry indicates no visit.

Management actions (11 fields): Potential management actions are described above.

X = a positive response for that action.

No entry is a negative.

Comment: Rationale for chosen management plan for site.

This plan is based upon the following reports, available at the Natural Resources Branch office, building 733, Garrard Rd, West Point, NY.

Barbour, J.G. 1995. Report, with site maps. *Rare Plants of the West Point Military Reservation.* Unpublished.

Barbour, J.G. 1996. Report, with site maps. *Supplementary Rare Plant Survey of the West Point Military Reservation and Constitution Island 1996.* Unpublished.

Barbour, J.G. 1997. Report, with site maps. *West Point Supplementary Rare Plant Survey, 1997*. Unpublished.

Barbour, J.G. 2000. Report, with site maps. *West Point Rare Plant Survey, 2000.* Unpublished.

Clemants, S and Barringer, K. List. 1991. *Plants of the U.S. Military Academy, West Point, New York, 1990.* Brooklyn Botanic Garden, 1000 Washington Ave. Brooklyn, NY 11225-1099

Clemants, S and Barringer, K. List. 1992. *Plants of the U.S. Military Academy, West Point, New York, 1990 (revised 1992).* Brooklyn Botanic Garden, 1000 Washington Ave. Brooklyn, NY 11225-1099

Kakerbeck, R. 1995. Paper map. *Rare Flora of U.S.M.A.* Unpublished.

Michell, R and Tucker, G. 1993. List. *A Checklist of the Flora of the West Point Reservation.* The University of the State of New York, The State Education Department, Albany, NY, 12230.

Pray, C. 2001. Digital map (ArcView), with attributes, and metadata. *Rare Flora.* Unpublished.

Attributes of Rare flora 95.shp

map reference #	Species Name	Common Name	Location	GIS ID #	Rarity	NYS Status	90	92	93	94	95	96	97	98	99	00	02	Project review	Notify manager	Fire protection	Passive barrier	Fence	Habitat management	Transplant/bank seed	Annual monitor	2003 survey	2006 survey	No action	Remarks
2	*Aristolochia serpentaria*	Virginia Snakeroot	N of Cascade Brook	2	S1	E								y		n		X		X				X	X	X	X		Look along Cascade brk May-June.
75	*Carex aggregata*	Glomerate Sedge	S of MTR W of cem	201	S1	E				y								X								X	X		NYSM specimen, not looked for again.
16	*Carex straminea*	Straw Sedge	Owl Swamp	53	S1	E												X										X	Old record
			MTR cem	54	S1	E	y			y			y			n		X										X	ID? (Dry location)
			RR 8 landfill	55	S1	E	y			y		n	n			n		X										X	Probably gone.
17	*Carex striatula*	Stripe-Fruited Sedge	Crow's nest Brk parking	56	S1	E	y			y		y	y			y		X	X		X					X	X		Pipe-line work in 2002 may change habitat
			Crow's nest S Flank	57	S1	E					y							X										X	UXO
49	*Crassula (Tillaea) aquatica*	Pigmyweed	Con Is N shore	77	S1	E	y			y						n		X								X	X?		Probably gone.

Desmodium glabellum (laevigatum?) (SH) Smooth Tick Trefoil 2 locations in 96 report *Taxonomic revision places some specimens in D. humifusum, some in D. perplexum. Need expert to examine specimens*

27	*Elatine americana*	American Waterwort	Stilwell old fishing	92	S1	E				y						y		X									X		Secure
			Lake Frederick	93	S1	E			y							y		X								X	X		Only other off Stilwell
			Stilwell Engineer pnt	94	S1	E				y					y			X								X	X		Training danger
			Stilwell Is off MTR	197	S1	E										y		X									X		Secure
			Other sites possible along Pop?																							X?			Common to muddy, sluggish shores.
64	*Geranium carolinianum*	Carolina Cranesbill	Burnt hill MTR	95	S1	E				y			y			y		X								X	X?		Apparently secure, site has plentiful rare plant community
			Long mt.	96	S1	E												X								X	X?		Reappear after fire?
29	*Juncus debilis*	Weak Rush	RR 3 Cran end	100	S1	E			y	n	y		y			y		X					X		X	X	X		Both sites at roadside, increase hydroperiod,
			RR 1 Cran end	196	S1	E										y		X					X		X	X	X		limit disturbance from traffic.
34	*Lycopus rubellus*	Gypsywort	Hem Brk wetland	118	S1	E	y			n		n						X										X	All sites for this plant are probably no longer extant.
			Con Is post	119	S1	E				y	y	n				n		X										X	
			Gees point	219	S1	E		y		n		n						X										X	
39	*Pinus virginianus*	Virginia Pine	Crow's Nest Summit	128	S1	E				y								X										X	All plants were destroyed in 1999 fire.
			The Torne	129	S1	E		y										X										X	Probably on the Palisades side of Torne.
44	*Potamogeton diversifolius*	Pondweed	Bull Pond near outlet	141	S1	E				y			y			y		X									X		Secure
			Bull Pond near dock	206	S1	E							y			y		X									X		Secure
			S. end Mine Lake	220	S1	E							y					X								X	X?		Not looked for since discovery.
47	*Scirpus georgianus*	Georgia Bulrush	Fred near sm pnd parking	158	S1	E		y										X					X			X	X		Comments apply to all:
			Fred Wooded Pocket	159	S1	E		y										X					X			X	X		Probably surviving plants. Seedheads mowed.
			Fred Open Field	160	S1	E				y	y		y					X					X			X	X		Revise mowing plan for Frederick.
			Fred DZ wetland S	161	S1	E					y							X					X			X	X		NRB should look for mature seed pods in August.
			Fred DZ wetland N	162	S1	E					y							X					X			X	X		
			Fred roadside ditch	163	S1	E				y		y				y		X	X			X	X			X	X		Last known location
			We should try to protect some plots from mowing, perhaps on a rotating schedule, to allow successful fruiting. Bobolink (others?) would benefit.																										
9	*Bidens laevis*	Smooth Bur-Marigold	Pop brk X Weyant's rd	21	S2	T				y			n			n		X										X	ID questionable.
			Target Field rr tracks	22	S2	T					y	n	n			n		X										X	Not seen for some time.
11	*Cardimine longii*	Long's Bittercress	Constitution Is N	24	S2	T		y	y	y		y	n			y		X									X		Healthy populations at Con Is.
			Constitution Is NW	184	S2	T						y	n			y		X									X		
74	*Carex abscondita*	Thicket Sedge	W of RR9 S of summit	200	S2	E				y								X								X	X?		NYSM specimen, not looked for since discovery.

map reference #	Species Name	Common Name	Location	GIS ID #	Rarity	NYS Status	90	92	93	94	95	96	97	98	99	00	02	Project review	Notify manager	Fire protection	Passive barrier	Fence	Habitat management	Transplant/bank seed	Annual monitor	2003 survey	2006 survey	No action	Remarks
73	*Carex mesochoria*	Midland Sedge	Crow's Nest Brk	193	S2	E										y		X			X					X			Gas-Line 2002
26	*Digitaria filiformis*	Slender crabgrass	Redoubt 7	90	S2	T				y						y		X	X								X		
			Con Is Boathouse path	91	S2	T				y								X	X								X		
28	*Hottonia inflata*	Feathefoil	Hottonia Pool RR9	98	S2	T		y	y	y			y		y	n		X	X						X	X	X		Some near-by dumping. Equestrian Ctr?
			Brook's Hollow	99	S2	T		y	y	y			n			y		X									X		
33	*Linum medium var. texanum*	Texas Wild Flax	RR9	117	S2	T				y			y			y		X	X		X			X		X	X		Population damaged by road work.
36	*Oxalis violacea*	Violet Wood Sorrel	RR 1 Cran Brk	121	S2	T				y	y							X								X	X?		Old sighting. First post- fire search (Formerly S1S2)
			Con Is	122	S2	T				y						y		X									X		Probably secure.
			Burnt hill MTR	123	S2	T				y	y					y		X									X		Common on hill
			Burnt hill MTR	124	S2	T				y	y					y		X									X		
41	*Podostemum ceratophyllum*	Riverweed	Pop Brk above waterfall	130	S2	T				y			y			y		X									X		Reliable species.
			Pop Brk near MTR cem	131	S2	T				y		y	y					X									X		
			Mine Lake Outflow	132	S2	T				y		y	y			y		X									X		
			Pop Brk Below waterfall	133	S2	T				y			y			y		X								X	X?		Pesticide application in area.
42	*Polygonum careyi*	Carey's Smartweed	Redoubt 1	134	S2	T				y	n	n				n		X										X	Very Itinerant.
			Lee Gate	221	S2	T			y		n	n						X										X	
45	*Potamogeton pulcher*	Pondweed	Long Pond	142	S2	T				y								X									X		Competition from milfoil? (Formerly S1)
			Pop Brook	143	S2	T				y								X								X	X?		Not looked for 00.
			Bull Pond	144	S2	T				y						y		X	X								X		Secure and spreading in Bull Pond.
			Bull Pond W of compound	207	S2	T										y		X	X								X		
46	*Ranunculus micranthus*	Small-Flowered Crowfoot	Blackcap Mt S	145	S2	T										y		X									X?		Applies to all: Second survey is contingent upon first -
			Burnt hill MTR	146	S2	T					y					y		X									X		Population at WP may be so secure extra effort unwarranted.
			Redoubt 2	147	S2	T	y	y			y					y		X								X	X?		Prone to disturbance.
			Blackcap Mt N	148	S2	T										n		X									X?		
			Summit W of Ridge rd	149	S2	T												X									X?		
			Burke Mt mid	150	S2	T												X									X?		
			Con Is Roman's	151	S2	T		y		y	y					y		X									X		
			Long Mt	152	S2	T					y	y						X								X	X?		Look before logging.
			Cascade Valley	153	S2	T												X								X	X?		An unconfirmed report.
			Bog Med Mt (Cascade Ridge	154	S2	T						y						X									X?		
			Crow's Nest	155	S2	T					y							X										X	UXO's in area
			Burke Mt S	156	S2	T												X								X	X?		99 fire.
			Burke Mt N	157	S2	T												X								X	X?		99 fire.
			Burnt hill MTR	198	S2	T					y	y				y		X									X		
			Burnt hill MTR	199	S2	T					y	y				y		X									X		
			Cran Brook X RR1	222	S2	T						y														X			Not looked for since 96.
52	*Utricularia radiata*	Small Floating Baldderwort	Wilkin's W shore	172	S2	T				y			y			y		X									X		Common and widespread at WP
			Bull Pond	173	S2	T												X								X	X?		BK sighting
			Owl Swamp inlet	174	S2	T				y			y			y		X									X		
			Beaver Pond	175	S2	T				y			y			y		X									X		
			Weyant's	176	S2	T				y			n			n		X									X		
			Owl Swamp	177	S2	T				y					y	y		X									X		
			Wilkin's Is	178	S2	T				y						y		X									X		
			Cranberry P	179	S2	T				y						y		X									X		
10	*Callitriche terrestris*	Pigmy Starwort	Morgan farm corral	23	S2S3	T		y		y			y		y	y		X	X		X				X	X	X		Doing well, but conditions can change rapidly at farm. (formerly S1)

map reference #	Species Name	Common Name	Location	GIS ID #	Rarity	NYS Status	90	92	93	94	95	96	97	98	99	00	02	Project review	Notify manager	Fire protection	Passive barrier	Fence	Habitat management	Transplant/bank seed	Annual monitor	2003 survey	2006 survey	No action	Remarks
13	*Carex cumulata*	Cluster Sedge	Beaver's P Mt pool	41	S2S3	T				y			y			n		X								X	X?		Apparently secure. (Formerly S2)
			Beaver's p Mt ruins	42	S2S3	T				y			y			n		X								X	X?		Watch for status change.
			Constitution Is. W	43	S2S3	T				y			y			y		X									X		Likely to become S3.
			Burke lower pool	44	S2S3	T												X								X			
			Turkey Mt.	45	S2S3	T				y			y			n		X										X	
			Burke Buttonb outflow	46	S2S3	T				y						n		X								X			
			Burke N summit pool	47	S2S3	T										y		X								X			
			Con Is Redoubt 7 plaque	185	S2S3	T										y		X	X								X		
			Con Is Redoubt 7 logs	186	S2S3	T										y		X	X								X		
3	*Asclepias purpurascens*	Purple Milkweed	E of Ridge Road	3	S3	U					y		n			n		X								X			No known extant location for species.
			Long P ROW	4	S3	U			y	n								X								X	X?		Look along SE shore of Long pond ROW ~ midpoint.
			W of Ridge Road	5	S3	U				y			n			n		X								X			
			Trout Brook	6	S3	U		y		n								X										X	
			E of Audi (RR24)	7	S3	U												X										X	
			Across 9w from cem	8	S3	U												X								X	X?		
			Long P X 293	9	S3	U				y			n			n		X										X	
			Near Pershing Road	10	S3	U		y		n								X										X	
			Brooks Hollow	11	S3	U				y			y			n		X										X	
			Weyant's wildlife clearing	12	S3	U		y		n								X										X	
8	*Betula nigra*	River Birch	Georgina Dam	20	S3	U				y					y	y		X										X	Unchanged for years. Area often visited by NRB.
14	*Carex albicans var. emmonsii*	Emmon's Sedge	Crow's Nest	33	S3	U					y	y						X										X	
			Burnt hill MTR	34	S3	U				y		y				y		X									X		Monitor 1 good site at WP
			Bull Pond road	35	S3	U		y		y								X										X	
			Old West Point rd	36	S3	U						y						X										X	
			Long Mt	223	S3	U						y						X										X	
			Mt Rascal	224	S3	U					y							X										X	
57	*Carex bicknellii*	Bicknell's Sedge	Beaver's Ponds Mt.	37	S3	T							y					X								X	X?		Not looked for since 97, status changed from S2S3.
12	*Carex bushii*	Bush's sedge	Proctoria Helicopter	38	S3	T		y	y	y	y		y			y		X	X								X		Monitor the most consistent site.
			Min Springs near RR21	39	S3	T							y			n		X										X	
			Buckner Wetland	40	S3	T		y	y	n								X										X	
60	*Carex lupuliformis*	False Hop Sedge	Cran horse trail	48	S3	R							y			y		X	X							X	X?		Both sites are prone to disturbance.
			Cran Lilly pond	49	S3	R							y			y		X	X		X					X	X?		
15	*Carex seorsa*	Weak Stellate Sedge	Con Is wetland	50	S3	T	y				y					y		X	X								X		Very common at Morgan farm, but less so elsewhere. (Formerly S2)
			Lower Crag NW point	51	S3	T										y		X									X		
			Cragston Lilly pond	52	S3	T	y				y		y			y		X	X							X	X?		
			Blackcap Mt	187	S3	T										y		X									X		
			Cragston Brook	188	S3	T										y		X									X		
			Lower Crag N point	189	S3	T										y		X									X		
			Lower Crag feeder stream	190	S3	T										y		X	X								X		
			Lower Crag feeder head	191	S3	T										y		X	X								X		
20	*Corydalis flavula*	Yellow Harlequin	Thayer rd N	62	S3	U				y						y		X										X	(Formerly S2)
			Long Mt.	63	S3	U				y	y	y						X										X	
			Redoubt 1	64	S3	U				y						y		X									X		The Redoubt area is close to housing, and has foot-traffic and
			Con Is S	65	S3	U				y						y		X									X		invasive species invasions.
			Redoubt 2 uphill	66	S3	U				y						y		X									X		
			Con Is S	67	S3	U				y						y		X										X	

map reference #	Species Name	Common Name	Location	GIS ID #	Rarity	NYS Status	90	92	93	94	95	96	97	98	99	00	02	Project review	Notify manager	Fire protection	Passive barrier	Fence	Habitat management	Transplant/bank seed	Annual monitor	2003 survey	2006 survey	No action	Remarks
			Crow's Nest South	68	S3	U					y	y						X										X	
			Old West Point rd	69	S3	U										y		X										X	
			Con Is. SE	70	S3	U				y			y			y		X										X	
			Between Redoubts 1&2	71	S3	U				y						y		X									X		
			Crows Nest E flank	72	S3	U					y							X										X	
			Owl Swamp outflow	73	S3	U				y								X										X	
			Redoubt 2 downhill	74	S3	U				y						y		X									X		
			Beaver's Ponds Mt.	75	S3	U				y								X										X	
			Burnt hill MTR	76	S3	U					y		y			y		X									X		
			Thayer rd S	194	S3	U										y		X										X	
			Blackcap Mt	217	S3	U							y			y		X										X	
			Gee's Point	226	S3	U						y						X										X	
23	*Cyperus erythrorhizos*	Red-Root Flatsedge	Con Is wetland	88	S3	U		y		n			n			n		X										X	Presumed gone. (Formerly S2)
25	*Cyperus odoratus*	Fragrant Flatsedge	Sweeny Pit	89	S3	U				y	y		n			n		X										X	Conditions at the site may no longer be amenable for plant. (Formerly S2)
30	*Lechea racemulosa*	Racemed Pinweed	Camp Shea	101	S3	R				y					n	y		X										X	Sites for survey are close to other rare plant locations.
			RR 9 S downhill	102	S3	R				y						n		X										X	
			Burnt hill MTR	103	S3	R				y	y		y			y		X									X		
			RR9 N	104	S3	R				y						n		X										X	
			RR 9 S uphill	105	S3	R				y						n		X										X	
			Redoubt 1	106	S3	R	y	y		y			y			y		X									X		
			Beaver's Ponds Mt.	107	S3	R				y						n		X										X	
			Crag near Lilly p	108	S3	R				y						y		X									X		
32	*Lespedeza violacea*	Violet Bush Clover	Ridge Rd ROW W	110	S3	R				y	y					y		X										X	Sites for survey are close to other rare plant locations. (Formerly S2)
			Burnt hill MTR	111	S3	R				y	y					y		X									X		
			Crow's Nest E flank	112	S3	R					y							X										X	
			RR 1 Cran Brk	113	S3	R				y								X										X	
			Redoubt 2	114	S3	R				y						y		X									X		
			Redoubt 1	115	S3	R				y						y		X									X		
			Burke Mt.	116	S3	R				y						y		X									X		
43	*Polygonum tenue*	Slender Knotweed	Gee's Pnt	135	S3	R				y								X								X	X?		Vulnerable location.
			Burnt hill MTR	136	S3	R				y		y				n		X									X		Survey as part of rare plant community.
			Beaver's Ponds Mt.	137	S3	R				y						n		X										X	
			Turkey Mt	138	S3	R				y						y		X										X	
			Forest of Dean	139	S3	R				y		y						X										X	
			Ridge Rd ROW W	140	S3	R					y							X										X	
			Round Pond Look out	218	S3	R										y		X									X		Near bearberry site.
			Burke Mt. S. slope	225	S3	R						y						X											
51	*Utricularia geminiscapa*	Gemmed Bladderwort	Mt Rascal Fen	171	S3	U	y	y		n	y		y					X									X		Comes and goes. Only known site at WP
5	*Aster schreberi*	Schreber's Aster	Min Springs near Trout b	13	(EX)	U												X										X	No further action necessary at this time. (Formerly S3)
			Min Springs near RR21	14	(EX)	U				y			y			y		X										X	
			Redoubt Trail	15	(EX)	U				y			y			n		X										X	
			Cragston dam	16	(EX)	U				y			y			y		X										X	
56	*Carex agyrantha*	Hay Sedge	RR 7 near owl swamp W	25	(EX)	U												X										X	No further action necessary at this time.
			RR 7 near owl swamp E	26	(EX)	U												X										X	
			Turkey Mt	27	(EX)	U												X										X	
			Hilltop SE of rng 4	28	(EX)	U												X										X	
			Beaver's Ponds Mt.	29	(EX)	U												X										X	

map reference #	Species Name	Common Name	Location	GIS ID #	Rarity	NYS Status	90	92	93	94	95	96	97	98	99	00	02	Project review	Notify manager	Fire protection	Passive barrier	Fence	Habitat management	Transplant/bank seed	Annual monitor	2003 survey	2006 survey	No action	Remarks
			Turkey Mt Weyan't side	30	(EX)	U												X										X	
			Mt Rascal	31	(EX)	U							y					X										X	
			Redoubt 1	32	(EX)	U												X										X	
18	*Chenopodium standleyanum*	Standley's Goosefoot	Turkey Mt.	58	(EX)	U				y								X										X	No further action necessary at this time.
			Long Mt N	59	(EX)	U				y								X										X	
			Burnt hill MTR	60	(EX)	U				y								X										X	
			Long Mt S	61	(EX)	U				y								X										X	
			Burke Mt	212	(EX)	U										y		X										X	
21	*Cunila origanoides*	Dittany	Redoubt 2	78	(EX)	U				y		y						X										X	No further action necessary at this time. (Formerly S3)
			N of Lower Crag	79	(EX)	U								y	y	y		X										X	
			N of Lower Crag	80	(EX)	U								y				X										X	
			Redoubt 1	81	(EX)	U				y								X										X	
			The Torne	82	(EX)	U				y								X										X	
			RR7 near Crag Brk trib	83	(EX)	U				y								X										X	
			W of RR9	84	(EX)	U												X										X	
			Lower Crag outflow	85	(EX)	U				y								X										X	
			Burnt hill MTR	86	(EX)	U				y								X										X	
			South of Goethal's trail	87	(EX)	U												X										X	
			N of Cascade Brk	195	(EX)	U										y		X										X	
			N of Ridge rd ROW	213	(EX)	U				y		y						X										X	
			RR1 Cran brk	214	(EX)	U				y								X										X	
			E of Burnt hill	215	(EX)	U				y								X										X	
38	*Pilea fontana*	Green-Fruited Clearweed	Johnston's Med	125	(EX)	U				y								X										X	No further action necessary at this time.
			Min Springs Brk	126	(EX)	U				y								X										X	
			Mine Lake Outflow	127	(EX)	U				y								X										X	
			Con Is. NW shore	216	(EX)	U				y								X										X	
50	*Uticularia biflora (gibba)*	Two Flowered Bladderwort	Con Is wetland trax s	168	(EX)	U		y		y								X											No further action necessary at this time.
			Con Is wetland trax n	169	(EX)	U				y								X											
			Con Is wetland S	170	(EX)	U				y						y		X											
1	*Arctostaphylos uva-ursi*	Bearberry	Roun Pond Look-out	1	RR	U				y			y			y		X									X		
7	*Betula cordifola*	Mountain Paper Birch	Bull Hill Grotto	17	RR	U				y			y		y	y		X									X		Unusual exception to plant's normal distribution.
			Bull Hill Grotto	18	RR	U				y			y		y	y		X									X		
			Bull Hill Grotto	19	RR	U				y			y		y	y		X									X		
31	*Lespedeza nuttallii*	Nuttall's Bush Clover	Beaver's Ponds Mt.	109	RR	U				y						y		X										X	Unusual hybrid of common plants.
63	*Mitella diphylla*	Miterwort	Deep Hollow	120	RR	U					y							X										X	Unlikely to be disturbed.
84	*Mitella nuda*	Naked miterwort	stream NW of RR 8	227	RR	U	y											X								X	X?		Not seen in many years.
73	*Sorbus Americana*	Mountain Ash	Bull Hill Grotto	167	RR	U		y					y		y	y		X									X		Mt Paper Birch location.
55	*Woodwardia areolata*	Netted Chainfern	Bear Swamp	183	S3	U		y		y						y		X									X		Added to NYNHP S3 list 2002.
83	*Bartonia virginica*	Bartonia	Cran P Bog mat	211	WR	U										y		X					X				X		A unique habitat at WP, and will be subjected to invasive control action.
76	*Juncus torreyi*	Torrey's Rush	Burnt hill MTR	202	WR	U										y		X									X		Look for as part of rare plant community.
77	*Dicentra cucullaria*	Dutchman's Breeches	Blackcap Mt	203	WR	U										y		X										X	Common in limestone areas of the reservation.

map reference #	Species Name	Common Name	Location	GIS ID #	Rarity	NYS Status	90	92	93	94	95	96	97	98	99	00	02	Project review	Notify manager	Fire protection	Passive barrier	Fence	Habitat management	Transplant/bank seed	Annual monitor	2003 survey	2006 survey	No action	Remarks
			Cascade Ridge	228	WR	U											y	X										X	
78	*Drosera intermedia*	Narrow-Leafed Sundew	Cran P Bog mat	204	WR	U										y		X					X				X		A unique habitat at WP, and will be subjected to invasive control action.
82	*Drossera rotundifolia*	Round-Leaf Sundew	Cran P Bog mat	210	WR	U										y		X					X				X		A unique habitat at WP, and will be subjected to invasive control action.
85	*Eupetorium altissimum*	Tall Bonesett	Rail ROW S Palisades	229	RR	U	y					y	y					X								X			Out of normal range.
86	*Eupetorium sessilfolium*	Upland Bonesett	W Ridge Rd	230	RR	U				y		y						X								X			Out of normal range.
79	*Glyceria grandis*	Great Manna Grass	Crow's Nest	205	WR	U										y		X										X	Rare to WP, but no action needed at this time.
65	*Hedeotis cerulea*	Bluets	Burke summit	97	WR	U					y							X										X	Rare to WP, but no action needed at this time.
72	*Sencio obovatus*	Round-Leaved Ragwort	Hilltop W or Ridge Rd	164	WR	U		y										X										X	Rare to WP, but no action needed at this time.
			Near OP Charlie	165	WR	U		y										X										X	
			W of RR21 n of Audi	166	WR	U		y				y						X										X	
			lime erratic E of Ridge Rd.	231	WR	U					y							X										X	
80	*Thelipteris simulata*	Massachusetts Fern	Bear Swamp	208	WR	U										y		X									X		New to flora of West Point.
81	*Vaccinium oxycoccos*	Small Cranberry	Cran P Bog mat	209	WR	U										y		X					X				X		Rare to WP, but no action needed at this time.
58	*Vaccinum macrocarpon*	Large Cranberry	Wetland between RR 1&3	180	WR	U	y			y								X										X	Rare to WP, but no action needed at this time.
			Cran P Bog mat	181	WR	U				y						y		X					X				X	X	A unique habitat at WP, and will be subjected to invasive control action.

APPENDIX I

USMA Regulation 215-5

Department of the Army **USMA REG 215-5**
United States Military Academy
West Point, New York 10996
1 February 2000 **1 February 2000**

Morale, Welfare and Recreation

Hunting, Fishing and Trapping

MAPA

FOR THE SUPERINTENDENT:

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Summary: This regulation covers the policies, responsibilities and procedures governing hunting, fishing, and trapping and the protection of fish and wildlife resources at the United States Military Academy (USMA).

Applicability: This regulation applies to USMA and tenant agencies and authorized users of USMA lands as a recreational activity (hunting/fishing/trapping).

***This regulation supersedes USMA Regulation 215-5 dated 1 February 1997**

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CHAPTER 1

SECTION 1
GENERAL

1-1. Purpose. To prescribe policies, responsibilities and procedures governing hunting, fishing, and trapping and the protection of fish and wildlife resources at the United States Military Academy.

1-2. References
Reference publications are listed in appendix A.

SECTION II
RESPONSIBILITIES

1-3. Community Recreation Officer (Chief, Community Recreation Division) (CRD)
The Community Recreation Officer will:

a. Control selling of the special USMA hunting/fishing/trapping permits and collect the recreational activity fee.

b. Distribute maps, promotional and regulatory materials to ensure that USMA personnel, guests, and visiting troops are aware of USMA hunting, fishing, and trapping regulations.

c. Implement administrative aspects of the hunting, fishing and trapping programs.

d. Operate the Field Archery Range.

e. Publish fees and charges annually.

f. Hold a lottery for the opening morning hunting slots of the Regular Firearms Big Game Season.

g. Position boats and docks at any authorized fishing area.

h. Maintain lists of individuals who have received warnings, citations, suspension and revocations.

i. Provide personnel to augment Range Control during the Big Game Hunt season.

1-4. Directorate of Housing and Public Works (DHPW)
DHPW will:

a. Prepare, update and implement the Cooperative Plan for Fish and Wildlife Management.

b. Determine fish and game harvest quotas, size limits, bag limits, and season lengths. Determine participation quotas and coordinate quota criteria with the Safety Officer.

c. Serve as the primary liaison in fish and wildlife matters with the NYS Department of Environmental Conservation, U.S. Fish and Wildlife Service, and neighboring landowners.

d. Operate the West Point Big Game Check Station.

e. Implement administrative and operational aspects of the trapping program.

f. Implement the administrative aspects of the Deer Management Unit 3P general public hunting program.

g. Provide the facilities engineering support required to implement the hunting, fishing and trapping program.

h. Post G2, J2, J3, J4, and J5, Hunting Areas prior to the special archery big-game season.

i. DHPW will provide to Range Control specific season dates for hunting/fishing/trapping seasons.

j. Have approval authority for appropriate West Point, Federal and State organizations to use internal combustion engines on all lakes and ponds during water quality, weed control, habitat management, and fisheries investigations.

k. Authorize to solicit up to five (5) trappers that do not meet the eligible requirements set forth in Appendix C to trap problem or nuisance animals.

1-5. Military Police

a. The MPs will issue written citations on DD Form 1805.

b. Forward copy of each citation to the Range Control Manager, acting as Chief Game Warden.

1-6. 1st Battalion, 1st Infantry

The 1-1 INF will:

a. Provide personnel to assist the USMA Game Wardens to enforce this regulation.

b. When requested by Range Control, assist USMA Game Warden patrols of the reservation.

c. Issue written notes of suspensions and revocations.

d. Ensure that the range and training area schedule and associated road closings are provided to the Adjutant General (AG) for inclusion in the USMA Post Bulletin and to the Range Control operation and the Chief, Community Recreation, so hunting, fishing and trapping will not interfere with the military mission.

1-7. Director of Operations, Plan and Security (DOPS)

DOPS will: Schedule training to minimize conflicts with the Regular Firearms Big Game Season. High deer harvests are required to meet long-term training area management objectives. Neither DOPS nor Range Control should approve a major USMA event that would significantly interfere with the Regular Firearms Big Game Season without prior coordination with Natural Resources Branch.

1-8. Adjutant General (AG)

Publish range and training schedules and associated road closings in the USMA Post Bulletin.

1-9. Safety Officer

The Safety Officer will review all safety-related aspects of the hunting, fishing, boating and trapping programs.

1-10. 1st Battalion, 1st Infantry Range Control

Range Control will:

a. Exercise absolute control of access to all training areas, ranges and danger areas no matter what the hunting, fishing or trapping activity.

b. Ensure any scheduled training activities are not interfered with by Hunting, Fishing and Trapping.

c. Ensure safe operation of the ranges and training areas in conjunction with hunting, fishing, and trapping.

d. Provide the administration and operation of all sign outs for small game hunting, archery, and trapping.

e. Operate the Big Game Hunt Control Center. Issue keys for access to hunting and fishing areas for authorized users.

f. Provide gate security of all ranges and training areas.

g. Contact MPs to report violations of Range Control restrictions.

1-10A.

The Range Control Manager, acting as Chief Game Warden will:

a. Suspend or revoke the hunting, fishing and trapping privileges at West Point of persons in violation of this regulation IAW appendix D.

b. Issue written warning based on issued warnings forwarded from Game Wardens.

c. Take administrative action against individuals based on issued DA Forms 1408 forwarded from the Provost Marshal and/or Game Wardens. Notify violators in writing, in accordance with para. 6-4, of suspensions or revocations of privileges.

d. Maintain list of individuals who have received warnings, citations, suspensions, and revocations of privileges.

e. Manage game wardens.

f. Issue written warnings, IAW appendix D of the regulation on DA Form 1408.

g. Furnish copy of each warning to DHPW, CRD, PM, and 1st of 1st.

1-11. Deputy Garrison Commander (DGC)

a. Maintains records of written warnings, suspensions, or revocations to prevent sale of licenses to suspended or revoked hunters. Provides same to CRD.

b. Act as the appeal authority for suspensions and revocations. Must respond to a written appeal within 10 working days.

1-12. USMA Hunters, Trappers and Anglers

See Appendix B for rules for USMA hunters, trappers, and anglers.

SECTION III
POLICIES

1-13. Policies

a. Hunting, fishing and trapping on USMA lands will be in accordance with this regulation, the USMA Integrated Natural Resources Management Plan, applicable Federal laws, and the Environmental Conservation Law of New York State (Appendix E).

b. Hunting, fishing and trapping on the reservation are promoted primarily for personnel eligible under provisions of this regulation, AR 215-1, and AR 200-3.

1-14. USMA Permits and Fees

a. As authorized by the Sikes Act (16 USC 670 et seq.) and in accordance with AR 200-3, special USMA hunting, fishing and trapping permits will be sold to individuals authorized under AR 215-1 and Eligibility Priorities in appendix C of this regulation. The fees collected for the special permits will be deposited on a monthly basis in the USMA Wildlife Conservation Fund Account. Funds will be used by the DHPW for the protection, conservation, and management of fish and wildlife.

b. A recreational (hunting/fishing/trapping) activity fee will also be collected for the Installation, Morale, Welfare, and Recreation (MWR) Fund. Activity fees will be used IAW AR 215-1.

c. The acceptance of a hunting, fishing, trapping permit, or guest pass shall constitute an acknowledgment by the permittee of his/her duty to comply with this regulation, and all permits are conditioned upon such acceptance.

1-15. Federal and State Licensing and Permits

The privileges accorded by the special USMA hunting/fishing/trapping permit will not relieve the permittees of the licensing requirements in the Migratory Bird Hunting Stamp Act (16 USC 718 et seq.) or the Environmental Conservation Law of New York State.

1-16. Season and Bag Limits

Harvest regulations will be as those prescribed in the Environmental Conservation Law of New York State, and/or the Federal Government except where more stringent measures may be promulgated by DHPW in response to fluctuations of fish and game populations. These seasons bag limits and sizes will be published in the West Point Hunting/Fishing and Trapping Bag Limit Guide. The pamphlet will be used by Game Wardens to help determine violations. Violators are also subject to disciplinary action under the Uniform Code of Military Justice and/or Federal Law and may be permanently barred from the United States Military Academy.

CHAPTER 2
SMALL GAME HUNTING

2-1. Eligibility

Eligibility Priorities are listed in appendix C

2-2. General Procedures

a. Small game/fall turkey/waterfowl, pheasant, and spring turkey hunting areas and their hunter capacities will be listed annually by Range Control on the respective sign-out sheets posted at Range Control. It is the hunter's responsibility to sign-out on the correct sheet.

b. Small game/fall turkey/waterfowl, and pheasant hunters, during the Regular Firearms Big Game Season, will be required to sign out and in daily in person for hunting areas at Range Control. Only one area may be signed out by an individual at one time.

c. Off limits areas reserved for training will be indicated on the sign-out sheets at Range Control located on Route 293. Upon completion of a hunting trip, hunters will sign back in at Range Control in person and report their kill.

d. Licensed young hunters (12 to 15 years of age) are permitted to small game hunt on the reservation, but they must be accompanied by a sponsoring USMA hunter (over 18 years of age) and remain within 10 meters of that sponsoring hunter.

e. No individual or USMA activity is authorized to stock wildlife without the permission of the DHPW.

f. Any game taken that has leg bands, ear tags, radio transmitters, or other markers will be reported by the hunter to the Natural Resource Branch, DHPW.

g. Parking is limited at Range Control on route 293. Hunters should not park on the shoulder of route 293. They should park on the access roads across from Range Control when visitor parking is full at bldg 1403.

h. Hunters are responsible for checking the Dawn to Dusk Time Chart posted at Range Control for the day's hunting hours.

2-3. Small Game/Fall Turkey/Waterfowl

a. Small game hunting, including fall turkey, will be permitted in the "Bow Only" J areas by archers only during the NYS Archery Deer season.

b. Waterfowl hunters may establish their own blinds, making sure to maintain safe distance from other blinds. Blinds must be constructed entirely of natural material common to the hunting site. All blinds must be removed at the end of the waterfowl season.

c. Waterfowl hunters using boats while hunting must have U.S. Coast Guard approved flotation devices for each person in the boat.

d. Waterfowl hunters must only possess non-toxic (non-lead) shot.

2-4. Spring Turkey

a. Spring turkey hunters will sign out and in daily for hunting areas at Range Control. All spring turkey hunters must be signed in no later than 1330 hours daily.

b. Spring turkey hunters may be completely camouflaged.

c. Spring turkey hunting will not be permitted in Hunting Areas J2, J3, J4, J5, or G2. Spring turkey hunting by bow and arrow only will be permitted in Area J1.

2-5. Raccoon and Predator (Night)

a. Night hunters will follow the same Range Control sign-out and in procedures as small game hunters. Small game hunters must coordinate with Range Control during duty hours to schedule an area for night hunting. Additionally, hunters must check back in with Range Control the next morning.

b. Nighttime hunting is prohibited during the Regular Firearms Big Game Season.

c. Nighttime hunters may possess only 22 rim fire or shotguns loaded with No. 4 shot or smaller (5, 6, 7, 8, 9). Centerfire rifles or pistols may not be carried by the hunter or in the vehicle.

CHAPTER 3
BIG GAME HUNTING

3-1. Eligibility

Eligibility priorities are listed in appendix C

3-2. General Procedures

a. All big game harvested during the season will be registered at the West Point Big Game Check Station.

b. Upon legally harvesting a deer or bear, after it is properly tagged according to the Environmental Conservation Law of New York State, the hunter will proceed via the most direct route to the West Point

Check Station. Bear taken by any big-game hunter will be immediately reported to the DHPW Natural Resources Branch's Wildlife Biologist.

c. Harvested big game will be presented by the hunter for registration with all internal organs removed. Registration procedures will be posted at the Hunt Control Center.

d. Any area not being used for training and open for hunting may be closed at the discretion of the Hunt Control Officer, Forester, or Military Police. In order to fully implement the big game hunting program, the Range Control NCOIC may restrict non-hunter access on the reservation during the hunting season.

e. Big-game hunters will be permitted to use temporary, pre-fabricated, portable stands provided that the tree(s) supporting the stand is (are) not significantly damaged when the stand is erected. Screw-in footholds, spikes, or any structures nailed into a tree will not be permitted. All stands must be removed at the end of the big-game seasons. Permanent tree stands are prohibited.

3-3. Hunting Areas and Hunter Density

The authorized Big Game Hunting areas and their maximum hunter capacities will be posted at Range Control.

3-4. Archery Season

a. Archery hunting areas and their hunter capacities will be listed by Range Control on the hunting sign-out sheet at Range Control.

b. Big Game taken during the archery seasons will be registered and weighed at a location to be announced by DHPW. Bear taken by archers will be immediately reported to the Natural Resources Branch, DHPW.

c. Archery hunting will not be permitted in the hunting areas specially reserved for weekend and holiday pheasant hunting.

d. Archery deer hunters are allowed tree stands. IAW paragraph 3-2e.

e. During the Regular Firearms Big Game Season archers will follow the sign out and harvest registration procedures applicable to firearms big game hunters.

f. No archery hunting will be permitted in the J areas on the Saturdays of home football games.

g. Young hunters (14 to 15 years of age) with junior archery licenses may hunt big game with bow and arrow during the special archery season. Young hunters must be accompanied by a sponsoring USMA hunter and must remain within 20 meters of that sponsoring hunter.

3-5. Regular Firearms Big Game Season and Deer Management Permit (DMP) Program

a. During the Regular Firearms Big Game/DMP Season all hunters will sign-out and in at the Hunt Control Center.

b. After selecting a hunting area, hunters will be issued distinctive Hunting Area Identification and they will surrender their Big Game Hunting License (not back tag), which will be retained in the Hunt Control Center. When signing in from an area, a hunter will turn in the Hunting Area Identification and receive back his/her license.

c. Hunters will wear at all times the distinctive identification issued by the Hunt Control Center and 400 square inches of fluorescent orange clothing visible from all sides.

d. The parking pass issued by the Hunt Control Center will be prominently displayed in the windshield whenever the vehicle is parked in or adjacent to a hunting area. Hunters must park in or immediately adjacent to their hunting area and display their parking pass issued by the Hunt Control Center.

e. Beginning big game hunters (16 to 17 years of age) may hunt big game on the reservation during the Regular Firearms Season, but they must be accompanied by a sponsoring hunter.

f. During the season, hunters will choose hunting areas on a first-come, first-served basis (except lottery assignments for opening morning).

3-6. Administrative Procedures of DMP Hunting

a. Administrative aspects of general public DMP hunting will be coordinated by DHPW.

b. General Public hunters hunting at West Point with a valid DMP 3P must fill their DMP 3P first before they are authorized to hunt for an antlered deer. This requirement may be suspended during the

later part of the Regular Big-Game Season if the DHPW Wildlife Biologist determines that a sufficient antlerless deer harvest has been achieved.

c. Special Buck Hunting Passes will be issued by DHPW to general public hunters who fill their DMP P3 tag at West Point with an antlerless deer.

d. General Public DMP 3P hunters will not be issued a Special Buck Hunting Pass until their antlerless DMP 3P deer is registered at the West Point Deer Check Station.

e. General Public hunters may not sign-out the first week of the season until 0700 hours. After the first week, General Public hunters may sign-out at 0500 hours.

f. General Public hunters may also use their DMP 3P permits at West Point during the Regular Big-Game, Special Muzzleloader, and late Special Archery Seasons.

g. General Public DMP 3P Hunters may only take deer or coyotes (provided the hunter has a small-game or sportsman license and furbearer tags).

h. General public hunters will comply with all other regulations and policies applicable to hunting at West Point.

i. General public hunters are not permitted in any Hunting Areas located east of US Route 9W.

3-7. Lottery

a. The Community Recreation Officer will hold a lottery for the opening morning hunting slots of the Regular Firearms Big Game Season. Eligibility priority in the lottery will be:

Priority I - Active duty military personnel and civilian employees living on West Point and assigned to USMA, and their family members.

Priority II - Active duty military and their family members not assigned to West Point, and retired military personnel. Drilling Reserve and Guard personnel.

Priority III - USMA Civilian Personnel

b. In the event an individual will be away from USMA on the date of the lottery, a letter of explanation may be submitted to the Community Recreation Officer requesting that an area be selected by proxy.

c. If slots are still available following the lottery, USMA hunters may choose a slot prior to opening day on a first-come, first-served basis at Range Control during business hours at bldg. 1403 on Rte 293.

d. Hunting slots reserved for opening morning will be held in reserve until 0900 hours on opening morning. After 0900 hours the spaces will be signed out on a first-come, first- served basis.

3-8. Guests

a. Authorized personnel may sponsor only two guests.

b. Guests are not authorized to hunt on opening day of Big Game Season.

c. Guests possessing a valid DMP 3P Permit will pay lower applicable fee. Daily, if hunting one or two days or DMP 3P fee for three or more days.

3-9. Muzzleloader Season

a. Muzzleloaders will sign-out and in at Range Control, Bldg 1403 on route 293.

b. Muzzleloaders will wear 100 square inches of fluorescent orange clothing (e.g., hat) while hunting.

c. Muzzleloaders will register and weigh their kill at Range Control, Bldg 1403 on Route 293.

CHAPTER 4
FISHING & BOATING

4-1. Eligibility

Eligibility Priorities are listed in appendix C

SECTION I
FISHING

4-2. Authorized Fishing Areas

Note: Fires are not authorized on the ice while ice fishing.

a. **Water Bodies**: Beaver Pond (NE of Cat Hollow), Brooks Hollow, Bull Pond, Popolopen Lake, Cragston Lake, Cranberry Pond, Lake Frederick, Lake Georgina, Lusk Reservoir, Mine Lake, Round Pond, Stilwell Lake, Weyants Pond, Wilkins Pond, and any unnamed ponds outside of the USMA dud danger zones. Bull Pond and Round Pond will only be open to fishing during the NYS trout season and Lusk Reservoir will be open from 1 April through 30 November. A one day trout derby may be held in Round Pond if a Fishing Preserve License is obtained by DHPW.

b. **Streams**: Cranberry Brook, Highland Brook, Long Pond Creek, Deep Hollow Brook, Johnson Meadow Brook, Popolopen Brook, Queensboro Brook, Mineral Springs Brook, Crows Nest Brook, and any unnamed drainage flowing outside of USMA dud danger areas. Highland Brook, Queensboro Brook, and Mineral Springs Brook are only open to fishing during the NYS trout season. Mineral Springs Brook is strictly a catch-and-release (no-kill) trout fishery.

4-3. Policies

a. Anglers will not release bait fish live in any West Point waters.

b. Catch and Release of sportfish species (bass and trout) will be promoted to reduce exploitation of this resource.

c. Children under 12 years of age must be accompanied by an adult or a responsible person at least 16 years of age while fishing in West Point waters, except at Round Pond and Lake Frederick.

d. All anglers must check in with Range Control to determine which lakes are open. Some lakes may close during training. Any persons who plan on fishing in the training area would obtain a key to the gate that access the area from Range Control during normal business hours, Monday thru Friday 0830-1700. Range Control will be insuring the gates to Camp Buckner, Camp Natural Bridge and other training areas are locked at 1700 hrs.

4-4. Stocking and Habitat Management

DHPW will coordinate and implement all fish stockings and habitat management projects as prescribed in the Cooperative Plan. USMA Activities that wish to conduct habitat management projects or to stock additional fish (at their expense) must seek prior approval from the DHPW.

4-5. Reporting

All fish kept will be reported either on the appropriate form or by calling DHPW 938-2314. Other reporting arrangements must be coordinated in advance with DHPW.

4-6. Bass Tournaments

a. Aerated live wells will be used by all competitors to keep bass alive.

b. Bass will be returned to the same lake as caught immediately after weigh-in.

c. Records will be kept of tournament participants and the catch to include lengths and weights by fish species.

d. During the tournament, the USMA minimum length and possession limit will be waived and the NYS minimum legal bass length and possession limit may be used for fish that will be released immediately after the competition. Anglers may keep one trophy bass (minimum length 20 inches) per tournament. All other bass must be released.

e. All anglers in the tournament will possess NYS fishing licenses and USMA fishing permits or guest passes.

f. Not more than three one-day tournaments will be held on any individual body of water in any one year. Non-participants will not be excluded from fishing lakes and ponds.

4-7. Ice Fishing Derby

One-day ice fishing derbies for trout may be conducted on Round Pond. The derbies will be conducted under the provisions of a NYS Fishing Preserve License.

a. During the derbies no more than three tip-ups and one hand line may be used per angler.

b. All fish caught during the derbies will be tagged by derby personnel.

SECTION II
BOATING

4-8. Authorized Boating Areas

a. All boats will have the necessary safety equipment aboard in compliance with current USCG rules. Operators are responsible for complying with Federal and State boating laws.

b. The term "boat" is intended to mean any watercraft.

c. Authorized boating areas and the types of propulsion authorized are:

	Powerboats			*Non-Power
	>10 hp	<10 hp	Electric	
Beaver Pond			X	X
Brooks Hollow			X	X
Bull Pond			X	X
Cragston Lake			X	X
Cranberry Pond			X	X
Lake Frederick			X	X
Lake Georgina			X	X
Lusk Reservoir				X
Mine Lake			X	X
Popolopen Lake	X	X	X	X
Round Pond			X	X
Stilwell Lake	X	X	X	X
Weyants Pond			X	X
Wilkins Pond			X	X

*****Non-power boats include canoes, rowboats, kayaks, skiffs, paddleboats, or other watercraft without internal combustion engines or motors.

Note: Long Pond is leased to the Town of Highlands for use by its residents; use by West Point personnel is not authorized.

d. On the areas permitting internal combustion engines, no more than five (5) powerboats greater than 10 hp may be used at Stilwell Lake at any one time, and two at Popolopen. The limit on powerboats less than 10 hp will be seven (7) per area. Sanctioned fishing derbies are excluded from this provision.

e. Powerboats will not be permitted on Popolopen Lake during the period of Cadet Field Training. Powerboats needed to support cadet training will be permitted at the Camp Commander's discretion. Only electric powerboats are authorized on Popolopen Lake during the period of Cadet Field Training.

f. In addition to the appropriate state boat registration, USMA Daily Powerboat Use Permits will be required for the operation of an internal combustion powerboat over ten horsepower. Daily permits will be issued by the Round Pond Registration Office during hours of operation on a first-come, first-serve basis. See Appendix F for Power Boat SOP.

g. DHPW may authorize appropriate West Point, Federal and State organizations to use internal combustion engines on all lakes and ponds during water quality, weed control, habitat management, and fisheries investigations.

h. Lusk Reservoir is limited to two non-power boats.

4-9. Community Recreation Division Boats

a. CRD may position boats and docks at any authorized fishing area.

b. No more than one CRD boat will be stationed on Beaver Pond, Cragston Lake, and Lake Georgina.

c. No CRD boat will be stationed at Lusk Reservoir.

CHAPTER 5
TRAPPING

5-1. Eligibility

Eligibility priorities are listed in appendix C

Guests are not authorized for those meeting eligibility priorities 1 through 15 in appendix C

5-2. Policy

Trapping is an important tool in wildlife management and it is permitted on the reservation primarily for the removal or control of problem and nuisance animals and, secondarily for recreation

5-3. General Procedures

a.. Individuals who wish to trap on the West Point Military Reservation must make application to CRD for a USMA Trapping Permit by 28 October for that license year's trapping season.

b. West Point trappers must have a USMA trapping permit and a NYS Trapping License.

c. Upon determination that sufficient densities of furbearers exist to permit limited trapping, DHPW will determine the number of trappers needed for each season (not to exceed 15 individual trappers). Trappers will be selected through a lottery.

d. DHPW will assign trappers areas to trap. Authorized trapping areas will be listed on the trapper's permit along with the authorized harvest for each area, sign-out procedures, season restrictions and reporting requirements.

e. All traps will be marked with the owner's name and address. Traps will be checked IAW NYS Conservation Laws. Unmarked or unattended traps may be confiscated by USMA Natural Resources personnel, Military Police Game Wardens, or NYS Environmental Conservation Officers.

f. Beaver and otter trapping areas and harvest must be authorized by DHPW.

g. Legally trapped furbearers must be dispatched immediately after capture. Only .22 caliber firearms may be carried by the trapper to dispatch animals. Non-target animals, such as stray domestic animals or protected wildlife species, must be immediately released at the capture site.

h. Trapping will not be authorized during the Regular Firearms Big Game Season

i. Authority to trap live woodchucks, raccoons, skunks, and opossum on the Main Post may also be granted by DHPW. Animals captured on the Main Post in this program will be dispatched at an off-post location to be determined by the DHPW.

j. All harvested animals will be reported to the Natural Resource Branch, DHPW as stipulated on the trapping permit.

k**. LEG HOLD TRAPS LARGER THAN SIZE 1-1/2 AND SNARES ARE NOT AUTHORIZED FOR USE ON THE RESERVATION.**

(l). Should less than five (5) individuals eligible under paragraph 5-1 (appendix B) of this regulation apply to CRD for a USMA trapping permit, DHPW is authorized to solicit up to five (5) other trappers that do not meet the eligibility requirements set forth in 5-1 to trap problem or nuisance animals. Potential persons will be located through written notice sent to local county trappers organizations. Selection will be made on a first-come/first-serve basis by designating the first five individuals that telephone the Natural Resources Branch at 0001 hours on 11 November. Selected individuals will be sold a USMA trapping permit. All other restrictions and/or guidance provided in this chapter will apply to the selected individuals. Access to the reservation shall be coordinated at all times with Range Control.

5-4. Land Sets

a. Open area land sets will be restricted to box, cage traps (e.g., Havahart, Tomahawk) up to a size 1-1/2 leg-hold trap, and up to a #3 Soft Catch Trap.

b. Body gripping traps (e.g., Conibear or similarly designed lethal body gripping traps) may not be used for any type of open land set.

5-5. Water Sets

a. Submerged body gripping traps with jaw spreads no larger than 10 inches (e.g., Conibear 110 through 330) may be used at designated wetland or open water sites during the mink, muskrat, otter, and beaver open seasons.

b. Enclosed body gripping traps with jaw spreads no larger than 4.5 inches (e.g., Conibear 110, 120 or 126) may be used in cubby or den sets under the following conditions:

(1) The cubby or den sets must be no more than 15 feet from water at the designated wetland or open water sites.

(2) The opening of the cubby or den must be eight inches by eight inches or smaller.

(3) The bait or lure must be hidden well inside the cubby out of sight of predatory or scavenger birds.

(4) The conibear must be placed no less than eight inches from the opening of the cubby or den.

c. No dam, den, or lodge belonging to beaver or muskrat may be disturbed by trappers.

CHAPTER 6
ENFORCEMENT

SECTION I
RESPONSIBILITIES

6-1. Deputy Garrison Commander

Maintain rosters of individuals who have received letters of suspensions, or revocations, or hunting privileges, based on warnings and citations. Copies will be provided to PMO, 1-1 INF, Range Control and CRD who will maintain copies on site. Responds to appeals.

6-2. 1st Battalion/1st Infantry

Provide military police to assist USMA Game Wardens during the hunting and fishing season.

6-3. Range Control

a. Maintain absolute control of access to all training areas, ranges and danger areas no matter what the hunting, fishing or trapping activity.

b. Provide Game Warden to patrol the fishing, hunting, range and danger areas to enforce regulations and report violators to the USMA Provost Marshal.

SECTION II
PROCEDURES

6-4. Warnings

a. Military Police will respond to serious violations of New York law to issue DD Form 1805, United States District Court Violations Notice.

b. Written warnings may be issued for infractions in Appendix D by the Game Wardens and/or Range Control Manager, acting as Chief Game Warden, based on the circumstances contributing to the incident (e.g., fail to sign in because someone removed sign-out sheet).

c. USMA Game Wardens will be the primary enforcement officer to issue warnings for violations of USMA Regulations 215-5. The Game Warden will issue warnings on the Armed Forces Traffic Ticket (DA Form 1408). A copy of the ticket will be provided to the Provost Marshal.

6-5. Citations

a. **Commander, 1st Battalion, 1st Infantry.** Will take administrative action of this regulation. Violations of State and Federal law discovered by Provost Marshal, wardens, range control manager, CRD and or DHPW personnel will be reported to the Provost Marshal, who will cite and coordinate enforcement with State and Federal authorities. USMA Game Wardens will be the primary enforcement officers to apprehend violators of this regulation. Persons apprehended will be turned over to the Provost Marshal and cited on DD Form 1805 for violation of State or Federal law and or given a DA Form 1408 (Armed Forces Traffic Ticket), for violation of this regulation.

b. **Range Control**. Violators of this regulation, and/or Federal fish and wildlife laws apprehended by, or reported to, the Game Wardens will be cited by the Provost Marshal on the violation notice (DD Form 1805). The citation will be forwarded to the Range Control Manager, acting as Chief Game Warden, for administrative action. Violations of State fish and wildlife laws will be referred to the local

NYS Environmental Conservation Officer. In areas of the reservation under exclusive or concurrent federal jurisdiction, violations of State and/or Federal law may be cited by the Provost Marshal on a Violation Notice (DD Form 1805). In areas of the reservation under proprietary jurisdiction, DA Form 1408 may be used. In addition to any criminal prosecution, copies of citations will be forwarded to Range Control Manager, acting as Chief Game Warden, for administrative action.

SECTION III
PROCEDURES FOR SUSPENSIONS AND REVOCATIONS

Violators of this regulation will be notified of suspensions or revocations by a letter from the Range Control Manager acting as the Chief Game Warden.

6-6. USMA Military and Civilian Personnel

The notification of suspension of revocation letter will be sent to their organization or activity if the violator is a cadet, active duty military person, or civilian employee stationed at USMA.

6-7. Other Military and Civilian Personnel

The notification of suspension or revocation will be sent by registered mail (return receipt requested) if the violator is an immediate family member of USMA military personnel, civilian employee, guest, retired military person, military person not stationed at USMA, or from the general public.

SECTION IV
APPEALS

Any individual cited for a violation of this regulation which results in the loss of privileges may appeal the decision providing the appeal is submitted in writing to the Deputy Garrison Commander within 10 working days of the notice of suspension. The DGC will respond to the appeal within 10 working days.

6-8. Failure to Comply with Suspension

Failure to comply with a suspension under this regulation may cause violators to be liable to further actions including proceedings barring personnel from access to the installation.

6-9. Violations Records

The following records will be prepared and maintained by the DGC.

a. A list of individuals who have received a citation or warning for violations of this regulation.

b. A list of individuals whose privileges have been suspended or permanently revoked.

c. The suspension list will be periodically updated and distributed to the Provost Marshal, 1-1 INF Range Control and CRD.

APPENDIX A
REFERENCES

a. Title 16, United States Code, Section 670 et seq., Conservation Programs on Military Installations and Title 18, United States Code, Section 1382, Trespassing.

b. Title 16, United States Code Section 718 et seq., Migratory Bird Hunting Stamp Act.

c. Title 18, United States Code Section 1382, Trespassing.

d. DoD Directive 4700.4, Natural Resource Management Program.

e. AR 37-100, Account/Code Structure.

f. AR 37-108, General Finance and Accounting for Finance and Accounting Office.

g. AR 190-29, Military Police-Misdemeanors and Uniform Violation Notices Referred to US Magistrate of District Courts.

h. AR 215-1, Morale, Welfare and Recreation.

i. AR 200-3, Natural Resources - Land Forest and Wildlife Management.

j. Environmental Conservation Law of New York State.

k. Integrated Natural Resources Management Plan: 1998 through 2002, at the United States Military Academy.

l. USMA Reg. 385-11, Range Regulation.

m. Uniform Code of Military Justice (UCMJ).

APPENDIX B
RULES FOR USMA HUNTERS, TRAPPERS AND ANGLERS

a. Have in their possession a valid New York State license for the activity they are engaged in (small game, turkey, big game firearms/deer management unit/archery big game/ muzzleloader big game, fishing, trapping) and a USMA hunting, fishing, or trapping permit or guest pass. In addition, personnel engaged in waterfowl hunting will possess a Federal Migratory Bird Hunting Stamp (duck stamp).

b. Present on demand their licenses, permits, weapons and game for inspection to any USMA Game Warden, Military Police, NYS Environmental Conservation Officer, or any other duly appointed law enforcement official.

c. Follow all sign-out/sign-in procedures, tagging procedures, and report all harvested fish and game as required by this regulation. Hunters must sign in at Range Control Building #1403 or the Hunt Control Center if they leave their hunting areas. Hunters signed out for hunting must be in their area or in transit to or from their area.

d. Hunters and Fishermen are authorized no more than two guests. Hunters and Fishermen must remain with their guests while hunting or fishing and be no more than 200 yards away.

e. Be permitted to be accompanied by one walker afield while hunting for instructional or learning purposes. The walker must be appropriately dressed, unarmed, and remain within five (5) meters of the hunter. USMA hunters who are already hunting with a junior hunter (a young hunter required to remain with a sponsor) are not eligible to be accompanied by a walker.

f. Report the whereabouts of any unexploded ammunition (dud and misfires) to the Range Officer, USMA Game Warden or Chief, Game Warden.

g. Not trespass into any woodlands bordering the West Point Military Reservation, into the impact areas, dud danger zones, into areas designated off limits or into any other area closed to hunting, fishing, or trapping.

h. Not interfere with any military activities or disturb any training devices.

i. Not discharge longbows or firearms within 500 feet of any occupied USMA dwelling. No weapon shall be discharged so that the path of the load, bullet, or arrow passes over any public highway or within 50 feet of Rt. 9W, Rt. 6, Rt. 293, Rt. 218, Mine Torne Road, Smith Clove Road, or Mineral Springs Road.

j. Not possess firearms in areas designated as "bow only."

k. Not target shoot or sight-in weapons in the hunting areas. Hunters will fire only at game. Free-ranging domestic animals may not be shot by hunters.

l. Not park their vehicles so an established road, firebreak, or gate is blocked.

m. Not consume or be under the influence of any alcoholic beverage and/or other drugs which may impair judgment or activity while hunting, angling, or trapping at West Point.

n. Remove all spent fishing line, bait containers, lure packaging, ammunition boxes and other trash.

o. Hunters and fishermen who check out gate keys from Range Control have three (3) days to check the keys back into Range Control.

APPENDIX C
ELIGIBILITY PRIORITIES

PRIORITY **ELIGIBLE PERSONNEL**

1. Active duty military personnel and their families assigned to the installation or directly supported by it. This includes military personnel assigned to units attached to the installation for logistical support of MWR support who have been identified in the host-tenant agreement. This includes cadets of all service academies who are assigned to West Point and military personnel of foreign nations assigned to USMA and their dependents.

2. Active duty Army personnel and their families not assigned to the installation.

3. Active duty military personnel (and their families) of other services not assigned to the installation.

4. Military personnel retired with pay and their families.

5. Medal of Honor recipients and their widows or widowers and dependents. Honorably discharged veterans of the U.S. Armed Services with 100 percent service-connected disability.

6. Active drilling Military members assigned or attached to the Ready Reserve and National Guard Units.

7. Surviving spouses of military personnel who have not remarried and their dependents.

8. Cadets of Air Force Academy, U.S. Naval Academy midshipmen, officer candidates when in active duty training status, and NROTC midshipmen only when on active duty during college vacation periods. ROTC personnel training during summer seasons.

9. DoD civilian employees (appropriated and non-appropriated fund, contract, and AAFES) and their dependents stationed in Alaska, Hawaii, and all U.S. territories and possessions, and foreign countries, who are authorized unlimited exchange.

10. DoD civilian employees (appropriated and non-appropriated fund, contract, and AAFES) and their dependents who reside on the installation and are authorized unlimited exchange privileges.

11. Military personnel of foreign nations and their dependents when authorized unlimited exchange privileges.

12. Other U.S. personnel which include members of the Coast Guard, National Oceanic and Atmospheric Administration. Environmental Science Service Administration of the U.S. Public Health Service, and paid members of the Red Cross and other such organizations assigned to or serving Armed Forces and dependents of the aforementioned, and cadets of the Coast Guard Academy.

13. Surgeons under contract to the Army.

14. DOD civilian employees (appropriated and non-appropriated fund, contract, and AAFES) employed at West Point. Former Prisoners of War (POW) and their immediate family members.

15. Guests of military personnel, dependents of DoD civilian employees (appropriated and non-appropriated fund, contract, and AAFES) employed at West Point. Retired DoD employees from West Point and their dependents.

APPENDIX C (cont'd)
ELIGIBILITY PRIORITIES

PRIORITY	ELIGIBLE PERSONNEL

16. Immediate family members spouse, son, daughter, or father, mother, brother, sister who are not dependent but are currently residing with their sponsor. Sponsor must be eligible person under conditions of categories 1 thru 7 and 9 thru 14 above.

17. Guest of West Point DoD civilians. Guests may not fish or hunt without their sponsor.

18. Members of the general public other than those covered under 1 to 17 above, holding a valid NYS Department of Environmental Conservation Deer Management Permit for the NYS Deer Management unit that West Point is within.

APPENDIX D
OFFENSES AND AUTHORIZED ADMINISTRATIVE ACTION

a. Violations of this regulation or violations of State and Federal fish and wildlife laws need only be proven by substantial evidence in order to impose USMA administrative actions. Consequently, the USMA administrative actions listed in subparagraphs 6-6 and 6-7 may be taken against personnel whose civil or criminal prosecutions for violations of State and Federal fish and wildlife laws resulted in acquittals if substantial evidence nevertheless exists that the violations occurred.

b. Except in the instances where a written warning had been issued previously for a USMA violation, suspension periods may be reduced or rescheduled upon recommendation of the issuing USMA Game Warden, Chief Game Warden, Military Police person, Hunt Control Officer, or Natural Resources personnel. A violation of the same nature after a written warning has been issued, however, will result in the maximum USMA suspension being imposed.

c. Multiple violations may result in consecutive suspensions.

d. All penalties include hunting and fishing privileges.

e. USMA Regulation Offenses.

Regulation Paragraph(s)	**Offense**	**USMA Admin Action Period of Suspension**
3-5, Appendix B	Parking in unauthorized area	Up to 30 days
2-2,2-4,2-5,3-5, 6-4, Appendix B	Failure to sign in from a hunting area	Up to 30 days
3-5, 3-8, Appendix B	Failure to wear fluorescent orange clothing	Up to 90 days
3-2 , 3-5	Failure to display USMA back-tag or parking permit	Up to 30 days
3-2, 3-4	Construction and/or use of a permanent tree stand	Up to 30 days
1-3, 1-4, 2-2,2-3,2-4, 2-5,3-2,3-3,3-4,3-5, 4-2, 4-3, Appendix B	Hunting or fishing in wrong area	Up to 90 days
1-3,1-11, 6-1, 6-5, 6-8,6-9	Hunting, Fishing or Trapping with USMA privileges suspended	2-5 License years
1-13, 6-5, Appendix A	Loaded firearm in a motor vehicle	2 License years
1-3	Hunting or fishing in a closed area or area filled to capacity	Up to one full license year
1-3, Appendix B	Littering	Up to 60 days
4-8	Boating in an unauthorized area	Remainder of season and 3 license year

Regulation Paragraphs(s)	Offense	USMA Admin Action Period of Suspension
1-3	Failure to report kill (other than turkey, deer, or bear)	Up to 90 days
1-16, 2-2, 3-2	Entering off limits/impact area	Remainder of season and 1-5 license years
5-3, 6-4, 6-5	Trapping in wrong area	30 - 90 days
2-3	Hunting in a waterfowl area without possessing non-toxic, non-lead shot	30 - 60 days
4-4 , 4-5	Possession of fish less than USMA length limits	Up to 90 days
4-4	Exceeding USMA fish possession limits	Up to 90 days
4-8, Appendix F	Failure to have required safety equipment on board boat.	1-30 days
4-8, Appendix F	Failure to comply with USCG and/or Federal Boating Laws regarding lifejacket wear for young children.	1-30 days
4-8	Operation of a motor boat while intoxicated.	120 days to 5 years
4-8, Appendix F	Reckless operation of a motor boat	30 days to 2 years
4-8B, Appendix F	Boating in an off limits or closed lake for training.	14 - 180 days
4-8, Appendix F	Failure to obtain daily boating permit for boats over 10HP.	7 – 180 days
Appendix F	Failure to have permit on file.	30 days
Appendix F	Improper registration.	1 – 18 months
Appendix F	Skier without lifejacket or PFD	7 – 30 days

Regulation Paragraphs	Offense	**USMA Admin Action Period of Suspension**
1-3	Unauthorized target shooting	30-90 days
2-2, 3-4	Failure to accompany junior	60 - 90 days
3-8, Appendix B	Failure to accompany guest while hunting or fishing (guest privileges cease immediately)	60 - 90 days
	Killing a domestic animal	Permanent USMA Admin Action
1-10	Failure to comply with key Procedures.	1-6 months
3-4, 3-5	Failure to accompany junior archer, young small game hunter or beginning firearms big game hunter	Up to 90 days
1-14, 5-3, Appendix B	Hunting/Fishing/Trapping without West Point permit	Remainder of season and up to 5 license years
5-3	Use of a body gripping trap or leg-hold traps in an open land set	Remainder of season and one license year
3-2, 3-6	Hunting without Special Buck Pass	Remainder of season and 2-5 license years
Failure to comply with the requirements stipulated on USMA Trapping Permit.		Remainder of season and one license year.
1-3, Appendix B	Hunting/fishing/trapping under the influence of intoxicants	Remainder of season and 5 license years
1-11,6-5,6-6, 6-7,6-8,6-9	Habitual violators (accumulation of three citations during a 365 day period)	Remainder of season and 1-3 license years
1-3, Appendix B	Failure to comply with a law enforcement official's reasonable and proper order including, but not limited to, orders to produce license or	Remainder of season and 1-3 license years

Regulation Paragraphs(s)	Offense	USMA Admin Action Period of Suspension
	wildlife for inspection, and orders to cease firing, hunting, or trapping.	
4-3	Persons failing to properly sign out of a training area or lake for fishing and obtain a key for access.	6 months suspension of fishing privileges.
4-4, 4-5	Failure to report fish catch	Up to 90 days
Appendix B	Failure to return gate keys in 3 days	Up to one (1) full years Suspension
1	Failure to report deer, bear, or turkey kill	Remainder of season + license year
	Firing weapon within 500 ft from dwelling	Remainder of season + 1 license year
	Firearm hunting in a bow only area	Remainder of season + 3 license years
	Firing at a domestic animal	Remainder of season + 3 license years
	Exceeding trapping quota	1 calendar year
	Use of a cubby dr den set body in excess of 4.5”	30 – 60 days
	Use of a cubby dr den set body in excess of 15’ from water	30 – 60 days
Appendix B 2-2	Failure to properly fill out hunting sheets	Up to 30 days
	Returning later than posted time at Range Control	Up to 90 days

APPENDIX E
NYS ENVIRONMENTAL CONSERVATION LAW OFFENSES

Violations below will also be referred to the local NYS Environmental Conservation Officer.

ECL Paragraph	Offense	Actions Taken By the State of New York
11-0110	Interference with the lawful taking of wildlife	Up to 120 days
11-0705	Failure to carry NYS license or stamp	Up to 90 days
11-0905	Exceeding daily bag limit for small-game	Up to 90 days
11-0911	Failure to transport deer in the prescribed manner	Up to 30 days
11-1101	Use of a trap within 5 feet from a beaver den or house	Up to 60 days
11-1203	Hunting while intoxicated or ability impaired by drugs	Remainder of season and 1 license year
11-1303	Exceeding the daily bag limit for fish; taking fish below the size limit	Up to 90 days
11-1307	Failure to mark tip-ups with name and address	Up to 120 days
11-1913	Failure to tag fish from a fishing preserve	Up to 30 days
11-0503	Use of salt lick	Remainder of season and 5 license years
11-0503	Disturbing a beaver dam, den or house	Remainder of season and 5 license years
11-0931	Loaded weapon in motor vehicle	Remainder of season and 1 license year
11-0931	Discharge of a firearm or bow so that the load or arrow passes over a public highway	Remainder of season and 1 license year
11-0931	Discharge of a firearm or bow within 500 feet of an occupied dwelling, school, or playground	Remainder of season and 1 license year

ECL Paragraph	Offense	Actions Taken By the State of New York
11-0031	Possession of a firearm while bowhunting during the archery season	Remainder of season and 1 license year
11-1321	Use of explosive to take fish	Remainder of season and 1 license year
11-0901	Hunting deer or bear with a shotgun less than 20 gauge	Remainder of season and 1 license year
11-0901	Hunting deer or bear with shotgun shells other than shells carrying a single ball or slug	Remainder of season and 1 license year
11-0901	Hunting deer or bear with aid of a pre-established bait pile	Remainder of season and 5 license years
11-0901	Taking raccoons by cutting den trees	Remainder of season and 1 license year
11-0901	Taking a protected species for which no open season is established or for which the season is closed	Up to 1 license year
11-0901	Taking water fowl or upland game birds with the aid of baiting or over any baited area	Remainder of season and 1 license year
11-0507	Stocking fish without a permit	Remainder of season and 1 license year
11-0901	Hunting from a motor vehicle	Remainder of season and 5 license years
11-0901	Taking wildlife from or on a public highway	Remainder of season and 1 license year
11-0901	Taking wildlife with a crossbow	Remainder of season and 1 license year
11-0901	Hunting deer or bear with the aid of a light	Permanent Revocation

ECL Paragraph	Offense	Actions Taken By the State of New York
11-0901	Hunting deer or bear with a pistol, revolver or rifle using rimfire ammunition	Permanent Revocation
11-0931	Possession of slug or single ball shotgun shells during the deer season by a person without a valid deer permit or license	Remainder of season and 1 license year
11-0901	Failure to wear back tag	Up to 90 days
11-0901	Hunting and/or taking a species outside of an open season, permitted hours, or by permitted methods.	Up to 90 days

APPENDIX F

STANDARD OPERATING PROCEDURES (SOP)
POWER BOATING LAKE STILWELL AND POPOLOPEN LAKE

1. PURPOSE: This SOP sets forth the rules and regulations for the operation of power boats and jet skis on Lake Stilwell and Popolopen Lake.

2. RESPONSIBILITY:

a. Both the Chief, Community Recreation, and Range Control game warden are responsible to make periodic checks to insure compliance with the provisions of this SOP, US Coast Guard (USCG) rules and that New York State Marine Safety requirements are met.

b. DHPW is responsible for repairs and maintenance IAW AR 210-55, AR 420 and USMA Regulations 420-1 and 420-11.

c. DOPS and 1-1 INF Range Control will provide dates of availability to the AG for inclusion in Daily Bulletin.

3. POLICIES AND PROCEDURES:

a. Eligibility: Active duty military personnel assigned to or stationed at West Point and their family members have priority and may obtain boat permits up to 72 hours, and other category of personnel may make reservations on a first-come, first-serve basis.

b. Program will be conducted 1 May through 30 October from 0800 to 2000.

c. Permits are required for power boats 10 horsepower or more and all jet skis. Permits will be issued at the Round Pond Registration Office. Only five permits will be issued at a time for Stilwell Lake and two for Popolopen Lake. Permits are to be returned to Round Pond as soon as individuals are finished. Permits will be issued on a first-come, first served basis. Only one permit will be issued to an individual.

d. All personnel who wish to use Lake Stilwell must have a registration card on file at Round Pond. The registration card will have the following information: Owner's name, address, work and home phone numbers, boat make, color and serial number, and motor make and serial number. Primary tow car for boat.

e. All boats must be properly registered.

f. Safety rules in paragraph 4 below will be followed.

g. Policing (keeping areas clean) rules in paragraph 5 below will be followed.

h. Restrictions: Personnel bringing pets to Popolopen Lake or Lake Stilwell area will not allow them to swim in the lake. Pets should be kept in cars or on a leash.

i. Lake Stilwell is not an authorized beach or swimming area. Water skiers are the exception to this rule.

4. SAFETY RULES:
Individuals desiring the use of Lake Stilwell water for water skiing will be required to comply with the following rules:

a. At least two persons must be in the boat, one driving and one facing the rear of the boat watching the skier(s).

b. Boats will be operated in a counter-clockwise direction around the lake

c. Boat operators will not zigzag or cut across the path of other boats. Operators will operate their craft at a safe distance behind other boats towing skiers (approximately 150 feet minimum). In the event a skier should fall into the water, boats following will use extreme caution going around the fallen skier.

d. All boats will have the necessary safety equipment aboard in compliance with current USCG rules. There shall be one USCG approved life preserver for each person in each boat. This applies to all types of boats authorized on the lakes.

e. All skiers will wear a life preserver (approved USCG design).

5. Policing:

a. Personnel using the area will not deposit litter or waste material in the water. Personnel observing any infractions of the rules outlined above are required to pass particulars on as quickly as possible to the Range Control.

b. Of particular concern is the potential spillage of oil and gasoline mixtures. The presence of hydrocarbon residuals imparts severe tastes and odors to drinking water. If a petroleum spill occurs it must be reported to the West Point Fire Department at 911.

c. Violations of safety rules and their resulting administrative actions are covered in Appendix D.

APPENDIX J

Bald Eagle Management Plan

Endangered Species Management Plan
For the
Bald Eagle (*Haliaeetus leucocephalus*)
On the Properties at the United States Military Academy

US Military Academy
West Point, New York

Prepared by

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Directorate of Housing and Public Works

1 October 2002 - 30 September 2007
DIRECTORATE OF HOUSING AND PUBLIC WORKS

UNITED STATES MILITARY ACADEMY
WEST POINT, NEW YORK

ENDANGERED SPECIES MANAGEMENT PLAN
FOR THE
BALD EAGLE (*Haliaeetus leucophalus*)

UNITED STATES MILITARY ACADEMY
WEST POINT, NEW YORK

October 2002

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Acronyms/Abbreviations

CFR	Code of Federal Regulations
DHPW	Directorate of Housing & Public Works
ESA	Endangered Species Act (16 U.S.C. 1531, *et seq*.)
ESMP	Endangered Species Management Plan
NRB	Natural Resources Branch
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
SOP	Standard Operating Procedure
U.S.C.	United States Code
USFWS	United States Fish & Wildlife Service
USMA	United States Military Academy
WPMR	West Point Military Reservation

MAEN-EV-N (200-3)

MANAGEMENT PLAN FOR BALD EAGLES (*Haliaeetus leucocephalus*) ON THE PROPERTIES OF THE UNITED STATES MILITARY ACADEMY (USMA)

1.0 BACKGROUND

The bald eagle (***Haliaeetus leucocephalus***), our Nation's symbol, is a large bird in the Order Falconiformes, Family Accipitridae (hawk family) with an average wingspan of six to seven feet. It was originally found across the continental United States including Alaska and throughout Canada south to the Gulf Coast and Baja California, Mexico. Bald eagle numbers declined across North America due to habitat loss or alteration, shootings, and the widespread use pesticides such as DDT in the 1950s and 1960s. Eagles accumulated pesticides in their systems through the food chain, which led to fertility problems and thin eggshells that would break when an eagle incubated its eggs (NYSDEC, 1993a).

The Federal Government first listed the southern bald eagle as an endangered species under the Endangered Species Preservation Act of 1966 on March 11, 1967. All bald eagles in the lower 48 states were listed as ***endangered*** under the Endangered Species Act of 1973 (ESA) (codified in Title 16, U.S.C. Part 1531, et seq.) in 1978, except in Michigan, Minnesota, Wisconsin, Oregon and Washington where it was listed as ***threatened***. On July 12, 1995, the eagle's status was downgraded to ***threatened*** throughout most of the continental United States. On July 6, 1999, the USFWS proposed to de-list the bald eagle, declaring the species "recovered". At present, this proposed change has not been finalized in order to address concerns raised by bald eagle researchers who believe the proposed de-listing is premature due to concerns about habitat protection.

New York State listed the bald eagle as ***endangered*** on March 30, 1971 under the Environmental Conservation Law (Section 11-0535) and accompanying regulations (Title 6 NYCRR Part 182). On December 4, 1999, New York downgraded the bald eagle's status to ***threatened***.

The bald eagle is also protected under the Bald and Golden Eagle Protection Act (Title 16, U.S.C. Parts 668a-668d) and its implementing regulations (Title 50 CFR Chap. 1, Subchapter B, Parts 13, 17, and 22).

Army Regulation 200-3, Natural Resources – Land, Forest, and Wildlife Management, directs installations to develop and implement an Endangered Species Management Plan (ESMP) for any listed or proposed species protected under the ESA that reside on installation properties.

2.0 STATUS AT USMA

2.1 SETTING AND HISTORY

Lands under the management authority of USMA include the West Point Military Reservation (WPMR), (ca. 16,000 acres) and Constitution Island (178 acres). These lands are located in Orange and Putnam Counties, New York in the Townships of Highlands, Woodbury, Cornwall and Phillipstown. The USMA has three miles of shoreline along the west bank of the Hudson River at river miles 51 to 54, which includes the river bottom out to the middle of the river.

Historically, bald eagles have been residents and visitors to the lands of the USMA. One of the last active bald eagle nests in the lower Hudson River valley was on West Point lands in the Popolopen Creek gorge area, last used in the 1880s (Bull, 1985). In 1878, Edgar Mearns¸ a noted naturalist of the Hudson

Highlands and a U.S. Army Surgeon stationed at USMA, reported as many as 25 bald eagles in the Cornwall Bay area just north of West Point (Bull, 1985). In a 1906 essay, William Thomas Howell describes his first encounter with a pair of bald eagles on the south peak of Crows Nest Mountain in 1891, continuing to see the birds there over the next 15 years (Howell, W. T., pp. 12-13, Vol. 2 *in* Walking News, Inc., 1982). Howell judged by the birds' behavior that there must be young eagles nearby, perhaps on the Crows Nest cliffs (Howell, W. T., pp. 12-13, Vol. 2 *in* Walking News, Inc. 1982).

The Palisades Interstate Park Commission had designated Iona Island – located just south of the Bear Mountain Bridge south of West Point – as a bald eagle winter sanctuary in 1983 (Nye et al, 1994). This was based on the concentration of eagles that were observed on the island during winter months.

The Biological Survey Unit of the New York State Museum conducted a survey of USMA properties for threatened and endangered species in 1991 and 1992. A report of their findings was received by USMA 7 October 1993. The report states that the bald eagle is considered a winter resident in the lower Hudson River valley (Biological Survey, 1993). All eagles encountered on USMA properties should be considered visitors from this winter population (Biological Survey, 1993).

The USMA Natural Resources Branch has recorded reported sightings of bald eagles on the WPMR and Constitution Island during all months of the year. During the 1990s, eagle sightings on USMA properties increased in numbers and frequency. Constitution Island was the USMA location that had the most sightings, with other bald eagle sightings at Brooks Hollow, Stilwell Lake, along Popolopen Brook, Long Pond, Popolopen Lake, lower Cragston Lake, along the Crown Ridge & Long Mountain and on the Main Academy grounds (Figure 1). Since January 1992, the greatest number of bald eagles seen on USMA properties at once was nine on Constitution Island & nearby ice floes (2000-01 winter) and seven on the WPMR on a different occasion.

2.2 ECOLOGY & HABITAT

Bald eagles in Southeastern New York prefer nesting locations near large water bodies that are relatively undisturbed by human activities (P. Nye, personal communication). A bald eagle pair often prefers to place its nest in a large, super-canopy, white pine tree that has several large branches and is near a large water body. The location in the tree must also have at least 270º visibility. There are very few suitable nesting trees such as these near any water bodies on the WPMR. The pine trees found on Constitution Island are also short on height and large branches. However, surveys by NYSDEC over the last 15 years have altered the perception as to where and in what types of trees bald eagles will set up their nests in New York State (P. Nye, personal communication). Mr. Peter Nye, Unit Leader for the New York State's Department of Environmental Conservation's (NYSDEC) Endangered Species Unit, reports finding eagle nests in a wide variety of other tree species (P. Nye, personal communication). He also reports usage of trees with atypical eagle-nest-site characteristics, including dead snags, deciduous trees (some as low as 55' high) and trees located considerable distances from water's edge (some up-slope) or close to human habitation (P. Nye, personal communication).

There is human activity near some potentially suitable trees on Constitution Island during the spring and summer (visitors to the historic Warner house and Revolutionary War sites on the south side of the island), plus, a USMA caretaker lives year-round on the island. On the WPMR, intense levels human activity start around 1 April as USMA staff prepare Camps Buckner and Natural Bridge (located next to Popolopen Lake) for summer training. The firing of weapons firing, including mortars, howitzers, and grenades, occurs from May through July and is directed into the dud-danger impact area adjacent to Cranberry Pond and Stilwell Lake. Due to the intense human activity levels associated with military

training that occurs on the WPMR from May through August, it is unlikely that bald eagles will ever choose to nest around most of the lakes on the WPMR.

Bald eagles are known to sometimes place their nests on cliffs overlooking water bodies (Anderle and Carroll, 1988). Crows Nest Mountain in the northeast portion of WPMR has these characteristics and, given its off-limits-to-personnel status, may be a suitable nesting location (Figure 1). The reports by William Thomas Howell in the early 1900s certainly suggest that possibility (Howell, W. T. *in* Walking News, Inc. 1982).

Winter is a critical time for bald eagle survival in Southeastern New York (NYSDEC, 1993b). Energy conservation is of primary importance to bald eagles in the winter in order to maintain thermoregulation and body metabolism. Undisturbed daytime resting sites near open water & abundant food sources and undisturbed nighttime roosts are critical elements for bald eagle wintering areas.

Mr. Peter Nye has stated that, based on recent mid-winter aerial surveys, between 30 and 90 individual eagles likely winter in the lower Hudson River Valley. However, Iona Island was found to not be a winter roost site for wintering Hudson Valley eagles (Nye et al, 1994). The NYSDEC believes it is important to identify winter roost sites in the lower Hudson River Valley.

Mr. Nye has stated that no areas on USMA properties would be considered as ***"critical habitat"*** as defined under the Endangered Species Act of 1973 (P. Nye, personal communication).

2.3 RECENT SURVEYS

In January 1996, the USMA and NYSDEC initiated a joint two-year survey of wintering bald eagles in the lower Hudson River valley and its vicinity (McGowan and Nye, 1996). The study had five specific objectives: (1) document bald eagle distribution from November to March through systematic surveys; (2) live-trap bald eagles for telemetric monitoring; (3) identify critical habitat including concentration areas, day perches, foraging areas, and night roosts; (4) document bald eagle use of the WPMR and its vicinity; and, (5) document bald eagle feeding habits through direct observations and analysis of prey remains found below perches (McGowan and Nye, 1996).

Results from the 1996-97 study revealed that Constitution Island is an important day-use area for bald eagles in the lower Hudson River valley. Several trees were identified along the island's south shore as important daytime perch sites. No winter nighttime roosts were identified on USMA properties at that time, but six nighttime roosts were confirmed both upstream and downriver of USMA (all within 15 miles), with two other probable roosts also identified. It was not possible to identify which roosts the bald eagles seen on USMA properties utilize. However, based on observations of bald eagles at dusk, it is likely that birds are using roosts both north and south of USMA.

Because no eagles had been captured for telemetry studies (one near-miss) during the two-year-study period, USMA and NYSDEC extended the study period for one more year. Assistance was also provided by National Audubon Society staff from the Constitution Marsh Sanctuary adjacent to Constitution Island.

Four bald eagles (three adult females and one immature male) were subsequently captured on Constitution Island during the winter of 1997-98. The three adult females were outfitted with satellite

transmitters while the immature male was outfitted with a three-year radio transmitter. Besides the satellite transmitters, each female eagle was also outfitted with a radio transmitter that was attached to a central tail feather. The transmitter would be lost when a bird molted its flight feathers the following summer. Each bird was designated with an identification number sequentially from date of capture: F42, F43, F44 and F45 (the immature male).

Eagle F42 was captured on 16 December 1997. Following her outfitting with leg bands, a patagial wing tag, a satellite transmitter and a radio transmitter, she was released and her movements primarily monitored via satellite data (note: satellite transmitters only transmit a signal for eight hours and then turn off for 56 hours before turning back on again). Several attempts were also made to locate her via the radio transmitter signal.

F42 was only confirmed one more time on USMA property during the operation of the two transmitters. On 6 February 1998 at 0847 hours, F42's location was fixed at one kilometer due north of Cranberry Pond (Figure 2). Both satellite data and radio data also confirmed that she had used at least four separate night roosts during the 1997-98 winter. She began her return to her nesting grounds in the Labrador region of Eastern Canada on or about 25 March 1998. She returned to the lower Hudson River valley on or about 25 December 1998 (based on satellite data) and her transmitter stopped working on or about 28 December 1998.

Eagle F43 was captured on 2 March 1998 during her spring migration north to her nesting location at Lake Oromocto, New Brunswick, Canada (confirmed with the satellite telemetry data). Her satellite transmitter contained a battery with a three-year lifespan and provided useful data until around 1 May 2001.

Of 80 satellite telemetry data points recorded while F43 was wintering in the lower Hudson River Valley from 1998-2001, 20 points were located on or within 1,000 feet of USMA properties (Figure 3). Nine of the 20 points were recorded between the hours of local sunset and local sunrise, indicating the presence of a previously unknown nighttime winter roost site on USMA property. This roost area is located in the vicinity of the Morgan Farm /West Point Stables in the Cragston Creek drainage (Figure 3). Eagle F43 did not use just one tree or general location in this roost area, which indicates that the area as a whole has some importance to wintering eagles. For F43, this site provided an easy staging point for visits to a preferred daytime perch site on Con Hook island (see Figure 3), adjacent to the Town of Highlands wastewater treatment facility. F43 was visually confirmed using Con Hook several times in the past three years, both by NRB personnel and volunteer observers.

Because of the night roost data collected, NRB conducted additional surveys of the Crown Ridge/ Cragston Lakes area during the winter of 2000-01 and the 2001-02 winter (see item below). Additionally, one of the satellite data points involved a potential Crows Nest night roost. The NRB plans to look at this area in greater detail.

Eagle F44 was captured on 10 March 1998. She remained in the lower Hudson River Valley following her release until around 5 April 1998 when she began migrating back to her nesting territory in northern Quebec, Canada. She returned to the Hudson River Valley on or about 15 December 1998 and stayed until about 5 April 1999. The satellite transmitter stopped working some time in May of 1999.

Of the 61 satellite data points recorded in the lower Hudson River Valley for F44, seven points were located on or within 1,000 feet of USMA properties (Figure 4). Two of the nine points were recorded between local sunset and local sunrise. This indicates that another nighttime roost may be located on the

section of the WPMR located west of Popolopen Lake. The NRB will be looking at this in greater detail over the next five years.

Eagle F45 – a one-year old male – was captured on 17 March 1998, outfitted with a backpack radio transmitter with a 3-year battery, and released the following day. Several attempts were made by NRB staff to try and locate the bird during the next ten months with no success.
In the winter of 1999-2000, technicians working for NYSDEC in the Delaware River Valley/Mongaup River Bald Eagle Wintering Area reported detecting F45's radio signal several times between 23 December 1999 and 18 January 2000. This is significant for two reasons. First, when F45 was captured, he was missing his right foot, due to a past injury. The signals revealed that he had survived another full year despite his handicap. Second, this lends credence to the observation that eagles sometimes divide time between the two wintering areas, depending on weather conditions and winter severity. Mid-winter surveys of bald eagle wintering areas by NYSDEC have shown proportional shifts in eagle numbers between the two areas (lower Hudson & Delaware/Mongaup), with Hudson eagle numbers higher and Delaware/Mongaup numbers lower when winter conditions are colder with more ice & snow cover (P. Nye, personal communication). During cold, snowy winters, more bald eagles should be expected to utilize USMA properties.

2.3.1 NIGHT ROOST SURVEYS

As a result of the discovery of the Crown Ridge winter night roost from satellite telemetry data, the NRB instituted a weekly survey of the roost during the winter of 2000-01. The survey would seek to determine bald eagle usage levels and, if possible, identify preferred roosting trees/locations. Some surveys were conducted in late afternoon to sunset looking for birds returning to the roost and some surveys were conducted in the pre-dawn to mid- morning hours trying to observe birds leaving the roost.

During the winter of 2000-01 (Jan.-Mar.), NRB personnel surveyed the Crown Ridge roost on 12 separate dates. On seven of those dates, bald eagles were observed entering or departing from the general area of the roost. The number of eagles observed ranged from one to seven, involving both adults and immature bald eagles. On only one date was an eagle observed actually perched in a tree in the general roost location. The topography & environmental conditions at the observation location used make observation of bald eagles entering and leaving the area very difficult. Nevertheless, based on this limited data, it would appear that the Crown Ridge vicinity is utilized by modest numbers of bald eagles as a winter nighttime roost under normal climate conditions.

NRB hired a contractor to survey the Crown Ridge roost during the winter of 2001-02 and a final report was received by NRB on 3 July 2002. The contractor reported seeing four bald eagles (two adults and two immatures) but none were observed flying into or departing from a night roost (Patsch, 2002).

The mild winter weather of 2001-02 was undoubtedly a factor in no observed roosting activity as anecdotal evidence from other observers in the lower Hudson River valley suggests that bald eagle numbers are down by 67% (Patch 2002). Additionally, NYSDEC (P. Nye, personal communication) reported a similar drop in bald eagle sightings during its annual mid-winter survey of wintering bald eagle populations (22 bald eagles seen during the Jan. 2002 survey in the Hudson River Valley compared to 87 bald eagles observed during the Jan. 2001 survey). Birds may not have migrated as far south as the lower Hudson River or they may be scattered inland from the river, visiting many of the lakes within the Hudson Highlands or the Delaware River/Mongaup River wintering area.

During the winter of 2001-02, NRB personnel discovered that the southern end of Long Mountain, located in Training Area X is also utilized by up to four bald eagles as a winter nighttime roost. Given that the 2001-02 winter was particularly mild, additional surveys will be conducted in the future to determine the full extent that the site is used by bald eagles as a winter nighttime roost site.

3.0 SPECIES EFFECTS ON TRAINING

The mission of the USMA is to educate, train, and inspire the Corps of Cadets so that each graduate is a commissioned leader of character. This mission ensures that each graduate is committed to the values of duty, honor, country, and professional growth throughout a career as an officer in the United States Army, and a lifetime of selfless service to the nation. Military training on West Point is primarily concentrated during the time period of mid-May to mid-August (USMA Regulation 385-11, June 1998). This is when Cadet Basic Training and Cadet Field Training occur. Cadets are instructed in individual soldier skills and small-unit operations during this time. Weapons training is conducted at designated range areas only, with all firing directed into the ca. 2,000-acre off-limits, dud-danger area. All of this training, and that conducted at other times of the year, involving cadets or other military units, occurs in designated training areas that are inland from the Hudson River. As a result, normal winter eagle presence has no effect on the military training.

The only training affected by wintering eagles is helicopter-training flights over the Reservation, which is conducted by the 2nd Aviation Detachment stationed at Stewart International Airport in Newburgh, NY. Helicopters flying too close to roosting/resting eagles could cause the eagles to fly and unnecessarily expend energy reserves.

Telephone conversations in 1993 with Mr. Peter Nye, NYSDEC and Mr. Tom McCartney, Endangered Species Biologist with USFWS at the Cortland, NY office (in informal consultation) resulted in a minor modification to helicopter training from 1 December through 31 March. Pilots are instructed not to fly over the WPMR and Constitution Island at an elevation below 1000 feet and to avoid the portion of the WPMR west of Mine Torne Road and south of NY Route 293. If an eagle is sighted, pilots are instructed to leave the immediate area and not to disturb, chase, or otherwise cause the eagle to fly. All eagle sightings are to be reported to the NRB as soon as possible.

This procedure is formalized in a memorandum that is sent to the 2nd Aviation Detachment Commander each November. A copy of this memorandum is at Exhibit B.

4.0 MANAGEMENT PLANS AND GOALS

People, both visitors and those who work and/or live at West Point, enjoy seeing bald eagles in the area. However, the primary mission of the USMA is to educate & train the Corps of Cadets as officers in the United States Army. As such, any actions taken to protect or enhance eagle populations at USMA must be planned to avoid conflict with mission activities while meeting requirements of ESA.

Three suitable winter night roosts have been identified on the WPMR – one along the Crown Ridge, one west of Popolopen Lake and one at the southern end of Long Mountain near the West Point boundary. Important winter daytime perches have been identified on Constitution Island and Crows Nest Mountain has also been identified as an area of moderate winter eagle usage. Suitable nesting habitat is limited on WPMR, but is available on Constitution Island and Crows Nest.

4.1 Goals: For the next five (5) years: (1) ensure that bald eagles wintering in the lower Hudson River valley can continue to visit and use the WPMR and Constitution Island; (2) ensure that helicopter training flights do not disturb eagles during the winter months; (3) assist NYSDEC and USFWS in gathering biological and ecological information on the bald eagle population in the lower Hudson River Valley; (4) provide an opportunity for the West Point community and the general public to view bald eagles at West Point; (5) protect winter daytime perch trees on Constitution Island from disturbances; (6) protect identified nighttime roosts on USMA properties from disturbance; (7) monitor Crows Nest, Long Mountain and Constitution Island during February and March of each year for possible bald eagle nesting activity; and (8) follow-up on any breeding season sightings of adult bald eagles, determine if nesting, and take appropriate actions to allow for successful nesting.

4.2 Management Actions:

1. From 1 December to 31 March, survey Constitution Island and likely areas of the WPMR for bald eagle day usage. The survey will be conducted once per week with the following information recorded: number of eagles seen; ages of eagles seen (adult vs. immature); location of sightings; and, activity eagles engaged in when sighted. Monitor identified and likely winter nighttime roosts for activity at least two days/week. Develop and execute contract to monitor the Crown Ridge roost for activity, dependent on contractor & funding availability.

2. The USMA Caretaker assigned to Constitution Island will be notified of the location of the winter daytime perch trees so that maintenance activities do not disturb or harm them. The Caretaker will also be provided data sheets and solicited for all bald eagle sightings on the island at all times of the year. Should it be found that bald eagles have commenced nesting on the island, all human activity within 200 meters of the nest site will be prohibited and USMA will initiate formal consultation with USFWS and NYSDEC to determine what other actions are necessary.

3. Notices will be placed on the Post e-mail bulletin boards, in the **Post Bulletin** and in the Post newspaper **The Pointer View**, soliciting all eagle sightings by any member of the West Point community. Said notices will be placed in November and April.

4. Memorandum will be sent to the Commander, 2nd Aviation Detachment NLT 15 November regarding restrictions on helicopter flights over WPMR and Constitution Island between 1 December and 31 March.

5. Develop an information sheet or card for helicopter pilots in the 2nd Aviation Detachment so that they can properly identify bald eagles (both adults and subadults) from other birds of prey.

6. Review all USMA construction projects and other proposed Federal activities at the USMA for potential impacts to bald eagles. If no potential beneficial or adverse impacts to bald eagles are likely to exist as a result of the project or activity, then initiate informal consultation with USFWS in accordance with Section 7 of ESA to clarify the USMA's position. If beneficial or adverse impacts may exist should the USMA action be taken, then initiate formal consultation with USFWS in accordance with Section 7 of ESA. Once bald eagles are de-listed by the federal government, consultations on behalf of bald eagles will still occur with NYSDEC.

7. Review, update and modify (if necessary) this ESMP each year based on information obtained from the monitoring program in (1), (2), and (3) above.

4.3 Annual Costs To Implement: 260 man-hours (GS-5 technician) for monitoring wintering eagles; 20 man-hours (GS-11 biologist) to draft and send notices soliciting information on eagle sightings, analyze any new data gathered on bald eagles at the USMA, review ESMP and communicate with USFWS and NYSDEC personnel regarding bald eagle populations in the lower Hudson River Valley; $5-10K for contract personnel for capture/monitoring efforts (dependent on requirement needs). Total government man-hours/year: 280. Additional funds required per year: $5-10K.

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Exhibit A

Individuals and Organizations Contributing to the Plan

1.0 USMA ESMP Team

James A. Beemer, Fishery & Wildlife Biologist, NRB
Joseph L. Deschenes, Chief, NRB

2.0 Individuals Contacted

Name	Affiliation and Address	Telephone
Peter Nye Unit Leader	NYSDEC Endangered Species Unit 625 Broadway Albany, NY 12233	(518) 402-8859
Mark Clough Endangered Species Biologist	USFWS New York Ecological Services Office 3817 Luker Road Cortland, NY 13045	(607) 753-9334
Michael Stoll Endangered Species Biologist	USFWS New York Ecological Services Office 3817 Luker Road Cortland, NY 13045	(607) 753-9334
Dave Linck USMA Coordinator	USFWS Lake Champlain Fish & Wildlife Resources Office 11 Lincoln Street Essex Junction, VT 05452	(802) 951-6313

Exhibit B.

Annual Memorandum sent to Commander, Second Aviation Detachment regarding winter restrictions on winter helicopter flights over WPMR and Constitution Island.

MAEN-EV-N (200-3)

MEMORANDUM FOR: DOPS

SUBJECT: Bald Eagles at the West Point Military Reservation and Constitution Island

1. Bald eagles, our Nation's symbol, are listed as protected species by both the Federal and New York State Governments. Federal Law prohibits activities that harm or disturb eagles.

2. Each winter, bald eagles congregate in the lower Hudson River Valley. During the day, several of these birds will fly to the waters of the West Point Reservation south and west of Mine Torne Road (Mine Lake, Stilwell Lake, Weyants Pond, Popolopen Brook, Brooks Hollow), Popolopen Lake, Long Pond, and to Constitution Island to rest in the trees surrounding those waters. These eagles may or may not feed on any animals or fish they find at West Point. Because winter is a critical time of year for bald eagles, any activity that disturbs them from a resting site should be avoided.

3. Request that when conducting helicopter flights over the Reservation from 1 December through 31 March that flights over the section southwest of Mine Torne Road be no less than 1000 feet above ground level. If an eagle is sighted during a flight, do not attempt to get closer to the bird but rather leave the vicinity as quickly as possible. Flights over Constitution Island and the Hudson River should also be no lower than 1000 feet above ground level. All eagle sightings must be reported within 72 hours to the Natural Resources Branch, DHPW at 938-3857, email: yj6936@exmail.usma.army.mil (date, time of sighting, coordinates, and number of eagles seen).

4. Your assistance in watching out for and protecting our Nation's symbol is deeply appreciated. If you have any questions, do not hesitate to contact James Beemer, USMA Fish & Wildlife Biologist, at the extension above.

Colonel, EN
Engineer

6.0 Checklist For Monitoring Compliance With The ESMP For Bald Eagles On The Properties Of USMA, West Point, NY

Schedule	Activity	IMPLEMENTED	
		Date	Signature
1 October 2002 to 30 September, 2003	Review all proposed construction projects for potential impacts on bald eagles.		
November, 2002	Send Memorandum to Commander, 2nd Aviation Detachment regarding helicopter flight restrictions from 1 Dec. through 31 March.		
November, 2002 & April 2003	Place notices in **The Pointer View,** on the Post e-mail bulletin boards, and in the Post Bulletin soliciting eagle sightings from the West Point community.		
1 December 2002 through 31 March 2003	Survey WPMR and Constitution Island once/week for bald eagles. Record all sightings in a computer database.		
15 December 2002 through 31 March 2003	Survey weekly the Crown Ridge, the western shore of Popolopen Lake, Long Mountain and Crows Nest Mountain for eagle night roost activity. Record all sightings in a computer database. Develop and execute contract to monitor Crown Ridge roosting activity if funding and suitable contractor are available		
Summer, 2003	Consult with USFWS and NYSDEC to ascertain current status of the bald eagle.		
Summer, 2003	Consult with NYSDEC to determine what monitoring/ capture goals have been set for the coming winter months. If capture of bald eagles is planned, solicit a qualified individual for contract hire to provide assistance at the feeding station/capture location.		
August, 2003	Review, update, and modify plan (if necessary) based on findings for the past year.		
August, 2003	Report to Garrison Commander on effectiveness of ESMP.		

CHECKLIST (continued), page 2

Schedule	Activity	IMPLEMENTED	
		Date	Signature
1 October 2003 to 30 September, 2004	Review all proposed projects for potential impacts on bald eagles.		
November, 2003	Send Memorandum to Commander, 2nd Aviation Detachment regarding helicopter flight restrictions from 1 Dec. through 31 March		
November, 2003 & April, 2004	Place notices in **The Pointer View,** on the Post e-mail bulletin boards, and in the Post Bulletin soliciting eagle sightings from the West Point community.		
15 December 2003 through 31 March 2004	Survey WPMR and Constitution Island once/week for bald eagles. Record all sightings in a computer database.		
15 December 2002 through 31 March 2003	Survey weekly the Crown Ridge, the western shore of Popolopen Lake, Long Mountain and Crows Nest Mountain for eagle night roost activity. Record all sightings in a computer database. Develop and execute contract to monitor Crown Ridge roosting activity if funding and suitable contractor are available		
Summer, 2004	Consult with USFWS and NYSDEC to ascertain current status of the bald eagle.		
Summer, 2004	Consult with NYSDEC to determine what monitoring/ capture goals have been set for the coming winter months. If capture of bald eagles is planned, solicit a qualified individual for contract hire to provide assistance at the feeding station/capture location.		
August, 2004	Review, update, and modify plan (if necessary) based on findings for the past year.		
August, 2004	Report to Garrison Commander on effectiveness of ESMP.		

CHECKLIST (continued), page 3

Schedule	Activity	IMPLEMENTED	
		Date	Signature
1 October 2004 to 30 September, 2005	Review all proposed projects for potential impacts on bald eagles.		
November, 2004	Send Memorandum to Commander, 2nd Aviation Detachment regarding helicopter flight restrictions from 1 Dec. through 31 March		
November, 2004 & April 2005	Place notices in **The Pointer View,** on the Post e-mail bulletin boards, and in the Post Bulletin soliciting eagle sightings from the West Point community.		
1 December 2004 through 31 March 2005	Survey WPMR and Constitution Island once/week for bald eagles. Record all sightings in a computer database.		
15 December 2002 through 31 March 2003	Survey weekly the Crown Ridge, the western shore of Popolopen Lake, Long Mountain and Crows Nest Mountain for eagle night roost activity. Record all sightings in a computer database. Develop and execute contract to monitor Crown Ridge roosting activity if funding and suitable contractor are available		
Summer, 2005	Consult with USFWS and NYSDEC to ascertain current status of the bald eagle.		
Summer, 2005	Consult with NYSDEC to determine what monitoring/ capture goals have been set for the coming winter months. If capture of bald eagles is planned, solicit a qualified individual for contract hire to provide assistance at the feeding station/capture location.		
August, 2005	Review, update, and modify plan (if necessary) based on findings for the past year.		
August, 2005	Report to Garrison Commander on effectiveness of ESMP.		

CHECKLIST (continued), page 4

Schedule	Activity	IMPLEMENTED	
		Date	Signature
1 October 2005 to 30 September, 2006	Review all proposed projects for potential impacts on bald eagles.		
November, 2005	Send Memorandum to Commander, 2nd Aviation Detachment regarding helicopter flight restrictions from 1 Dec. through 31 March		
November, 2005 & April, 2006	Place notices in **The Pointer View,** on the Post e-mail bulletin boards, and in the Post Bulletin soliciting eagle sightings from the West Point community.		
1 December 2005 through 31 March 2006	Survey WPMR and Constitution Island once/week for bald eagles. Record all sightings in a computer database.		
15 December 2002 through 31 March 2003	Survey weekly the Crown Ridge, the western shore of Popolopen Lake, Long Mountain and Crows Nest Mountain for eagle night roost activity. Record all sightings in a computer database. Develop and execute contract to monitor Crown Ridge roosting activity if funding and suitable contractor are available		
Summer, 2006	Consult with USFWS and NYSDEC to ascertain current status of the bald eagle.		
Summer, 2006	Consult with NYSDEC to determine what monitoring/ capture goals have been set for the coming winter months. If capture of bald eagles is planned, solicit a qualified individual for contract hire to provide assistance at the feeding station/capture location.		
August, 2006	Review, update, and modify plan (if necessary) based on findings for the past year.		
August, 2006	Report to Garrison Commander on effectiveness of ESMP.		

CHECKLIST (continued), page 5

Schedule	Activity	IMPLEMENTED	
		Date	Signature
1 October 2006 to 30 September, 2007	Review all proposed projects for potential impacts on bald eagles.		
November, 2006	Send Memorandum to Commander, 2nd Aviation Detachment regarding helicopter flight restrictions from 1 Dec. through 31 March		
November, 2006 & April, 2007	Place notices in **The Pointer View,** on the Post e-mail bulletin boards, and in the Post Bulletin soliciting eagle sightings from the West Point community.		
1 December 2006 through 31 March 2007	Survey WPMR and Constitution Island once/week for bald eagles. Record all sightings in a computer database.		
15 December 2002 through 31 March 2003	Survey weekly the Crown Ridge, the western shore of Popolopen Lake, Long Mountain and Crows Nest Mountain for eagle night roost activity. Record all sightings in a computer database. Develop and execute contract to monitor Crown Ridge roosting activity if funding and suitable contractor are available		
Summer, 2007	Consult with USFWS and NYSDEC to ascertain current status of the bald eagle.		
Summer, 2007	Consult with NYSDEC to determine what monitoring/ capture goals have been set for the coming winter months. If capture of bald eagles is planned, solicit a qualified individual for contract hire to provide assistance at the feeding station/capture location.		
August, 2007	Review, update, and modify plan (if necessary) based on findings for the past year.		
August, 2007	Report to Garrison Commander on effectiveness of ESMP.		

APPENDIX K

Shortnose Sturgeon Management Plan

Endangered Species Management Plan
for the
Shortnose Sturgeon (*Acipenser brevirostrum*)

US Military Academy at West Point
West Point, New York

prepared by

James A. Beemer
Fishery & Wildlife Biologist
Natural Resources Branch
Directorate of Housing and Public Works

1 October 1998 - 30 September 2003

Signature Page

Approving Official:

_____ _____

Supertintendent **Date**

Reviewed By:

_____ _____

Garrison Commander **Date**

_____ _____

Staff Judge Advocate **Date**

_____ _____

Engineer **Date**

_____ _____

Chief, Environmental Management Div. **Date**

Acronyms/Abbreviations

NYSDEC	New York State Department of Environmental Conservation
NMFS	National Marine Fisheries Service
NYSDS	New York State Department of State
USMA	United States Military Academy
ESMP	Endangered Species Management Plan

MAEN-EV-N (200-3)

MANAGEMENT PLAN FOR THE SHORTNOSE STURGEON (*Acipenser brevirostrum*) ON THE PROPERTIES OF THE UNITED STATES MILITARY ACADEMY

1.0 BACKGROUND

The shortnose sturgeon (***Acipenser brevirostrum***) is the smallest member of the genus **Acipenser** in North America (Smith. 1985). Shortnose sturgeon were originally found along the Atlantic Coast from the Saint John River in New Brunswick, Canada to the St. Johns River in Florida. In the northern part of their range, shortnose sturgeon tend to spend most of their lives in the tidal estuaries, moving up and down the rivers with changes in water temperature (K. Hattala, NYSDEC. personal communication). Shortnose sturgeon are more frequent inhabitants of the marine environment in the southern part of their range (K. Hattala, NYSDEC. personal communication).

Extensive fishing pressure and water pollution in the 1800's and 1900's resulted in declining population size and degradation of shortnose sturgeon habitat (NYSDS and The Nature Conservancy. 1990). Construction of dams on several rivers also prevented the sturgeon from reaching spawning grounds (Bouton. 1994). There was also a commercial fishery for sturgeon in New York, although the shortnose sturgeon was not harvested as intensely as the Atlantic and lake sturgeon (Smith. 1985).

The shortnose sturgeon is a long-lived (longevity 30+ years) species and reaches sexual maturity at 10 to 15 years of age, depending on sex. They are believed to spawn at intervals of three to five years (Smith. 1985). The stress on spawning sturgeon caused by pollution and dams was not evident until the mid- to late 1900's when serious population declines were first documented (Smith. 1985). The U.S. government took action to stop these declines by listing shortnose sturgeon as an endangered species (Federal Register. 1967). New York State provided additional legal protection when it designated the shortnose sturgeon **"endangered"** under its Environmental Conservation Law and accompanying regulations on March 30, 1971.

Current research indicates that the shortnose sturgeon adult population has increased since the 1970's (Bain et al. 1995). Population estimates range between 18,900 to 79,900 adult shortnose sturgeon in the Hudson River, considerably more than Bill Dovel's estimate of 13,000 adult fish in the 1970's (Bain et al, 1995). The current estimate of spawning shortnose sturgeon in the Hudson River is 38,000 fish (Bain et al. 1995).

2.0 STATUS AT USMA

Within New York waters, the shortnose sturgeon occurs in the Hudson River in New York (Dovel et al. 1992; Smith, 1985; Bouton, 1994). The U.S. Military Academy (USMA) has properties along both sides of the river, located at river miles 51 - 54. The West Point Military Reservation has three miles of shoreline along the west bank and Constitution Island has 1.5 miles of shoreline along the east side of the Hudson River. USMA also has riparian rights to the river bottom from its shorelines outward to the middle of the river.

The section of the Hudson River by West Point is not a known spawning location for shortnose sturgeon nor has it been identified as an important wintering area. Mark Bain of the New York Cooperative Fish and Wildlife Research Unit at Cornell University believes that the only likely sturgeon activity in West Point waters would be individuals moving to and from the

Haverstraw Bay wintering area. Activity occurs near West Point during April-May and October-November (M. Bain, personal comm.). Shortnose sturgeon usage of the Hudson River by USMA is deemed minimal (sturgeon appear to prefer deep habitats) and not likely to be essential to the Hudson River population (M. Bain, personal communication).

3.0 SPECIES EFFECTS ON TRAINING

West Point military training does not occur on any section of the Hudson River and therefore would have no direct effect on the shortnose sturgeon. As yet, no USMA operations have been impacted by the sturgeon's presence in the Hudson River.

4.0 MANAGEMENT PLANS AND GOALS

4.1 Goals: The goals of this management plan for the next five years are to: (1) prevent any adverse impacts to the shortnose sturgeon from any construction activities by USMA along the Hudson River and, (2) insure that project review of activities associated with Academy operations results in activities which do not pollute the Hudson River and harm the sturgeon nor impact the species from dredging operations.

4.2 Management Actions:

1. Consult if necessary, informally and formally, with the National Marine Fisheries Service (NMFS), pursuant to Section 7 of the Endangered Species Act, and New York State Department of Environmental Conservation (NYSDEC) regarding any USMA activities in the Hudson River. Incorporate any modifications into activities that arise from consultations and permits issued.

2. Comply with all provisions stipulated in the permit issued by NYSDEC for the operation of USMA's Target Field Wastewater Treatment Plant to reduce pollutants that may be discharged into the Hudson River.

3. Permit access to the Hudson River from USMA properties by Federal, state, and other researchers studying the shortnose sturgeon, provided it does not greatly interfere with USMA operations.

4. Consult annually with NYSDEC and NMFS to ascertain status and trends of the Hudson River shortnose sturgeon population. Review, evaluate, and modify this plan, if necessary, based on new information.

Costs To Implement: Implementation of this plan should not result in any new costs. Any future USMA projects that potentially impact shortnose sturgeon would be identified in the planning stages and mitigation costs would be absorbed into the project's total cost.

5.0 LITERATURE CITED

Bain, Mark, Steve Nack, and Jeremy G. Knight. 1995. Report To The North Atlantic Division of the U.S. Army Corps of Engineers - "POPULATION STATUS OF SHORTNOSE STURGEON IN THE HUDSON RIVER". October, 1995. 7 pg.

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Dovel, William, Anthony W. Pekovitch, and Thomas J. Berggren. 1992. Biology of the Shortnose Sturgeon (*Acipenser brevirostrum* Lesueur 1818) in the Hudson River Estuary, New York. pp. 187-216. In: Estuarine Research of the 1980s: Seventh Symoposium on Hudson River Research, (ed) C. L. Smith, State University of New York Press, Albany, NY.

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Exhibit A

Individuals and Organizations Contributing to the Plan

1.0 USMA ESMP Team

James A. Beemer, Fishery & Wildlife Biologist, Natural Resources Branch, EMD
Joseph L. Deschenes, Chief, Natural Resources Branch, EMD

2.0 Individuals Contacted

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Dave Linck	U.S. Fish & Wildlife Service Lake Champlain Fish & Wildlife Resources Office 11 Lincoln Street Essex Junction, VT 05452	(802) 872-0629
Mark Bain	New York Cooperative Fish & Wildlife Research Unit Dept. of Natural Resources Cornell University Ithaca, NY 14853	(607) 255-2840
Nancy Haley	National Marine Fisheries Service Protected Species Program c/o US Fish & Wildlife Service 300 Westgate Center Drive Hadley, MA 01035	(413) 253-8616

6.0 CHECKLIST

Schedule	Activity	IMPLEMENTED	
		Date	Signature
1 October 1998 to 30 September, 1999	Review all proposed projects for potential impacts on shortnose sturgeon.		
Summer, 1999	Consult with NMFS and NYSDEC to ascertain current status of shortnose sturgeon.		
Summer, 1999	Report to Garrison Commander on effectiveness of ESMP.		
1 October 1999 to 30 September 2000	Review all proposed projects for potential impacts on shortnose sturgeon.		
Summer, 2000	Consult with NMFS and NYSDEC to ascertain current status of shortnose sturgeon.		
Summer, 2000	Report to Garrison Commander on effectiveness of ESMP.		
1 October 2000 to 30 September 2001	Review all proposed projects for potential impacts on shortnose sturgeon.		
Summer, 2001	Consult with NMFS and NYSDEC to ascertain current status of shortnose sturgeon.		
Summer, 2001	Report to Garrison Commander on effectiveness of ESMP.		
1 October 2001 to 30 September 2002	Review all proposed projects for potential impacts on shortnose sturgeon.		
Summer, 2002	Consult with NMFS and NYSDEC to ascertain current status of shortnose sturgeon.		
Summer, 2002	Report to Garrison Commander on effectiveness of ESMP.		
1 October 2002 to 30 September 2003	Review all proposed projects for potential impacts on shortnose sturgeon.		
Summer, 2003	Consult with NMFS and NYSDEC to ascertain current status of shortnose sturgeon.		
Summer, 2003	Report to Garrison Commander on effectiveness of ESMP.		

6.0 CHECKLIST (continued)

Schedule	Activity	IMPLEMENTED	
		Date	Signature
Summer, 2003	Revise, update, and modify ESMP based on current status of shortnose sturgeon.		