

Natural Resource Management Plan for Brookhaven National Laboratory

Environmental & Waste Management Services Division
Brookhaven National Laboratory
Operated by

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PREFACE

This comprehensive Natural Resource Management Plan (NRMP) for Brookhaven National Laboratory (BNL) was built on the successful foundation of the Wildlife Management Plan for BNL, which it replaces. The plan establishes the basis for managing the varied natural resources located on the 5,265-acre BNL site, setting goals and actions to achieve those goals. The planning of this document was reviewed, commented on, and adjusted appropriately using the Technical Advisory Group (TAG) established by the Interagency Agreement between the Department of Energy (DOE) and the U.S. Fish & Wildlife Service (FWS). The TAG has played an essential role in developing the management to be carried out in such a way that it is sound ecologically and it benefits the greater Pine Barrens habitats in which BNL is situated. This plan applies equally to the Upton Ecological and Research Reserve (Upton Reserve). Any difference in management between the larger BNL area and the Upton Reserve are noted in the text.

FWS, The Nature Conservancy, New York State Department of Environmental Conservation (NYSDEC) and DOE, as well as appropriate BNL personnel, have reviewed this NRMP.

Selected Acronyms

ATV	All Terrain Vehicle
BER	Brookhaven Executive Roundtable
BMP	Best Management Practice(s)
BNL	Brookhaven National Laboratory
CAC	Citizens Advisory Council
CCC	Civilian Conservation Corps
CEGPA	Community Education Governmental and Public Affairs division
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act or Superfund
CPA	Core Preservation Area – The ~55,000 central portion of the Central Pine Barrens of Long Island.
CRMP	Cultural Resource Management Plan
DOE	Department of Energy
EA	Environmental Assessment
ECL	New York State Environmental Conservation Law
EMP	Environmental Monitoring Plan
FMP	Wildland Fire Management Plan for BNL - Strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. Supplemented by operational procedures: preparedness plans, preplanned dispatch plans, prescribed fire plans, and prevention plans.
FWS	United States Fish & Wildlife Service
GIS	Geographic Information System
GPS	Global Positioning System
IPM	Integrated Pest Management
LIWMA	Long Island Weed Management Area
LMS	Lawler, Matusky & Skelly
MIST	Minimum Impact Suppression Tactics
NRCS	Natural Resource Conservation Service
NYSDEC	New York State Department of Environmental Conservation
NEPA	National Environmental Policy Act – Requires environmental review of major actions carried out, funded, or occurring on or by the federal government.
NPS	National Park Service
NRMP	Natural Resource Management Plan
PBC	Central Pine Barrens Joint Policy and Planning Commission
PLC	Protected Lands Council – one of the committees of the Central Pine Barrens
RHIC	Relativistic Heavy Ion Collider
SBMS	Standards Based Management System
SER	Site Environmental Report
SME	Subject Matter Expert
SPDES	State Pollution Discharge and Elimination System
STP	Sewage Treatment Plant
SUNY	State University of New York
TAG	Technical Advisory Group
TNC	The Nature Conservancy
TS or ts	Tiger Salamander
Upton Reserve	Upton Ecological and Research Reserve – a 530 acre parcel located along the east boundary of the Brookhaven National Laboratory
USDA	United States Department of Agriculture
USDA-APHIS-WS or USDA-WS	United States Department of Agriculture, Animal Plant Health Inspection Service, Division of Wildlife Services
USFS	United States Forest Service
WMP	Wildlife Management Plan –Plan that preceded the current Natural Resource Management Plan
WW I, WW II	World War I or II, as appropriate.

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1.0 INTRODUCTION

Brookhaven National Laboratory (BNL) is located near the geographic center of Long Island, New York. The Laboratory is situated on 5,265 acres of land composed of Pine Barrens habitat with a central area developed for Laboratory work. In the mid-1990s BNL began developing a wildlife management program. This program was guided by the Wildlife Management Plan (WMP), which was reviewed and approved by various state and federal agencies in September 1999. The WMP primarily addressed concerns with the protection of New York State threatened, endangered, or species of concern, as well as deer populations, invasive species management, and the revegetation of the area surrounding the Relativistic Heavy Ion Collider (RHIC). The WMP provided a strong and sound basis for wildlife management and established a basis for forward motion and the development of this document, the Natural Resource Management Plan (NRMP), which will guide the natural resource management program for BNL.

The body of this plan establishes the management goals and actions necessary for managing the natural resources at BNL. The appendices provide specific management requirements for threatened and endangered amphibians and fish (Appendices A and B respectively), lists of actions in tabular format (Appendix C), and regulatory drivers for the Natural Resource Program (Appendix D).

2.0 PURPOSE AND PHILOSOPHY OF PLAN

The purpose of the Natural Resource Management Plan is to provide management guidance, promote stewardship of the natural resources found at BNL, and to integrate their protection with pursuit of the Laboratory's mission. The philosophy or guiding principles of the NRMP are stewardship, adaptive ecosystem management, compliance, integration with other plans and requirements, and incorporation of community involvement, where applicable.

2.1 INTEGRATION WITH OTHER DOCUMENTS

The NRMP must integrate with other requirements that govern BNL's operation. The Environmental and Waste Management Services Division is responsible for developing and implementing several management documents for BNL, including the Cultural Resource Management Plan, Environmental Monitoring Plan, and Environmental Management Systems. Other divisions are responsible for the Standards Based Management System, environmental restoration, infrastructure management, and emergency management. Where requirements from various other management systems affect this plan, those requirements will be integrated by direct reference. For example, the WW I trench systems and the white pine groves are both historic features of the BNL site, but their maintenance may be, in part, within the scope of natural resource management.

3.0 LABORATORY MISSION

BNL is a multi-program national laboratory managed by Brookhaven Science Associates for the U.S. Department of Energy (DOE). BNL was founded in 1947, and is located on land formally operated as Camp Upton by the U.S. Army. BNL is in Suffolk County, New York (NY), and is approximately 60 miles east of New York City.

The Laboratory's broad mission is to produce excellent science in a safe, environmentally responsible manner with the cooperation, support, and appropriate involvement of our many communities. Specifically, the mission of BNL, which supports the DOE's strategic missions, is to:

- Conceive, design, construct, and operate complex, leading edge, and user-oriented facilities in a safe and environmentally responsible manner that is responsive to DOE and the needs of the international community of users.
- Carry out basic and applied research in long-term programs at the frontier of science in support of DOE missions.
- Develop advanced technologies that address national needs, and initiate their transfer to other organizations and to the commercial sector.
- Disseminate technical knowledge to educate new generations of scientists and engineers, to maintain technical currency in the nation's workforce, and to encourage scientific awareness in the general public.

BNL makes its unique facilities, technical expertise, and the natural environment within its facility available to state and federal agencies, universities, and the private sector to conduct research in a manner that is consistent with these missions.

4.0 DRIVERS

The development of a Natural Resource Management Plan is a contract requirement for BNL, according to DOE Order 450.1. There also are a number of federal, state, and local regulations and statutes relevant to wildlife, wetland, and natural resource management. It is BNL's policy to integrate environmental stewardship into all facets of the Laboratory's missions, to manage programs in a manner that protects the ecosystem. Specific regulatory, secretarial, cooperative, and internal drivers are presented below and are listed again in Appendix D.

4.1 REGULATORY (FEDERAL AND STATE)

Federal regulations directly applicable to natural resource management or requiring coordination and integration include:

Endangered Species Act
Migratory Bird Treaty Act
Clean Water Act
Clean Air Act
10 CFR 1022 Compliance with Wetlands and Flood Plains Executive Orders

Executive Order 13148 Greening the Government Through Leadership in Environmental Management
 Executive Order 13112 Invasive Species
 Executive Order 13186 Responsibilities of Federal Agencies To Protect Migratory Birds

State regulations applicable to natural resource management include:

New York State Environmental Conservation Laws
 NYS Endangered Species Act
 Wild, Scenic, Recreational, Rivers Act
 NYS Wildlife Laws
 NYS Wetlands Protections Laws
 Pine Barrens Act

4.2 DEPARTMENT OF ENERGY (DOE POLICY, ORDERS)

DOE P 430.1 Land and Facility Use Policy
 DOE P 450.6 Secretarial Policy Statement; Environmental Safety and Health
 DOE O 450.1 Environmental Protection Program
 DOE O 5400.5 Radiation Protection of the Public and Environment

4.3 LABORATORY POLICY

Brookhaven National Laboratory has developed an Environmental Stewardship Policy that is integrated into all of the Laboratory's missions. BNL will manage its programs in a manner that protects the ecosystem and public health. In support of this policy, BNL has made the following commitments:

- We are committed to achieving compliance with applicable environmental requirements.
- In consideration of the potential impacts of our activities on the environment, we will integrate pollution prevention/waste minimization, resource conservation, and compliance into all of our planning and decision-making. We will adopt cost-effective practices that eliminate, minimize or mitigate environmental impacts.
- We will define, prioritize, and aggressively correct and clean up existing environmental problems.
- We will work to continually improve our environmental management system and performance. We will establish appropriate environmental objectives and performance indicators to guide these efforts and measure our progress.
- We will maintain a positive, proactive, and constructive relationship with our neighbors in the community, regulators, DOE, and our other stakeholders. We will openly communicate with stakeholders on our progress and performance.

All Staff have a role in achieving the policy commitments.

In addition the Laboratory Director conducts an annual review of BNL's progress on environmental goals and adherence to this policy.

4.4 COOPERATIVE (LONG ISLAND PINE BARRENS PROTECTION ACT)

Brookhaven National Laboratory occupies approximately five percent of the 102,000-acre Central Pine Barrens and works in cooperation with the Central Pine Barrens Joint Policy and Planning Commission (PBC) established by the Long Island Pine Barrens Protection Act of 1995. This Act requires preparation of a Pine Barrens Management Plan, which the PBC did in 1996. Since the Act does not have its origin in a federal statute, federal facilities are not subject to it. However, BNL developed a Future Land Use Plan (BNL 1995) with considerable input from the PBC and other stakeholders. The plan does not preclude future development which may take place in pursuit of BNL's missions, but recommends that the majority of BNL's undeveloped lands be maintained as open space.

BNL participates as a member of several committees established under the Pine Barrens Protection Act, including the Central Pine Barrens Advisory Committee, Protected Lands Council, Law Enforcement Task Force, and the Wildland Fire Task Force. As a member of these committees BNL provides technical assistance and professional experience to the decision-making process of the PBC.

4.5 Zoning Approach

In 2000, BNL began developing a Site Master Plan for the Laboratory. This plan directs the management and development of the Laboratory's infrastructure. Included in the master plan is an ecological zoning approach to infrastructure development that divides the Laboratory into six ecological zones based on a priority for development within a given zone (See Figure 1). Areas designated as a "1" are considered most suitable for development, and in many cases are already developed. Areas designated as a "5" are the highest priority for protection and preservation and least suitable for development. Priority 5 zones would also be appropriate for consideration for use in environmental research. The Upton Ecological and Research Reserve makes up a sixth zone that will not be considered for any development.

It is important to note that development would not necessarily be precluded in areas zoned 2 through 5. In the future, BNL may need space for new scientific machines requiring large areas of real estate for expansion. The zoning priorities are taken into consideration during the planning process. The environmental aspects of development anywhere on the site are always considered during planning.

Priority 1. Priority 1 areas are already developed but may contain limited sensitive areas. These areas are most suitable for further development. The developed area at BNL could also be used to study the effects of developed areas on natural areas (i.e., the urban/wildland interfaces).

Priority 2. Priority 2 areas include potentially sensitive resources. Consultation with the environmental protection staff is required prior to disturbance or development. Resources include buffer zones around sensitive habitats (e.g., wetlands, scenic river corridor) and areas that may contain cultural resources. Priority 2 areas are scattered across the BNL site.

Priority 3. Priority 3 areas are suitable for public environmental education or environmental research, and are generally park-like in nature. The Priority 3 areas at BNL could readily be developed by BNL should the need arise.

The Priority 3 area would be: Starting at William Floyd Parkway and Princeton Rd., then north to North Gate, then south along Upton Rd. to the intersection of Upton Rd. and Cornell Ave., then west along the

tree line to the first firebreak road, then south to the intersection of the firebreak road and Brookhaven Ave., then east to the intersection of Brookhaven Ave. and Woods Rd., then south along Woods Rd. to its end, then continuing through the forest to Princeton Rd., then west to William Floyd Parkway. The western forested area of the Laboratory could be used for environmental research.

Priority 4. Priority 4 areas are less sensitive than Priority 5 areas, but are valuable for ecological habitat and research. The majority of the Priority 4 areas at BNL are included in the Pine Barrens Core Preservation Area.

Two areas are designated as priority 4 zoning and are recommended for environmental research. These areas encompass the larger expanses of Pine Barrens Core Preservation Area, including some wetland areas and the Gamma Forest, and provide added protection for Priority 5 zones located within the Priority 4 zones. (Note: All wetland areas and scenic river corridors would be protected regardless of whether areas were used for environmental research.) The areas are:

North Area: Starting at the intersection of 5th Ave. and 1st St., north to the east–west road south of the Gamma Forest, then east to the East Firebreak road, then diagonally northeast to the BNL east boundary, then north to the BNL north boundary, then west to the west BNL boundary, then South to the North Firebreak, then east along the North Firebreak to the eastern edge of RHIC, then south to the firebreak road just south of the Shotgun Range, then south to 5th Ave., then back to the intersection of 5th Ave. and 1st St.

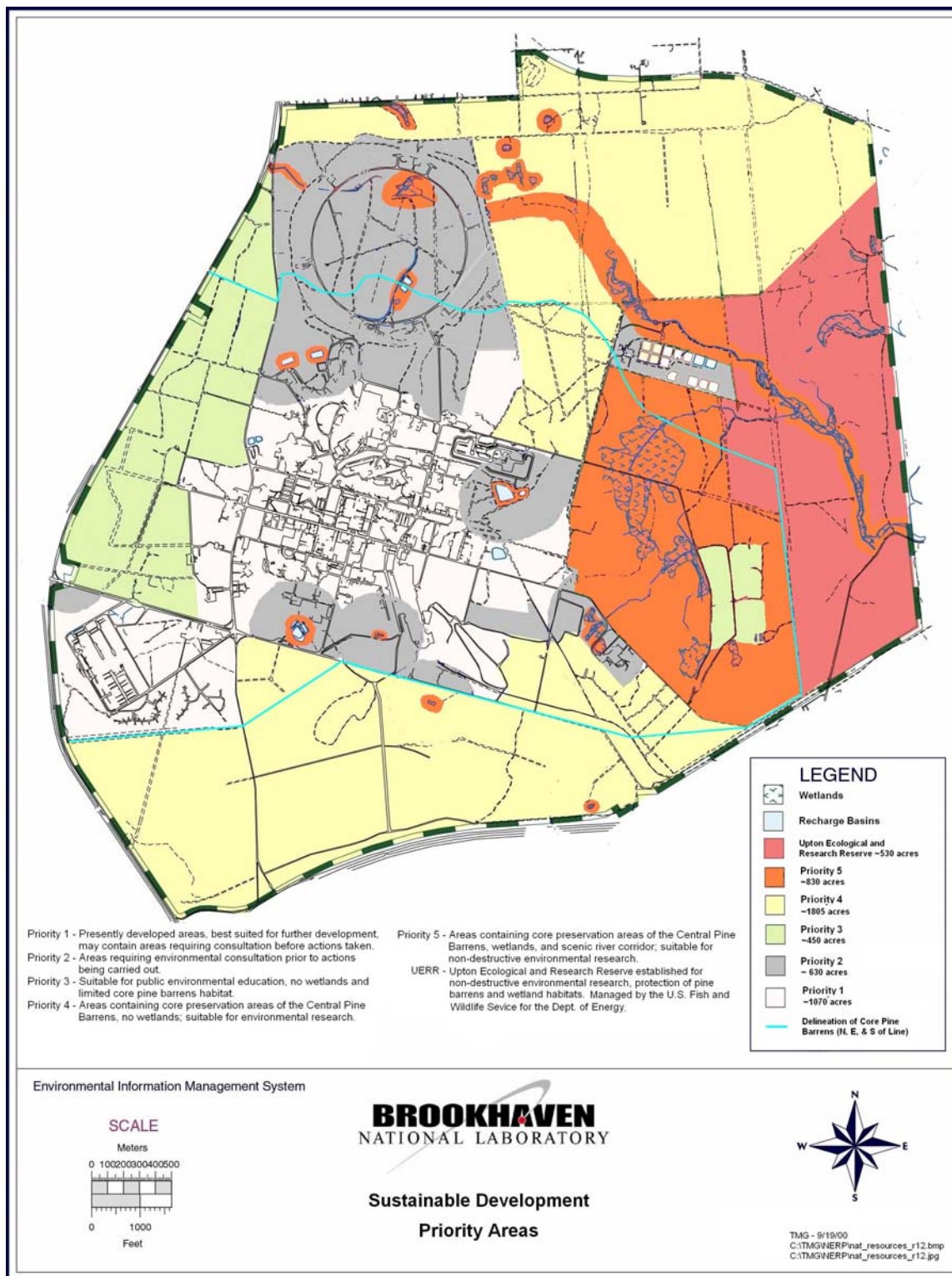
South Area: Starting at the intersection of Princeton Ave. and Upton Rd., then east along Princeton Rd. to just east of the Glass Pit area, then north to the south boundary of the Archery Range, then east to the south boundary of the Capped Landfill and along the south and east boundary of the former Hazardous Waste Facility to Brookhaven Ave., then east/southeast along Brookhaven Ave. to the intersection of Brookhaven Ave. and the SE boundary road, then west along the SE and S boundary roads to the west boundary, then north to the South Firebreak, then east to Upton Rd., then north to the intersection of Upton Rd. and Princeton Ave.

Priority 5. Relatively speaking, Priority 5 represents the most ecologically sensitive habitat on site. It is primarily within the Pine Barrens Core Preservation Area and is considered least suitable for development.

The Priority 5 area includes most of the wetlands, the Peconic River corridor and the portions of the Peconic River designated as a Scenic River. (Note: Some of the area marked as Priority 5 on Figure 1 is already developed, e.g., the Biology Fields.) The Priority 5 area encompasses most of the eastern portion of BNL. The area designated as Priority 5 zoning is as follows:

Starting at the intersection of Brookhaven Ave. and the SE boundary road, to the intersection of Brookhaven Blvd. and 1st St., north to the intersection of 1st St. and the firebreak that is south of the STP, then east to the first firebreak west of the East Firebreak, then north to the firebreak road running south of the Gamma Forest, then east to the East Firebreak, then diagonally northeast to BNL East, then south along the east boundary to the SE corner of the BNL property, then back along the boundary to the intersection of Brookhaven Blvd. and the SE boundary road.

Figure 1. Sustainable development priority areas.



Upton Ecological & Research Reserve. Approximately 530 acres of Priority 4 and 5 areas were designated for environmental research. The Upton Reserve encompasses much of the area east of the East Firebreak. This area contains Zeke's Pond and part of the Peconic River Corridor and is composed of Pine Barrens habitats included in the Core Preservation Area of the Central Pine Barrens of Long Island.

5.0 TECHNICAL ADVISORY GROUP

The development and implementation of the NRMP is being supported by input from a Technical Advisory Group (TAG) composed of representatives from several agencies and organizations with natural resource management responsibilities, as well as input from DOE, BNL, and the Citizen's Advisory Council to BNL. This diverse group of people is providing technical knowledge on the various management issues that are incorporated in this document.

The TAG was established through the Memorandum of Understanding (Agreement) that established the Upton Ecological and Research Reserve. This document was signed on November 9, 2000 by then-Secretary of Energy Bill Richardson and the Acting Director of Refuges-Region 5, Susan McMahon of the U.S. Fish & Wildlife Service.

5.1 PURPOSE AND ROLE

The TAG is charged with two primary functions: 1) to provide technical advice on the development of a comprehensive Natural Resource Management Plan for the Laboratory (including the Upton Reserve), and 2) to develop criteria for the solicitation, review, and award of research funds for proposals on research to be conducted within the Upton Ecological and Research Reserve.

5.2 MEMBERSHIP

The TAG is composed of members representing the following groups:

Department of Energy
 Brookhaven National Laboratory
 Citizens Advisory Council to BNL
 Brookhaven Executive Roundtable
 U.S. Fish & Wildlife Service
 The Nature Conservancy
 Suffolk County Parks
 Central Pine Barrens Joint Planning and Policy Commission
 New York State Department of Environmental Conservation

5.3 INPUT BY TAG AND ANCILLARY GROUPS

The TAG provides input through discussions regarding management issues. The Cultural and Natural Resource Manager for BNL places management issues on the agenda for regular meetings that are held as necessary throughout the year. Input is also provided through technical review of documents prepared as part of action items identified during scheduled meetings. Comments received during the review process are considered for applicability to BNL management objectives and for agreement with all requirements governing the management of BNL's natural resources.

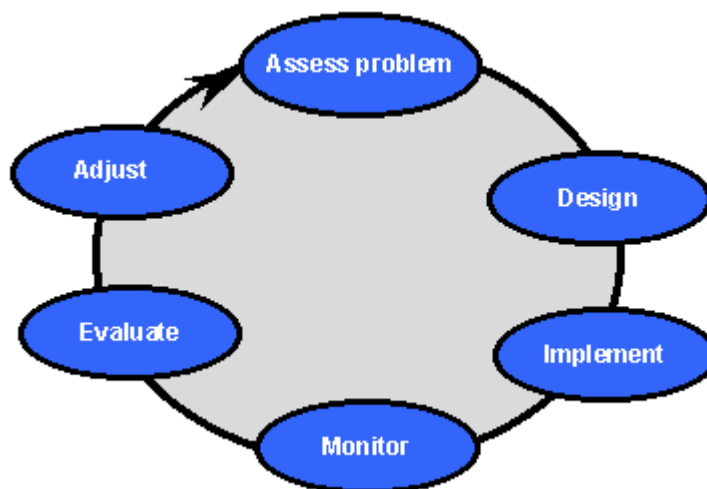
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It is expected that some members of the TAG will provide natural resource management documents to other groups, as will BNL. BNL will accept and consider all relevant and applicable comments resulting from this input mechanism.

5.4 ADAPTIVE MANAGEMENT

The Natural Resource Management program will utilize "Adaptive Management" as a mechanism for continual improvement to the program. Adaptive Management follows a similar pattern that is utilized by Integrated Safety Management and Environmental Safety Management systems. It is defined below.

Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form—"active" adaptive management—employs management programs that are designed to experimentally compare selected policies or practices, by evaluating alternative hypotheses about the system being managed.



In this plan the problems are defined through management needs; strategies are determined; actions are assigned and implemented; results are monitored, reported, and evaluated; and adjustments are made to the program.

6.0 MANAGEMENT NEEDS AND STRATEGY

The development and implementation of a Natural Resource Management Program is a slow process in which management needs (gaps) must be identified, goals set, actions developed, and assessments planned. The Management Needs and Strategy document serves as the basis for establishing the management program, identifies known management gaps, and establishes the continuous improvement cycle that will result in the identification of additional gaps and inclusion of these management gaps into the program and plan. Each section below will have an appropriate goal or goals, and actions identified to meet the specified goal(s).

6.1 USE OF WILDLIFE MANAGEMENT PLAN

Substantial portions of the Wildlife Management Plan have been transferred over to and incorporated into this NRMP, as appropriate. The WMP covers areas of natural resource management concerning population monitoring (deer, songbirds, turkeys, tiger salamanders, etc.), deer management, threatened and endangered species management, and habitat enhancement. Actions found within the Wildlife Management Plan have been incorporated into this NRMP and will continue to be implemented.

Goal. Fully transition appropriate management activities carried out under the Wildlife Management Plan into activities under the Natural Resource Management Plan and continue the management activities established by the action items in the WMP.

Action. Transition each of the original 17 action items (as appropriate) into the applicable sections of this plan. See Appendix C for a list and status of these action items.

6.1.1 Management Gap Identification

Several areas of specific management needs have been identified for inclusion within this plan and are being addressed. Additional gaps in management are likely to be identified in the future and will need to be addressed. Significant gaps will result in the need to submit an addendum to this plan within a reasonable amount of time, while other gaps will be noted and added to the plan during major revisions.

Goal. Establish a mechanism to identify natural resource management needs that are not currently addressed, and routinely (at least annually) review the NRMP for new management activities that need to be added.

Action. The TAG committee will complete a yearly review once an annual report has been written and submitted to the TAG by the Natural Resource Manager. A rewrite should be considered every 5 years.

6.2 INTEGRATION OF UPTON ECOLOGICAL AND RESEARCH RESERVE MANAGEMENT

Most of the goals, objectives, and evaluation criteria developed in this plan will apply to both BNL and the Upton Reserve. Differences in management requirements that are specific to the Upton Reserve will be specified in each section.

Goal. Integrate the management of the Upton Reserve within the natural resource management of BNL as well as ensure BNL natural resource management initiatives are consistent with those for the Core Preservation Area (CPA) of the Central Pine Barrens. Integration with the CPA of the Central Pine Barrens may be facilitated through the Protected Lands Council of the Central Pine Barrens Joint Planning and Policy Commission.

The Upton Reserve is an integral unit of the BNL property. Integration of this unit into BNL natural resource management will serve to:

- Ensure coordination between Upton Reserve and BNL Natural Resource Management strategies.
- Ensure cooperation between the U.S. Fish & Wildlife Service and BNL.
- Ensure that ecosystem-based management is carried out on all BNL lands.

BNL is a single management unit identified within the Management Plan for the Core Preservation Area of the Central Pine Barrens. Integration of BNL resource management with that of the Central Pine Barrens will serve to:

- Ensure coordination between BNL Natural Resource Strategies and those of the Central Pine Barrens.
- Ensure cooperation between BNL and members of the Protected Lands Council of the Central Pine Barrens.
- Demonstrate sound management techniques for the Pine Barrens.

Action. The U.S. Fish & Wildlife Service has two offices at BNL, establishing an on-site presence in order to manage the Upton Ecological and Research Reserve. Frequent meetings are conducted between U.S. Fish & Wildlife and BNL's Natural Resource Manager. The Natural Resource Manager provides input to most management actions prior to implementation by U.S. Fish & Wildlife.

BNL's Natural Resource Manager is a participant on the Protected Lands Council of the Central Pine Barrens. This body serves as a sounding board for new management issues that may periodically arise. Discussions with the Protected Lands Council will be used to informally assess whether BNL's natural resource management is consistent with that of other managing organizations within the Central Pine Barrens.

6.3 RESOURCE IDENTIFICATION

Several resources are available for managing the natural resources at BNL, including those within the Upton Reserve. Resources include either assistance from governmental agencies (e.g., U.S. Fish & Wildlife Service) and non-governmental organizations (e.g., The Nature Conservancy), or technology tools that serve to improve our understanding of relationships in nature.

Goals

1. Identify resource agencies that can support BNL's Natural Resource Management Program, and develop good, long-term, cooperative relationships with those agencies.
2. Identify technological resources that would enhance and help implement BNL's Natural Resource Management Program, and incorporate their use, where appropriate.

Actions

1. Adapt natural resource management decisions based on up-to-date information gained collectively through cooperation with outside agencies and organizations.
2. Improve management decisions through the use of innovative tools.
3. Maintain and improve relationships between neighboring landowners, support agencies, and private environmental groups.

6.3.1 Agencies and Organizations

Several agencies and organizations provide technical expertise on either a cooperative or paid basis. BNL should take advantage of these services, where appropriate. Agencies providing cooperative and/or paid consultation support include the U.S. Department of Agriculture (USDA) Forest Service, USDA Animal Plant Health Inspection Service – Division of Wildlife Services, USDA Natural Resources

Conservation Service, U.S. National Park Service, U.S. Fish and Wildlife Service, Cornell Cooperative Extension, and New York State Department of Environmental Conservation (NYSDEC) Wildlife Branch.

Cooperative efforts between BNL and the Central Pine Barrens Joint Planning and Policy Commission provide opportunities for achieving mutual natural resource management goals. BNL lies within the Central Pine Barrens area, the third largest protected forest area in New York State. The Commission is charged with implementing a comprehensive land use plan for the Central Pine Barrens. Two primary goals of this plan are 1) to protect, preserve, and enhance the functional integrity of the Pine Barrens ecosystem and its significant natural resources, including plant and animal populations and communities, and 2) to protect the quality of surface water and groundwater.

BNL is a member of several of the councils created by the Commission to foster stewardship in the Pine Barrens including the Advisory Council, the Protected Lands Council (PLC), the Wildfire Task Force, and the Law Enforcement Council. The structure of the PLC and the expertise of its member organizations are an especially valuable resource for enhancing BNL's Natural Resource Management Program. Through BNL's continued active participation on the PLC and its cooperative interagency natural resource protection and management efforts, BNL can reap the benefits fostered by the PLC's goal "to forge stronger working relationships and partnerships between all public land holders and conservation land managers in the Central Pine Barrens so as to allow for sharing of limited resources and to strengthen the capacity of individual land managers to accomplish regional pine barrens resource protection and management goals."

Since 1996, BNL has also been one of the three organizational sponsors—along with the Central Pine Barrens Commission and the Long Island Groundwater Research Institute of SUNY at Stony Brook—of the annual Pine Barrens Research Forum. This two-day, October event draws scientists, researchers, managers, students at all levels, teachers, agency personnel, citizens, and interested individuals together to share research initiatives and results in diverse disciplines such as ecology, surface and groundwater hydrology, wildlife, botany, fire, historical land uses, land use planning, technology, and tools.

BNL resources have also been utilized for holding the annual Wildfire Academy, monthly Protected Land Council meetings, biennial National Park Service Science Symposia, and other public functions related to natural resource management.

Private organizations with expertise in wildlife and natural resource management should be utilized where applicable. The Nature Conservancy staffs a Long Island office with individuals trained and experienced in environmental conservation. The Conservancy plays a crucial role in Long Island conservation strategies. This organization should be utilized as a source for consultation and cooperation where applicable. Their particular areas of expertise include science and monitoring, prescribed fire management, invasive species control, and volunteer coordination. Other organizations, such as the Audubon Society, the Long Island Pine Barrens Society, and others, should be used where appropriate for managing or obtaining information about natural resources at BNL.

6.3.2 Tools

Technology-based tools include Geographic Information Systems (GIS), Global Positioning Systems (GPS), and computer-based modeling software.

6.3.2.1 Development and Use of GIS and GPS. BNL utilizes a Geographic Information System for managing environmental restoration data and uses Global Positioning System equipment to obtain location coordinates. This same technology is used by natural resource agencies around the world as a tool for looking at relationships in natural systems. This technology is being put to use in natural resource management at BNL. Data layers already present and available include topographic contours, wetlands and waters, developed areas, tiger salamander habitats, and forested areas. Data layers that need to be developed or acquired include soils, vegetation associations, location of transects and survey plots, location of experimental plots, species population data, and so forth. As new ecological data layers are acquired they should be mapped using GPS and stored within BNL's GIS database. The GIS Data Management Group will maintain ecological data layers that will be readily accessible by natural resource management personnel.

6.3.2.2 Computer-Based Modeling Software. Several computer-based modeling programs are currently available as tools to predict management effects based on various scenarios or information provided to the model. Models like BEHAVE for fire behavior and Deer Management Simulator can be used immediately. As other models are developed, their usefulness to BNL should be evaluated and utilized. Some models for projected species or habitat distributions could be developed as additional necessary GIS data layers are acquired.

6.4 HABITAT IDENTIFICATION, PROTECTION, OR ENHANCEMENT

Identification of habitat, and its protection and enhancement, are necessary to ensure healthy populations of plants and animals. In general, habitat identification should be focused in such a way that the entire ecosystem is protected and conserved. However, certain species of plants and animals have been identified as rare, threatened, endangered, or of special concern. These species and their habitats need to be identified within the boundaries of BNL and managed in such a way that their continued existence will be assured.

Goal. Identify key habitats needed by protected species, protect and enhance them, and maintain a healthy ecosystem benefiting all species that will ensure the survival of identified rare and threatened species, and species of special concern.

Actions

1. Ensure adequate habitat for protected species and species of special concern.
2. Maintain a healthy ecosystem that contains the proper environment for protected plants and supports habitat for protected species and species of special concern.

Implementation. Once habitats that are sensitive or critical to species protection have been identified, programs are developed to protect those habitats, particularly during periods (e.g., breeding) that are critical to species survival. Activities or projects that could affect those habitats are evaluated (e.g., pollutant discharge, construction activities). An example of this is limiting and controlling the use of pesticides through a site-wide training and application program. Appropriate actions to eliminate or minimize negative impacts are either incorporated into BNL procedures or incorporated into specific project plans. For example, the Laboratory has a Fire Management Plan that addresses the measures taken through training and equipment to prevent and control brush fires. The site is also criss-crossed with firebreaks, which are routinely maintained by the Plant Engineering staff as required by the Emergency Response Program. Environmental restoration efforts remove sources that could pollute or

have polluted habitats (i.e., landscape soils removal reduced presence of cesium-137). Access to critical habitats is restricted. Locations of endangered species breeding populations are kept confidential. Routine activities (e.g., road maintenance) that are not expected to affect habitats are allowed to proceed. In some cases, habitats will be enhanced to improve survival or increase populations of desirable species whose populations have dwindled due to development or habitat destruction on Long Island, even if they are not otherwise officially listed as threatened or endangered. BNL will use prescribed fire to maintain desired ecosystems and to set back forest succession, where appropriate. Prescribed fire would be managed under the Wildland Fire Management Plan for BNL (BNL 2003b).

Near-term activities planned in support of habitat protection or enhancement include the following:

- Adequate water bodies have been retained to provide landing sites and/or breeding sites for Canada goose (*Branta canadensis*) and other migratory birds.
- In order to attract birds, bird-nesting boxes are being refurbished and additional ones installed.
- Programs are being identified, planned, and implemented by the Technical Advisory Group.
- Disturbed areas are being revegetated with native grasses to provide a diverse habitat. Reforestation is being promoted using native trees obtained from Long Island seed stock, when possible. In 1998, 15,000 pine trees (*Pinus rigida*) were planted on site by volunteers and school children. Areas planted should be mapped and seed sources documented. In 2002, 6,000 pitch pines (*Pinus rigida*) were planted by volunteers and employees with seedlings purchased from the NYSDEC state nursery. Seedlings were reared from seed stock obtained from Long Island sources.

6.5 MONITORING AND SURVEYS

Ecological monitoring using appropriate techniques, as well as the development and implementation of biological surveys, will be used to identify areas, systems, or populations requiring additional or increased management. BNL currently uses migratory songbird surveys, deer surveys, turkey reporting, and periodic field excursions by natural resource management staff to track, document, and assess the population health of select species and the ecosystem. Forest monitoring plots have been identified as being necessary for establishing a baseline and tracking changes in the forest health at BNL.

Surveillance monitoring is also necessary to track historic contaminants and recovery after cleanup, and to determine the impacts from BNL operations. BNL has an established surveillance-monitoring program that is implemented through the Environmental Monitoring Plan (EMP). The EMP undergoes a thorough re-write every three years and is updated annually to reflect changes in the environmental monitoring program. The EMP was reissued in FY03 for implementation in CY03. Surveillance monitoring typically identifies problems in the environment that may be best solved within the context of natural resource management. Any identified problems applicable to natural resource management would be addressed through the EMP or its subsequent modifications and updates.

Goal. Establish appropriate biological and ecological monitoring projects and surveys to adequately assess ecosystem, forest, and species health as determined by information needs. Monitoring and surveys are designed to:

- Ensure that management actions are appropriate and are achieving goals.
- Allow for adaptive management as new information is obtained.
- Assess species population health (i.e., tiger salamander surveys), forest health, and ecosystem

health.

- Assess success of individual actions (i.e., prescribed fire).
- Evaluate and document impacts of Laboratory operations on the environment.
- Evaluate success of environmental cleanup.

Actions. Data collected on surveys will be summarized and any needed modifications will be added. New survey route locations may be added. New species will be identified and monitored. Songbird surveys began in July 1999. The site-wide survey assists in identifying species at BNL. It will also identify where habitat areas can be enhanced to attract songbirds.

Initiate a simple tracking program around known tiger salamander habitats to study the migration of adult salamanders to the breeding site, and study the migration of adults and juveniles (after metamorphosis) from the breeding site. This study will help natural resources staff to understand migration patterns on site and to develop plans to enhance the tiger salamander habitat, promoting successful population growth.

Other monitoring will be completed based on species-specific needs, as outlined later in this document. Monitoring for prescribed fires will follow the guidelines outlined in the Wildland Fire Management Plan (BNL 2003B).

6.6 POPULATION MANAGEMENT

Several species are of special interest for natural resource management. Some are highly noticeable (like deer and turkey), while others (songbirds and salamanders) are of interest to select groups of people or are of regulatory concern. Management of these populations may be primarily passive unless they are determined to need active management to enhance, maintain, or reduce the population.

Goal. Manage populations of species to maintain an optimum population level and sustain the species within a health ecosystem.

Actions. BNL must develop programs to manage populations to ensure that they are sustainable, and also to control undesirable species. BNL is in the process of evaluating options for controlling deer populations on site. The 1992 study indicated that the population of deer on site exceeded 700 (85/sq. mi.). Recent surveys indicate a population greater than 1,800 deer (219/sq. mi.). Normally, a population density of 20 to 30 deer per square mile is considered an optimum sustainable level for a given area. There is some scientific evidence that densities lower than 10 per square mile cause negative effects on forest ecosystems (Horsley et al., 2003). However, since the BNL site has a population density >200 per square mile, the need to initiate population control at the BNL site must be considered. Since overpopulation affects animal health and also results in increased property damage and traffic accidents as animals forage into developed areas looking for food, a number of options will be evaluated for feasibility and effectiveness. All options require a thorough evaluation prior to implementation, and community involvement would be planned if measures such as population culling or directed hunting were recommended.

6.6.1 Identification of Populations Requiring Special Management

Several species found on BNL are in need of population monitoring and, as appropriate, management. These species include: deer, turkey, Canada geese, bluebirds, tiger salamanders, swamp darter, and banded sunfish.

6.6.1.1 Deer. White-tailed deer are the most prevalent large mammal species on Long Island and at BNL. In 1966, the population was estimated at approximately 267 animals. A study in 1992 determined that BNL had a population of approximately 700 animals (85/sq. mi). Follow-up surveys in December 2000 estimated 1,942 animals (236/ sq. mi). The winter of 2000/2001 was relatively harsh with snow standing on the ground for several weeks at a time. The harsh winter resulted in deer mortality between 20 and 30percent, with continued mortality through the summer of 2001. Estimates in December 2001 through January 2002 indicate approximately 1,160 deer (141/sq. mi), and summer estimates during July 2002 indicate a population of 1,600 deer (195/sq. mi). While the population seems to be going through some fluctuation in numbers, the numbers of deer present result in continued ecological and economic damage at BNL. Most scientific literature suggests a population of deer should be between 10 and 30 animals per square mile. This would be equivalent to the population levels seen in 1966.

Increased deer populations resulted in 23 car/deer accidents in 2000 at the front gate area of BNL. High deer populations have also resulted in virtually every ornamental shrub being grazed within 4 to 5 feet of the ground. Browse lines on trees and in the forest are evident, and the forest has a lack of seedlings and, in most areas, saplings that are needed for continued forest regeneration. Decreased food supplies together with overpopulation have resulted in most deer at BNL being malnourished; this has led to an increased death rate in deer.

Population management of deer is necessary, and initial steps have been taken under the Wildlife Management Plan to implement deer management. Potential alternatives for deer management have been identified, population estimates have been made, and documentation has been submitted for agency review for National Environmental Policy Act (NEPA) review and compliance. The Department of Energy has authorized the development of an environmental assessment (EA) to determine the effects of deer management alternatives pending the approval of an issue and decision paper. The United States Department of Agriculture – Animal and Plant Health Inspection Service – Wildlife Services Division (USDA-WS) completed a state-wide EA for managing problem deer populations within New York. BNL intends to adopt this EA using local information. Once the EA is adopted and approved, deer management alternatives will be implemented, as resources allow, and deer populations will be reduced and stabilized through appropriate means.

Goal. Deer management will be initiated to establish and maintain a deer population (200 – 300 animals) that is optimized based on animal and ecosystem health.

Actions

1. Write an Issue and Discussion paper on deer management.
2. Complete the environmental assessment.
3. Reduce the existing population consistent with ecosystem sustainability (10 – 30 animals/sq. mile).
4. Establish mechanisms for maintaining the target population (hunting, periodic culling, etc.).

Deer management is expected to result in the following:

- Increased biodiversity
- Improved forest health
- Improved bird habitat
- Improved health of the deer herd
- Reduced damage to landscaped areas
- Fewer vehicle/deer accidents

6.6.1.2 Threatened and Endangered Species. There are four New York State threatened or endangered species known to exist on site. These included the endangered eastern tiger salamander (*Ambystoma t. tigrinum*), threatened banded sunfish (*Enneacanthus obesus*), threatened swamp darter (*Etheostoma fusiforme*), and the threatened frosted elfin butterfly (*Callophrys irus*). A single New York State threatened plant, the stiff goldenrod (*Solidago rigida*) is known to exist on site but its location is undocumented. There are currently no known federally threatened or endangered species on site.

In addition to the state threatened and endangered species, there are 10 vertebrate species of concern, two rare plants, and 15 exploitably vulnerable plants known on site (Table 1).

Goals

1. Locate and document all populations of endangered, threatened, species of concern, rare, or exploitably vulnerable species.
2. Manage identified populations as necessary to enhance and ensure continued existence at BNL.
3. Where desirable and practical, re-establish species that were once present in the area covered by BNL.

Actions. Steps will be taken to increase the knowledge of flora and fauna at Brookhaven National Laboratory. Appropriate protocols will be established as needed in the future based on any new findings.

6.6.1.3 Eastern Tiger Salamander. The eastern tiger salamander (*Ambystoma t. tigrinum*) is abundant at BNL. Surveys conducted in 1994 and 1995 identified 13 breeding locations on site. Follow-up surveys in 2000 through 2003 increased the number of known locations to 17. Information about the timing of metamorphic emergence and the utility of artificial cover boards was conducted during student research in 2001 and 2002. In 2003, the addition of drift fence arrays around two ponds has provided substantial information concerning the emergence of tiger salamanders from ponds. The tiger salamander population is apparently doing quite well at BNL. However, because the eastern tiger salamander is listed as a New York State endangered species, BNL will continue to protect and monitor its populations and habitat, and will conduct research to better understand the biology and ecology of this species. BNL currently has a mechanism in place (a required digging permit) to ensure that BNL activities near tiger salamander habitat are reviewed prior to initiation and any activity that could be harmful is minimized; more significant actions require consultation with NYSDEC.

Several of the known tiger salamander habitats are drainage or recharge basins. Periodic maintenance of these basins is necessary to ensure proper recharge capabilities. However, the timing of maintenance must be coordinated to ensure function of the basin as well as protection of tiger

salamanders that may be present there. One known requirement for managing the tiger salamander population is a protocol for basin maintenance that will ensure adequate tiger salamander habitat.

Table 1. New York State Threatened, Endangered, and Species of Special Concern		
Common Name	Scientific Name	State Status
Invertebrates		
Frosted elfin	<i>Callophrys irus</i>	T
Fish		
Banded sunfish	<i>Enneacanthus obesus</i>	T
Swamp darter	<i>Etheostoma fusiforme</i>	T
Amphibians		
Eastern tiger salamander	<i>Ambystoma t. tigrinum</i>	E
Marbled salamander	<i>Ambystoma opacum</i>	SC
Eastern Spadefoot Toad	<i>Scaphiophus holbrookii</i>	SC
Reptiles		
Spotted turtle	<i>Clemmys guttata</i>	SC
Eastern box turtle	<i>Terrapene Carolina</i>	SC
Eastern hognose snake	<i>Heterodon platyrhinos</i>	SC
Birds (nesting or common)		
Cooper's Hawk	<i>Accipiter cooperii</i>	SC
Osprey	<i>Pandion haliaetis</i>	SC
Horned lark	<i>Eremophila alpestris</i>	SC
Whip-poor-will	<i>Caprimulgus vociferous</i>	SC
Grasshopper sparrow	<i>Ammodramus savannarum</i>	SC
Plants		
Butterfly weed	<i>Asclepias tuberosa</i>	V
Spotted wintergreen	<i>Chimaphila maculata</i>	V
Flowering dogwood	<i>Cornus florida</i>	V
Pink lady's slipper	<i>Cypripedium acaule</i>	V
Winterberry	<i>Ilex verticillata</i>	V
Sheep laurel	<i>Kalmia angustifolia</i>	V
Narrow-leafed bush clover	<i>Lespedeza angustifolia</i>	R
Ground pine	<i>Lycopodium obscurum</i>	V
Bayberry	<i>Myrica pensylvanica</i>	V
Cinnamon fern	<i>Osmunda cinnamomera</i>	V
Clayton's fern	<i>Osmunda claytoniana</i>	V
Royal fern	<i>Osmunda regalis</i>	V
Swamp azalea	<i>Rhododendron viscosum</i>	V
Long-beaked Bald-rush	<i>Rhynchospora scirpoides</i>	R
Stiff goldenrod	<i>Solidaga rigida</i>	T
New York fern	<i>Thelypteris novaboracensis</i>	V
Marsh fern	<i>Thelypteris palustris</i>	V
Virginia chain-fern	<i>Woodwardia virginica</i>	V
Notes: Table information is based on 6 NYCRR Part 182, 6 NYCRR Part 193, and BNL Survey Data. No federally listed threatened or endangered species are known to inhabit the BNL site. E = Endangered, R = Rare, SC = Species of Special Concern, T=threatened, V=exploitably vulnerable		

Goals

1. Identify all eastern tiger salamander habitat sites at BNL.
2. Develop, maintain, or improve survey protocols.
3. Maintain a healthy and sustainable population of the eastern tiger salamander at BNL.
4. Establish a recharge basin maintenance protocol protective of tiger salamanders.

Action. See Appendix A for further information.

6.6.1.4 Banded Sunfish. The banded sunfish (*Enneacanthus obesus*) is a small sunfish that typically lives in backwaters and deeper pools of the Peconic River system on Long Island. On BNL the banded sunfish has been found in only two locations. It is currently managed passively by ensuring that water flow is maintained in the Peconic River. This is accomplished by discharges to the river from the Sewage Treatment Plant (STP). Water quality is maintained by treating sewage to the tertiary level (i.e., nitrogen removal) in the STP. Annual surveys conducted on the river between the STP and the East Firebreak document the population and sizes of the banded sunfish within this stretch of the river. From a management standpoint, additional information about this species is needed to determine the need for additional management.

Goals

1. Identify all populations and habitats of banded sunfish at BNL.
2. Establish routine monitoring protocols.
3. Maintain flows to the Peconic River.
4. Where and when practical, enhance habitats for banded sunfish.
5. Gain and improve understanding of the banded sunfish biology and ecology.

Action. See Appendix B for further information.

6.6.1.5 Swamp Darter. The swamp darter (*Etheostoma fusiforme*) is a small fish that lives in still, dark waters of Long Island. A single healthy population of this fish was identified during summer 2000. Sampling and information gathering needs to be conducted to confirm the identity of this species, and a determination of management needs must be made. The drought of 2002 may have resulted in the total loss of this species, as the only known habitat dried up in 2002.

Goals

1. Confirm identity of swamp darter.
2. Identify all swamp darter populations and habitats.
3. Establish monitoring protocols.
4. Re-establish populations as necessary.
5. Maintain and enhance habitats.

Action. An annual evaluation should take place to document the population health. Should a noticeable decline take place, the Natural Resource Manager will discuss options and alternative with the NYSDEC.

6.6.1.6 Frosted Elfin. The frosted elfin (*Callophrys irus*) is a small butterfly that lives at the edges of fields near woods or scrubs of Long Island. The frosted elfin, which is an obligate species and is limited

to the use of wild lupine for egg laying and larval development, has been added to the special-status species list. Historically, NYSDEC and the New York Heritage Foundation have documented frosted elfin within a single patch of lupine on BNL. The area of lupine will be maintained. In 2003, lupine seed was scattered in the RHIC Ring as part of the RHIC revegetation, and seeds were also scattered along the East Firebreak. Additional work should be done to confirm the establishment of additional populations of lupine in suitable areas.

Goals

1. Confirm identity of frosted elfin.
2. Identify frosted elfin populations and habitats.
3. Establish monitoring protocols.
4. Maintain and enhance habitats.

Action. Increase the population of lupine on site. Consider maintenance, such as mowing known habitats to maintain species, or planting additional habitats.

6.6.1.7 Other Special-status species. All other species in Table 1 require the collection of additional information concerning their presence at BNL, their biology, and possible management needs. Through monitoring programs, literature surveys, and field sampling, it is likely that additional special-concern species will be identified. If so, management protocols to ensure their continued existence will be needed.

Goals

1. Identify and document populations of protected species on list.
2. Determine habitat needs.
3. Develop monitoring protocols.

Actions

- Identify and map locations of all special-status species found on site. Develop goals and actions for each as they are identified.
- Continue to conduct field surveys of the Laboratory for additional species.

6.6.1.8 Geese. Canada geese (*Branta canadensis*) have established nonmigratory populations throughout the midwest and northeastern United States. A relatively small population (approximately 80 birds) is established at BNL. To date, these animals have created minor annoyances due to their behavior. Resident Canada geese at BNL typically feed on lawn grasses and nest in areas along drainage swales, recharge basins, and the Sewage Treatment Plant. Nuisances caused by the geese include traffic blockage and excessive fecal material on lawns and walkways. The level of disturbance has not yet met any thresholds where human health and safety are impacted. However, the goose population does have a potential to increase, with a concurrent increase in nuisance problems. Therefore, this plan will address the control of the goose population should the need arise and will identify basic requirements that must be met to reduce the population.

Goals

1. Determine population levels that would require management, and establish an acceptable target population, as necessary.
2. Establish appropriate management requirements to maintain the goose population at target levels.

Action. Population levels should be monitored. If necessary, BNL will work with U.S. Fish & Wildlife Service and the NYSDEC to reduce the population.

6.6.1.9 Wild Turkeys. The eastern wild turkey (*Meleagris gallapavo*) was re-introduced to Long Island in 1992 by NYSDEC. The original introduction occurred in two locations, the Montauk Peninsula, and at Southaven County Park southwest of BNL. The Southaven population quickly migrated down the Carmans River to Wertheim National Wildlife Refuge and up the Carmans River and across William Floyd Parkway to BNL. The population of wild turkey was estimated at 175 birds in 1999, with steady growth through 2001. The current estimated population is 250 birds, with the largest single winter flock being nearly 100 birds.

Habitat at BNL supports the continued existence of the wild turkey. The primarily oak-dominated woodlands provide adequate food source in both summer (insects) and winter (acorns and other seeds) in most years, while stands of white pines provide insulating shelter in colder months. It is likely that the wild turkey population will continue to grow. It should be monitored for population health and watched to identify any potential nuisance situations that could require action.

Educational articles are written at least once per year to inform BNL employees of the turkey's presence at BNL and to stress to employees not to feed the birds, ensuring that they stay wild. A reporting page has been established on the Environmental Services Wildlife Web Page allowing the general BNL population an opportunity to participate in population monitoring. Population estimates based on reports are periodically given to NYSDEC for tracking purposes.

Goal. Develop turkey population management criteria in coordination with NYSDEC wildlife branch.

Action. Monitor the wild turkey population. As requested, work with NYSDEC to trap and relocate a portion of the BNL population to establish populations elsewhere on Long Island.

6.6.1.10 Bluebirds. The eastern bluebird (*Sialia sialis*) was once a species of special concern in New York State. This species is a cavity nester, and the loss of natural cavities along with competition for available cavities from other cavity nesters (house wren, European starlings, and tree swallows) resulted in declining populations. The species has recovered significantly due to massive efforts to provide artificial nest boxes in appropriate habitat, which exists at BNL as in other locations on Long Island. Under the WMP, the Laboratory established 45 nest boxes to improve the bluebird population. Nest boxes are located around grassy areas and are monitored at least monthly during nesting season to determine their use and nesting success. Additional areas suitable for nest box installation still must be identified and boxes installed. Nest box location and nesting success should also be entered into BNL's GIS and a database established to track and trend success.

Goal. Provide enhanced nesting habitat and increase the bluebird population at BNL.

Action. BNL will continue to maintain boxes where appropriate and monitor populations. Box locations and data should be added to the GIS data system.

6.7 LAW ENFORCEMENT

Law enforcement for natural resource protection is provided as needed by the BNL Safeguards and Security Division. Increased law enforcement is typically needed when trespass situations such as off-road vehicles (quads and motorcycles) and poaching occur. As the Natural Resource Management Program gets established, additional law enforcement needs will likely be identified. (For example, should BNL initiate a hunting program on site to manage white-tailed deer?)

BNL currently participates in the Law Enforcement Taskforce under the Pine Barrens Commission. This group serves cooperatively to share law enforcement resources throughout the Pine Barrens region of Long Island. BNL can request additional law enforcement support from surrounding law enforcement agencies, including Suffolk County Police, Suffolk County Parks Police, Suffolk County Sheriff's Office, NYSDEC game wardens, NYSDEC Forest Rangers, and U.S. Fish & Wildlife Service officers. Typically, BNL detains violators and transfers them to the Suffolk County Police for disposition.

Goal. Protect BNL's natural resources from illegal activities including off-road vehicles, arson, and other actions resulting from trespass situations.

Action. The Natural Resource Manager will continue to work with BNL Safeguards and Security and the Pine Barrens Law Enforcement Task Force to reduce illegal motorized vehicles.

6.8 WILDLAND FIRE AND CONTROL BURN MANAGEMENT

The forested areas of BNL have had no active fire management, with the exception of suppression, for over 75 years. The area was formerly the site of World War I Camp Upton, at which time more than 1,400 acres were cleared for establishment of the camp. In 1921, the entire constructed site was auctioned. All structures, equipment, and materials were removed and the site was more or less abandoned. In 1934, the Civilian Conservation Corps (CCC) established the Upton National Forest and several CCC camps began planting trees on the former Army site (this is the source of the white pine plantations). In 1941, the War Department reactivated Camp Upton, built structures, and opened the camp as an induction facility. At the end of WW II the camp was converted to a Recovery hospital for injured GIs. By 1947, the continued need of Camp Upton for use by the War Department was declining; the Camp was transferred to the Atomic Energy Commission, and Brookhaven National Laboratory was established. Presumably, throughout the entire history of the site fire management was limited to suppression tactics. The accumulation of excessive fuel loads in the forests at BNL supports this assertion. A specific management initiative for suppression, prescribed fire, and fuel reduction is needed to manage the forest assets at BNL and ensure ecological integrity, biodiversity, and the protection of natural, cultural, and economic resources.

A Wildland Fire Management Plan (FMP) (BNL 2003b) has been developed to cover these issues. It addresses the suppression of wildfire, use of Minimum Impact Suppression Tactics (MIST), prescribed fire, and fuel reduction. A specific prescribed fire burn plan will be developed for BNL and the Upton Reserve as an attachment to the FMP and will be updated annually. Goals, objectives, and assessment criteria of the prescribed fire program will be addressed within the FMP.

6.9 WETLAND AND RIVER MANAGEMENT

BNL has six jurisdictional wetlands on site and numerous small basins and ponds that provide a variety of habitats (see Figure 2). The Peconic River and Zeke's Pond are both Class I wetlands under NYSDEC regulations, as are all known tiger salamander habitats. The east central part of the Laboratory contains wetlands that have been historically ditched for mosquito control. This area is likely no longer a fully functional wetland. It needs to be assessed for wetland values and possibly be restored through the construction of water control structures at key locations along the ditches. At the same time, concerns over the potential for West Nile Virus must be addressed. Most other wetlands would be monitored under management activities associated with threatened and endangered species (either tiger salamander, banded sunfish, or swamp darter). The Peconic River downstream of the STP is undergoing environmental cleanup under CERCLA regulations. Cleanup activities may have significant impacts on the river. All plans for cleanup should be reviewed under the NRMP to ensure that the process addresses ecological needs of the river and that a smooth transition from cleanup to long-term stewardship of the river occurs when the cleanup goals have been met. The New York State Wild, Scenic and Recreational River Act also protects the Peconic River. Any activities within a half-mile of the river require consultation and permitting by NYSDEC.

A number of groundwater recharge basins are used at BNL to manage cooling tower blow down, cooling systems, groundwater remediation systems, and storm water. Several of these basins are also used by the tiger salamander for breeding. Past basin maintenance practices have disrupted tiger salamander breeding, showing that there is a need to either manage the drainage basins as tiger salamander habitat or prevent their use by tiger salamanders. Either scenario requires the development of a maintenance schedule based on tiger salamander biology and coordination between the Natural Resource Manager, Plant Engineering, and NYSDEC.

Goals

- Improve the ecological function of BNL wetland areas.
- Comply with NYS Wild, Scenic, and Recreational River Act requirements.

Action. A monthly State Pollution Discharge and Elimination System (SPDES) sampling program is used to monitor the water quality and flow. Fish Sampling was performed with NYSDEC beginning in 1999 to assess the banded sunfish habitat and populations, and reassess management strategy as needed. Further investigation is needed to assess the potential for water control structures on wetland drainage ditches. Wetland and Wild, Scenic and Recreational Rivers Act permits are submitted as necessary.

6.10 INVASIVE SPECIES

Executive Order 13112, entitled Invasive Species, states that governmental agencies will have in-place mechanisms for identifying invasive species and for the early detection, control, and removal of invasive species when it is practical to do so. BNL has begun identifying invasive species that are present on site and has participated in the formation of a Long Island Weed Management Area (LIWMA) under the national management plan, *Meeting the Invasive Species Challenge*. The Nature Conservancy (TNC) is coordinating the formation and operation of the LIWMA. TNC has submitted a grant proposal to the

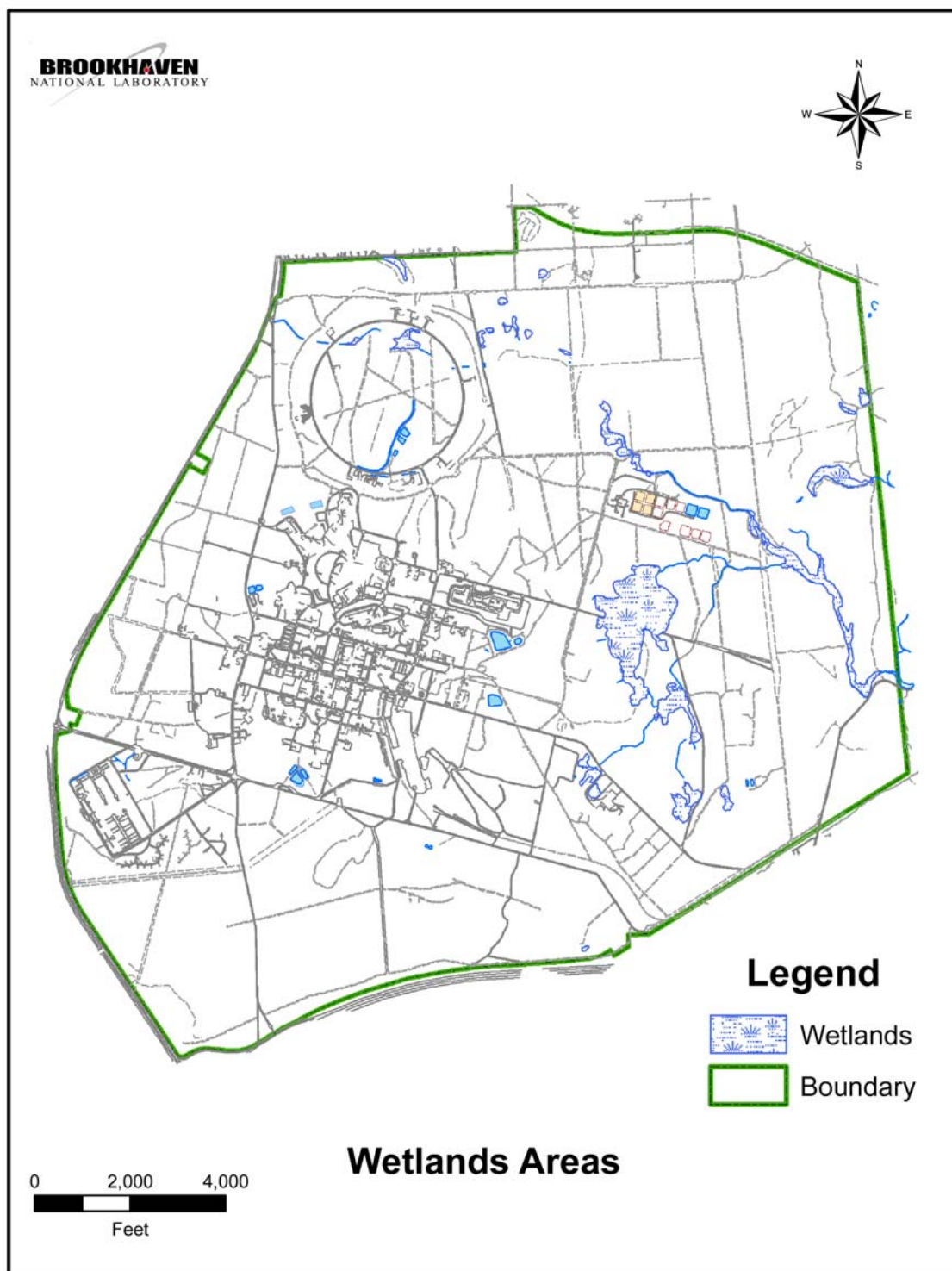


Figure 2. Wetland and river areas of Brookhaven National Laboratory.

National Fish and Wildlife Foundation for funds that would be used to hire a LIWMA coordinator whose primary responsibilities would be to coordinate efforts in meeting the goals of any invasive species management plans developed for the LIWMA. As a participant in the LIWMA, BNL would design its management efforts to support the larger LIWMA plan. Invasive species goals, objectives, and assessments established in this plan would be reviewed at the appropriate time to ensure compatibility with the LIWMA plan.

Goals

1. Identify, locate, and map all invasive species, especially those on New York's top 20 invasive species list.
2. Reduce area of impact from invasive species.
3. Eradicate new infestations of invasive species.

Action. Identify, map, and monitor invasive species distributions. Develop and implement procedures to eliminate, reduce or prevent spreading. BNL will participate in the early detection programs of the LIWMA. Sources of funding need to be identified to remove the invasive species. For any areas cleared, native vegetation should be planted. BNL should also establish a Weed Watchers Group similar to that planned under the LIWMA.

6.11 FERAL AND NUISANCE ANIMAL MANAGEMENT

Feral and nuisance animals are identified as causing potential problems that could impact worker health, cause property damage, or affect biodiversity. Feral animals (domestic cats and dogs) have the potential to carry diseases (rabies, distemper, toxoplasmosis, etc.) that are transmissible to humans and native fauna, to cause unpleasant odors from urine and feces, and to affect biodiversity by altering predation patterns for birds, reptiles, amphibians, and small mammals. Nuisance situations are defined as being unwanted human–animal interactions and include such situations as rodents chewing cables, animals in food preparation areas and garbage collection areas, animals under portable buildings (e.g. groundhogs, skunks, raccoons, etc.), and deer destroying vegetation. In general, the Plant Engineering Grounds Crew resolves most feral and nuisance animal problems at BNL. However, problem identification, coordination, and resolution should, in part, be coordinated through the NRMP and the Natural Resource Manager in association with volunteer groups at the Laboratory.

Goal. Establish coordinated management of feral and nuisance animals at BNL to protect human health and safety, increase biodiversity, reduce impacts (potential or real) on migratory birds and small mammal populations, and protect property.

Action. Pamphlets should be distributed to Laboratory employees to increase public awareness of the effects of feral cats on wildlife. The Natural Resource Manager will coordinate with Plant Engineering and volunteer groups to create guidelines for feral animals and nuisance wildlife. A management plan with goals for reduction of the feral cat population on site must be developed.

6.12 PESTICIDE APPLICATIONS

The Biology Department (in greenhouses and biology fields) and Plant Engineering's Grounds Crew (in buildings and other areas) apply pesticides (insecticides, herbicides, fungicides, algacides, and rodenticides). Applications are carried out by certified, licensed individuals or their apprentices and

comply with all applicable state and federal requirements and standards for worker protection. Pesticide applications are being addressed in this plan because of their potential use in managing problem species (phragmites, Japanese barberry, honeysuckle, kudzu, etc.) and because of the potential harm that improper use could have on the environment. BNL should identify a Subject Matter Expert and, as necessary, develop a subject area in the Standards Based Management System (SBMS), replacing old standards, to ensure that all potential pesticide users are aware of the requirements for pesticide use.

Goal. Establish coordinated use of pesticides through principles of Integrated Pest Management (IPM).

Action. As necessary, the Natural Resource Manager will work with the Subject Matter Expert to establish a subject area in the SBMS on pesticides. As areas are identified for use of pesticides, all applicable state, local, and federal laws will be followed before use.

6.13 VEGETATION MANAGEMENT

Executive Order 13148, entitled *Greening the Government Through Leadership in Environmental Management*, specifies that governmental agencies have programs in place to manage landscaped areas using native species. DOE has adopted the requirements of EO 13148 and is implementing the requirements through DOE Order 450.1. Vegetation management at BNL will also be required to ensure that disturbed areas resulting from construction or remediation projects be recovered using best management practices that take into account the use of the most appropriate species (usually natives).

Goal. Incorporate sound principles of vegetation management into construction planning processes at BNL utilizing native species where practical to do so, in compliance with regulatory drivers.

Action. Include native grass seed mixture into applicable revegetation plans for disturbed areas. Utilize native tree and shrub species around structures.

6.13.1 Landscape Management with Native Species

Landscape management should be evaluated to include the use of native species in all new applications. Landscaping with native species lessens the chance for invasive species being released to the Long Island ecosystems. Native species that are fire resistant need to be identified for use around structures, while lawn areas that are suitable for replanting with native grasses and wildflowers should be identified and management options developed for those areas.

Goal. Use native vegetation in all landscaping as appropriate.

Action. The Natural Resource Manager will develop a rapport with Plant Engineering to encourage the use of native vegetation in landscaping and landscape restoration. A list of suitable native species has been developed for use on site. Areas will be identified for conversion from non-native species to native species.

6.13.2 Revegetation

Areas disturbed during construction and remedial activities should be revegetated with native plants, where practical.

Goal. Use native vegetation in all revegetation activities.

Action. The Natural Resource Manager will work with Plant Engineering and the Environmental Management Directorate to integrate native vegetation into revegetated areas. The feasibility of a native grass nursery to be used for revegetation will also be determined.

6.13.2.1 RHIC Revegetation. The RHIC Revegetation plan should be modified appropriately and revegetation to stabilize soils should continue. The revegetation of the RHIC ring is not following the existing plan, as it focuses on restoration of the area to typical pine barrens habitat. The current use of native grasses with some establishment of seedling pitch pine is more cost effective, covers and stabilizes soils faster, and allows for future disturbance with revegetation at a lower cost. Continued effort to revegetate entire areas should be encouraged. There is a need for coordination with the Collider Accelerator Department to ensure that the RHIC berms are properly maintained and that native vegetation be used as much as is practical to maintain the integrity of the berms. Currently in most berm areas, non-native grasses are planted for soil stabilization because they establish much faster than native species. Identification of suitable native species is needed. Success of revegetation should also be included in any management activities associated with RHIC.

Goal. Utilize native plants as much as is practical at RHIC, realizing that non-natives may be temporarily necessary for soil stabilization on the RHIC berms to prevent erosion.

Actions. The Natural Resource Manager will work with the Collider Accelerator Department for the proper maintenance of the berms. Identify suitable native plants for berm stabilization.

6.13.2.2 General Revegetation. As remedial actions are completed and groundwater systems are retired, revegetation of the abandoned areas should be completed. Actions associated with these closures should include the need to cover and revegetate the areas being abandoned. Historically abandoned areas that can be recovered and revegetated need to be identified. In general, most groundwater systems will be in place for 10 to 30 years; no goal setting is necessary at this time.

6.13.2.3 Controlled Clearing. Actions that result in the need to open a path for construction, installation of wells, cleanup, or access for repair of underground systems have been identified as creating additional fragmented habitats. The amount of clearing completed for these actions needs to be coordinated and limited in scope. A recovery plan for clearing should be included prior to implementation of any clearing activities.

Goals

1. Limit clearing to that which is required, and establish the use of vegetation removal without soil disturbance.
2. Every project that causes vegetation disturbance will include a recovery plan, as necessary.

Action. The Natural Resource Manager is working with the Environmental Management Directorate and other organizations to minimize clearing during construction projects.

6.13.3 Maintenance of Cover Types

Some vegetation cover types and habitats will likely be identified as being unique (white pine stands) or desirable (blueberry thickets, pine/oak forest, shrub oak forest) (see Figure 3). Maintenance of these

unique or desirable cover types may be necessary. The cover types and the most appropriate management techniques should be identified.

Goal. Identify primary vegetation cover types for BNL, develop forest health monitoring criteria, and maintain cover types consistent with wildlife needs.

Action. Through the Upton Reserve, BNL has obtained an updated vegetation map based on the national vegetation standard. Using this new tool, BNL should develop criteria for suitable forest health monitoring and should implement a forest health monitoring plan.

6.13.4 Vegetation Best Management Practices

Best management practices for management of vegetation and revegetation must be identified. Management of vegetation cover types may require the use of different techniques based on objectives for sustaining a specific cover type (e.g., white pines may require timber harvest, whereas shrub oak thickets require periodic fire). Revegetation of areas may require broadcast seeding, use of hydro-mulch, or seed drills depending on the soil, and objectives. A set of standard practices for routine activities needs to be developed to ensure that a healthy ecosystem is reasonably maintained. In addition, a set of criteria for cutting and removal of trees during construction and maintenance activities should be established. Criteria should include the replacement of trees where applicable.

Goal. Have a set of best management practices for revegetation and maintenance of existing vegetative cover types. Include criteria for removing trees during construction and maintenance activities.

Action. The Natural Resource Manager, in coordination with Plant Engineering (as necessary), will develop a set of best management practices for revegetation and maintenance of existing vegetative cover types.

Prescribed fire will be implemented to maintain fire dynamic communities. Native grass seeds will be planted on site to encourage the establishment of grasslands and prevent the establishment of invasive species.

6.14 COMPLIANCE ASSURANCE POTENTIAL IMPACT ASSESSMENTS

BNL uses several mechanisms to ensure that environmental impacts from the operation of the Laboratory are eliminated, minimized, or mitigated. For existing facilities and operations, potential impacts are identified through experimental and process reviews and major actions (i.e., construction, new experimental facilities, etc.) are reviewed under the requirements of the National Environmental Policy Act. NEPA reviews identify potential impacts and actions that will be used to eliminate, minimize, or mitigate effects of impacts. When appropriate, NEPA reviews (Environmental Assessments and Environmental Impact Statements) are conducted with public input. Actions that are identified as likely to have public interest are brought before the Citizens' Advisory Council or the Brookhaven Executive Roundtable. Public input is considered prior to initiation of activities

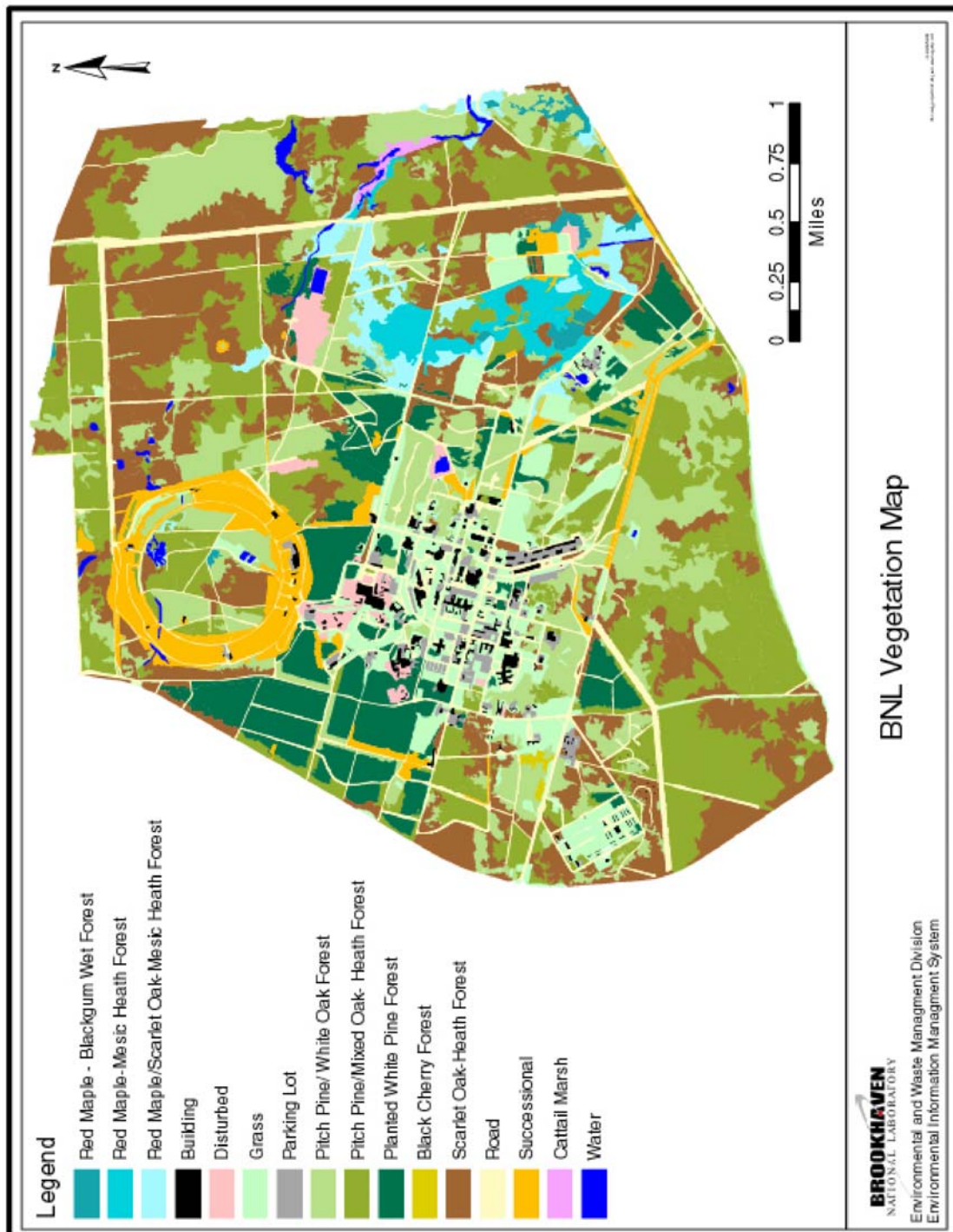


Figure 2. BNL vegetation cover types.

Goal. Maintain high level of awareness and review of experiments and processes to identify environmental impacts and to eliminate, reduce, or mitigate them through established experimental and work review processes as well as NEPA.

Action. The environmental evaluation of industrial processes and experimental research will continue, and the requirements of the NEPA and Cultural Resources Subject Area in SBMS will be followed. Requirements can be found in the SBMS subject areas on the BNL website.

6.15 INTEGRATION OF CULTURAL RESOURCE PROTECTION AND MANAGEMENT

The Laboratory is in the process of developing a Cultural Resource Management Plan to better manage cultural resources identified on site. To date, the Cultural Resource Program has identified several culturally significant areas that may be affected by natural resource activities. There is a potential that prehistoric features and artifacts may exist in some habitats. Homesteads, World War I features, unexploded ordnance, and military artifacts are known to exist within the forests on BNL property. Actions such as prescribed fire, fire suppression, and forest thinning (the white pines) may significantly impact historic features and artifacts if care is not taken during the planning phase. The purpose of this section is to draw attention to the need to integrate cultural resource considerations in natural resource planning.

Goal. Fully integrate knowledge about cultural resources into natural resource planning through the use of GIS and other documentation of the locations of cultural resources.

Action. Develop GIS layers for cultural resources. The Natural Resource Manager will identify cultural resources that could be affected by natural resource activities. Pre- and post-surveys for cultural resources will be performed in prescribed fire areas.

6.16 EDUCATION AND PUBLIC OUTREACH

Natural resource management has historically been of high interest to educators and the general public. Because of the interest as well as the often-controversial nature of natural resource management activities, a public outreach and education program is needed. Educational activities, lessons, and lectures need to be developed and coordinated through the Educational Programs Office and Community Education Governmental and Public Affairs (CEGPA) office. Coordination through CEGPA is needed to involve the public through participation in nature-oriented activities, outreach opportunities, and education. A communication plan may be needed for specific actions associated with this plan.

Goal. Incorporate wildlife-oriented education and public outreach in natural resource planning and management.

Action. Continue to provide educational materials to staff and the public on environmental issues. Material should be updated and redistributed as necessary. Nature walks and bird watching field trips should be conducted routinely. The Natural Resources pages on the BNL website should be updated for continued use as public education.

Summer opportunities should be available for students in high school and college to conduct research at the laboratory. The U.S. Fish & Wildlife Service will also provide separate but integrated opportunities for students within the Upton Reserve to conduct ecological research.

6.17 WILDLIFE ORIENTED RECREATIONAL ACCESS

A long-term need for wildlife-oriented recreational access should be included in the goals and actions of this plan. Wildlife-oriented access for hunting, bird watching, nature walks, ecology trails, bike paths, footpaths, and guided tours should be considered, where appropriate and compatible with management goals and activities.

Goal. Provide appropriate access for wildlife-oriented recreation to BNL employees and the general public, as applicable, through organized and unorganized activities.

Action

1. Planned trails or paths should be clearly marked and maps made available to employees, to limit impact on sensitive areas, while increasing awareness of the different vegetation areas on the BNL site.
2. To educate the public and familiarize them with the Laboratory environment, nature walks and programs for events such as Earth Day and Summer Sundays should be continued. The Natural Resource Manager will continue the summer education program with teachers as necessary and continue to give tours or talk to school groups about the BNL environment.
3. The potential of hunting opportunities will be investigated and addressed under deer population management planning.

6.18 RESEARCH

A primary purpose for formation of the Upton Reserve was to promote ecological research within the Pine Barrens ecosystem of Long Island. The TAG has responsibilities related to soliciting, reviewing, and approving proposals for funding by the FWS. Research needs must be identified and prioritized to facilitate the process of solicitation, review, and approval by the TAG. There is a need for research that furthers the understanding of Pine Barrens ecosystems, improves management of natural resources, and provides educational benefits.

Goal. Establish a program to solicit, review, approve, and fund research related to Pine Barrens ecology.

Action. The Annual Pine Barrens Forum has been held at BNL since 1996. Summer research programs on the Upton Reserve are available through US Fish & Wildlife Service and through DOE. The Natural Resource Manager will pursue further research exploring deer impacts and other applicable topics, as well as potential funding sources for research opportunities.

7.0 ASSESSMENT OF GOALS AND ACTIONS

An annual review of activities will determine progress on action items listed in the Natural Resource Management Plan (Appendix C). The Natural Resource Manager will identify possible financial needs in advance of requirements. An Annual Report of the activities and progress from the previous calendar year will be written by March 31 each year. A summary will be presented to the Technical Advisory Group.

The Technical Advisory Group will review the annual assessment document to provide input on success and modification of the Natural Resource Management Plan.

8.0 SCHEDULED UPDATES

Major updates to the Natural Resource Management Plan will be done every 5 years. The TAG will suggest minor updates after the annual assessment, and the Natural Resource Manager will incorporate the updates into the action items.

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10.0 APPENDIXES

- A. Eastern Tiger Salamander
- B. Threatened Fish
- C. Actions Matrix Chart
- D. Regulatory Drivers

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APPENDIX A

TIGER SALAMANDER HABITAT MANAGEMENT PLAN

1.0 PROTECTION OF THE EASTERN TIGER SALAMANDER

The eastern tiger salamander (*Ambystoma tigrinum*) was officially listed as a state-endangered species in 1983 (NYS ECL, Article 11, Section 11-0535, NYSCRR Title 6, part 182.6). Populations have declined as a result of loss of habitat through development, road mortality during breeding migration, introduction of predatory fish to breeding sites, collection by the bait and pet trade, water level fluctuations, pollution, and general disturbance of breeding sites.

The eastern tiger salamander is afforded “protection from habitat destruction, harm or harassment” by NYSDEC. All State-recognized breeding sites and the 500-foot radius buffer zone surrounding each site are considered critical habitat for breeding, and are accorded the highest priority for protection. An additional 350 feet beyond this area is also considered as critical to the resident adult population (Madison and Farrand, 1998). Use of land around the breeding pond buffer zone is subject to State Environmental Quality Review Act proceedings (A. Breisch, NYSDEC 1994), and therefore this 850-foot buffer zone is monitored by BNL, in collaboration with NYSDEC as needed.

2.0 BIOLOGY OF THE EASTERN TIGER SALAMANDER

2.1 INTRODUCTION

The eastern tiger salamander, an amphibian, is the largest of six mole salamanders (genus *Ambystoma*) found in New York. These salamanders seem to prefer the sandy, friable soils that are typical of pine-oak communities (*Pinus rigida*)/(*Quercus sp.*) on Long Island. However, tiger salamanders are also found in fields, lawns, gardens, and pastures. Tiger salamanders have been historically recorded from Central Nassau County and Jamaica, Queens County, far outside the limits of the Pine Barrens. Both adults and subadults lead a fossorial (underground) existence, foraging for invertebrates, insects, worms, and slugs through their own burrows or existing small-mammal burrows and root-ways (passages created when roots rot away). Occasionally, salamanders may move under leaf litter, through hollow logs, or beneath debris. Other mole salamanders potentially occurring in the same habitat include marbled (*A. opacum*), spotted (*A. maculatum*), and blue-spotted (*A. laterale*) salamanders (LMS, 1995). All mole salamanders have similar body configurations: broad, flat heads with protruding eyes, large mouths, thick bodies, and strong legs with thick blunt toes (four front and five rear). Adults are easily distinguished from juveniles by their color patterns and size. Larval salamanders are similar to adult salamanders in body shape, but body size, development, and coloration can usually be used to distinguish between the species (Figure A-1). Adult tiger salamanders may live 10 to 15



Figure A-1. Tiger Salamander (NYS – Listed Endangered Species).

years in the wild and grow to total lengths of 9 to 10 inches. Natural predators include short-tailed shrews, fish, snakes, turtles, herons, and shorebirds. Insect larvae may also prey on the early larval stages of tiger salamanders.

2.2 DISTRIBUTION

In the northeastern United States, tiger salamanders do not occur north of Long Island or in Pennsylvania. South of Long Island, tiger salamanders are found in southern New Jersey, Delaware, and Maryland. Tiger salamander populations on Long Island center around the towns of Brookhaven and Southampton. Since 1984, NYSDEC has confirmed over ninety active tiger salamander breeding sites on Long Island (Blais 1993), however, since then it has been observed that a number of such sites have been eliminated as breeding sites, except at the Laboratory site, where the largest number of sites were observed. Lawler, Matusky & Skelly (LMS) confirmed 13 on-site locations as tiger salamander breeding habitat during 1994 surveys (LMS 1995), whereas NYSDEC previously listed only one area. The on-site number of breeding ponds has now been confirmed at 17 locations.

2.3 BREEDING PATTERNS

In New York, tiger salamanders migrate to breeding ponds as early as mid-January or as late as mid-April. The timing depends on winter weather conditions, when the possibility of hard rains or snow

occurs. Migration usually takes place at night. As with most mole salamanders, rain or melting snow stimulates the adults to emerge from underground retreats and migrate to breeding ponds. Males usually outnumber females and reach the ponds first. Courtship begins when a female encounters one or more males. Males nudge the female and set spermatophores (sperm packets) in the sediment or on sticks and leaves. The female maneuvers herself to insert spermatophores into her cloaca, where sperm from the spermatophore fertilize her eggs. Within a few days after fertilization, females lay 200 to 400 eggs in several batches. The eggs are attached underwater to sticks and emergent/submerged vegetation about one foot below the surface of shallow (approximately 3-ft) ponds. Depending on water temperature, eggs hatch in 14 to 30 days (Blais 1993).

Newly hatched larvae are 0.50 to 0.68 inches long. They metamorphose from mid-June to early August (Blais 1993), with occasional emergence as late as mid-September (Green, Feinberg 2003). The aquatic larvae have fan-like gills, but gradually develop lungs in preparation for a terrestrial adult life. Larval salamanders feed on aquatic invertebrates (insect larvae, copepods), and are known to feed on the larvae of other amphibians. Larvae may undergo early metamorphosis in drying ponds. Mortality is high if the ponds dry up too rapidly. Adults leave the ponds soon after breeding, triggered by favorable weather conditions such as rain or high humidity; sub-adults migrate following metamorphosis.

Based on the above observations, the critical times for the salamander species are as follows:

- December to April for spotted and tiger salamander adults when they are most active, most often above ground and moving to and from breeding ponds (within the 850-ft buffer zone radius).
- May to the end of July for metamorphosis as they leave the ponds and travel to upland shelters (within the 850-ft buffer zone).

2.4 SURVEY METHODOLOGY

Tiger salamander surveys were first conducted in 1994. Twenty-three locations on the BNL site were checked at least once for adults or egg masses; 17 locations were checked for both adults and egg masses. During May and June, 11 sites were checked for larval tiger salamanders, primarily to verify species identification, which had tentatively been determined, based on size and configuration of egg masses. Survey locations included sites identified by NYSDEC as historical/confirmed or potential tiger salamander breeding habitats. Evaluations of potential habitat were first made on the basis of field and aerial photograph investigations. Figure A-2 (not included in public copies of this report) is a scaled depiction of the breeding locations. Superimposed on the map, at each confirmed or potential location, is an 850-ft buffer zone. Transmitters attached to tiger salamanders have determined this buffer zone of 850-ft radius to be the area within which tiger salamanders reside and breed (NYSDEC, 1995; Madison and Ferrand, 1998). As previously mentioned, information on tiger salamander pond locations is not public information; hence, the map showing the confirmed breeding ponds does not appear in distributed copies of this report.

Survey timing is coordinated with NYSDEC, the agency responsible for conducting concurrent tiger salamander studies on Long Island. Surveys at BNL are organized and carried out, under permit, by the Natural Resource Manager. Egg mass surveys are carried out between the end of January and mid-April, and larval surveys are conducted annually during the month of June. Emergence studies occur annually around two or more ponds to evaluate the use of cover boards and drift fences, and factors influencing their use.

All known and potential tiger salamander habitat is surveyed annually for egg masses. However, ponds that were completely dry and documented as not having egg masses by mid-April are not surveyed for larvae in June. All ponds documented with egg masses are resurveyed for larvae, if just to document the pond's having dried between the time of egg mass production and expected larval development.

The sampling methodology follows the basic protocols provided by NYSDEC (1994) and survey results are recorded and reported on log sheets provided by NYSDEC. Results of activities under a NYSDEC Threatened and Endangered Species Permit are submitted to the agency yearly with a request for permit renewal.

3.0 HABITAT PROTECTION PROTOCOLS

As part of the ongoing process to maintain and improve the suitability of the tiger salamander habitat and the tiger salamander breeding sites, each site (confirmed or potential) has been reviewed with NYSDEC staff. Improvements described below began to be implemented in 1999 as funding allowed, and all management actions established in 1999 have been implemented. The schedule for implementation of new and existing actions is given in Appendix C of the Natural Resource Management Plan. Figure A-2 shows the location of the sites. (Note: This map is confidential, and is not included in copies for general distribution.) Protection of this species will consist of the following actions.

- Identify and map tiger salamander habitats.
- Improve on the existing knowledge on the annual timing of migration, breeding, and emergence. During these times, construction or maintenance activities by the Laboratory engineering staff will be minimized. An example would be to restrict recharge basin maintenance activities to occur between August and December, to avoid the tiger salamander breeding and larval developmental periods.
- Test water quality as part of the routine monitoring of the basins. The data will be used to assess water quality, as it may affect tiger salamander breeding and larval development. Water quality parameters are routinely taken at recharge basins receiving discharge waters permitted under BNL's SPDES permit and include a broad suite of analytes. All ponds surveyed for egg masses and/or larvae have standard water quality parameters measured at the time of the egg mass or larval surveys. Water quality parameters routinely sampled during these events include temperature, salinity, conductivity, turbidity, and pH. No chemical analysis of natural ponds is conducted.
- Consult with NYSDEC any action that could possibly impact known or suspected tiger salamander habitats. Consultations will be coordinated through the Natural Resource Management Program staff. To ensure this action, the Environmental and Waste Management Services, Plant Engineering (PE), and Environmental Management Directorate (EM) program managers have received a map of known tiger salamander breeding areas, with the understanding that this information will remain confidential. When certain activities are planned within the 850-ft buffer zone, BNL staff will consult with the Environmental and Waste Management Services program, and NYSDEC as needed, in particular if the proposed action has the potential to significantly impact a confirmed breeding location (i.e., land clearing activities, well drilling near known or suspected habitat.). All major activities involving soil penetration, clearing, scraping, and so forth require the completion of a digging permit, which contains a sign-off line for threatened and endangered species. Any

significant activities within designated tiger salamander habitat areas would automatically trigger the requirement for consultation with NYSDEC prior to initiating the action. The purpose of this review is to ensure that the planned activity does not interfere with breeding or migration activity.

- Continue routine maintenance of roadways (including salting, snow plowing and mowing road shoulders) and periodic clearing of firebreaks, as these activities pose no direct impact to the breeding pools. However, whenever possible, conduct these activities before or after the breeding cycle, and consider potential impacts in surrounding areas during other sensitive stages of the tiger salamander's life cycle.
- Control and monitor the use of pesticides and salt. Pesticide application is tailored to minimize use. Agricultural fields are usually cultivated after the salamanders have completed their migration; however, the use of pesticides may require that a monitoring program be initiated to determine if pesticide residues in the water could impact the development of larvae and juveniles. Salting the road during winter and the potential of runoff entering the breeding areas will require monitoring of the runoff to evaluate the impact on larvae and juveniles. Currently, the following water quality parameters are monitored for natural bodies of water: temperature, pH, dissolved oxygen, conductivity, and salinity. In addition, water from recharge basins is monitored for those attributes plus chlorides, nitrates, sulfates, and metals.
- Beginning in 2000, the Natural Resource Management program has coordinated an annual survey of existing and potential tiger salamander habitats. The results of such surveys provide information for determining the length of the breeding period and provide an active window for construction activities in and around the breeding areas, and identify changes in site use and possible activities that could affect this species. Based on these surveys, reevaluate the NRMP every five years or as appropriate and update it with the additional threatened or endangered species found on BNL property .

3.1 CONFIRMED BREEDING SITES

The following describes known or suspected tiger salamander habitat protection plans for confirmed and unconfirmed breeding sites. Note that NYSDEC has records confirming approximately 107 breeding localities in New York State since 1983 – 1984. It is not known how many of these sites are still active. Some of these populations have been extirpated, and some were apparently never used by large numbers of breeding salamanders. NYSDEC personnel believe that a relatively small number of sites have confirmed breeding activity every year they are surveyed. Differences in observations may be due to biological phenomena or search/observer bias (McDougal to Naidu, July 12, 1998). A "TS" designation indicates that the site is confirmed; "ts" means unconfirmed; "TS-W" means a wetland site; and, "TS-A" means a man-made pond.

TS-1 is a vernal pool. This is a suitable habitat for breeding tiger salamanders, with appropriate submergent vegetation for attachment of egg masses. A number of potential predators are present, including bullfrogs, green frogs, painted turtles, and solitary sandpipers. This site has had egg masses documented each year 2000 – 2002. The habitat is relatively undisturbed, but has occasional trespass visitation along pond margins.

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the Tiger Salamander Map which is sensitive and not included in
distribution copies of this plan.

TS-2 is a vernal pool. This is a suitable habitat for breeding tiger salamanders and develops appropriate attachment sites for egg masses most years (egg masses have been documented annually). The public uses this pond illegally as an All Terrain Vehicle (ATV) racetrack. The use of this pond by ATV users will continue to be monitored. BNL participates with the Law Enforcement Task Force of the Central Pine Barrens to patrol the area in an attempt to eliminate or at least limit the incidence of ATV use in the area. Should continued action be necessary, NYSDEC will be consulted to develop potential solutions to the problem.

TS-4 (renaming of ts-A4 since this is not a man-made water body), also known as Zeke's Pond is a large pond that once fed the Peconic River. It is known habitat for two state threatened fish, the banded sunfish and swamp darter. Water is generally persistent enough to maintain a predatory fish population, large mouth bass and brown bullhead catfish that likely would limit successful tiger salamander use. The drought of 2002 resulted in this pond drying up. Prior to the reintroduction of banded sunfish, this pond was surveyed for other fish. During that survey several larval tiger salamanders were identified, confirming this pond as a viable tiger salamander habitat. The pond will continue to be surveyed on an annual basis.

TS-5, a coastal plain pond, has been surveyed for egg masses in 2000 and 2001 with no documentation of production. However, dead adult tiger salamanders were documented in 2000 along the banks of the pond and larval tiger salamanders were documented in May 1994. The presence of fish has been routinely documented. It is likely that individuals in the nearby neighborhood are stocking the pond. NYSDEC will be consulted to determine the feasibility of fish removal to enhance the habitat for tiger salamanders.

TS-6 (this pond is also known as the "water tank pond") was the only area on the BNL property identified as a significant habitat by NYSDEC (so designated because of its function as tiger salamander breeding habitat). The observation of several adult males and females, egg masses, and larvae attest to this. This pond is also known as habitat for marbled salamanders (*Ambystoma opacum*), red-spotted newts (*Notophthalmus viridescens*), and four-toed salamanders (*Hemidactylium scutatum*). The pond will continue to be surveyed annually for egg masses and larvae.

TS-7 is a modified wetland area used as a retention basin. It is also known as "Weaver Road Pond" or "Blue's Pond" and receives surface runoff from a man-made channel. The presence of adult salamander, egg masses, and larvae confirm that this retention basin provides breeding habitat for tiger salamanders. There is limited egg mass attachment, which does not seem to affect the use of this pond for production. There is some potential for road mortality during periods of salamander migration, and the basin receives runoff from a drainage ditch. Routine analyses of storm water runoff done during the year can be used to determine whether water quality in this pond is affected. The road adjacent to this pond has been blocked off to vehicular traffic because of flooding of the road. Blocking this road has prevented road kills, especially during the breeding season. This pond is routinely used for tiger salamander research to determine the timing and directional variation of emergence. Annual surveys will continue.

TS-8 is a coastal plain pond. The presence of males, females, and egg masses indicates that this pond provides a suitable habitat for tiger salamanders. This pond will continue to be surveyed for egg masses, larvae, and adults.

TS-9 is a sedge depression that becomes an elongated vernal pool by seasonal flooding. Presence of egg masses and larvae indicates that this pond may periodically (in wet years) provide a suitable habitat for tiger salamanders. This pond will continue to be surveyed for egg masses, larvae, and adults.

TS-10 is a man-made retention basin. The basin receives run-off and once-through noncontact cooling water from a large drainage ditch. This basin, until recently, had the potential of drying up and as such would not allow larvae to transform to adult salamanders. However, diversion of once-through noncontact cooling water to this basin has resulted in a continuous water source. As a result, limited emergent and submergent vegetation has begun to establish within the basin. While storm water run-off may result in some sediment transport to this basin, it is probably not sufficient to be considered a management problem for tiger salamander use. However, sediment and organic matter deposition on the bottom of this basin may lessen its ability to recharge, requiring periodic maintenance to clean the bottom. This basin is currently used to study tiger salamanders' use of cover boards.

TS-13 is a retention basin composed of two ponds. While the western most, larger basin allows rapid recharge with little potential for standing water, the eastern, smaller basin tends to retain water when used. Adult tiger salamanders were found in this basin; however, there was no evidence of egg masses or juveniles. In 2001 this basin contained water during the breeding season. While no egg masses were found, larvae were recovered in May 2001 as the basin began to dry down and were subsequently collected and transferred to a more permanent habitat. Because this basin may periodically be used for recharge of discharge waters, it will be managed as follows. If the basin is receiving, and retaining sufficient water for breeding from January through April, the water flow will be maintained through August of the year. If there is no water in the basin during breeding, then water may be diverted from this basin and flow terminated at any time for management purposes. This basin will continue to be included in annual surveys.

TS-15 is a small depression located within a larger surrounding wetland area. Egg masses have been noted both within the depression and throughout the surrounding wetland. Both the depression and the wetland contain suitable attachment sites for egg masses. This pond will continue to be monitored annually during field surveys.

TS-W3 is a vernal pool complex located in a large herbaceous wetland along the Peconic River within the RHIC ring. Presence of adult salamanders, egg masses, and larvae confirm this pool is a suitable habitat for tiger salamander breeding. However, this pond may receive road runoff from the William Floyd Parkway in wet years, as well as from the RHIC ring road. Much of the area contains sufficient egg mass sites on any given year. In most years this pond dries out prior to larval development. Annual surveys will continue to be conducted at this location.

TS-W4 is a series of small vernal pools. Presence of egg masses and larvae confirm this site as a breeding site for tiger salamanders. However, the pools are extremely small, most less than 20 square ft of surface area, and they tend to have high water temperatures and drying conditions prior to larval development. These small pools will likely be filled in as part of the ER program, but the adjacent TS-A7 pools will be upgraded to improve the habitat for tiger salamanders.

TS-A6a, TS-A6b, TS-A6c, TS-A6d and associated canal are all part of a recharge basin system receiving coolant water from facilities. Tiger salamander egg masses have been identified in the canal

and at least one larval salamander has been documented in one of the ponds in 2000 and 2001. Historically, large numbers of fish were present in these ponds. Currently the ponds contain golden shiners that periodically die off due to drying conditions, high water temperatures, or low dissolved oxygen. The ponds are periodically maintained for recharge purposes. This maintenance activity will be coordinated to occur between August and December. TS-A6d is a large basin added to the complex in 2002. The northern end of this basin is to be planted with native vegetation to encourage use by the tiger salamander. The sides and outer surfaces of this basin are to be planted with native grasses to reduce erosion. Annual surveys will continue to occur to document the use of these ponds and the associated canal by tiger salamanders.

TS-A7 contains two man-made retention basins lined with plastic. The presence of adult salamanders, egg masses, and larvae during surveys confirm this as a breeding pond for salamanders. These basins have consistently provided suitable habitat for reproduction. However, no larvae have been documented since 2000. This is probably due to high water temperatures, low dissolved oxygen, and drying conditions. The ER program will be removing known contamination from these ponds, forming one pond in the area, and constructing the single pond specifically to enhance tiger salamander habitat.

TS-W6a is in a wetland area shaded by a dense tree canopy. The area contains a man-made channel as well as four naturally occurring vernal pools. Egg masses indicate that tiger salamanders use this wetland. This site will continue to be surveyed annually.

TS-W6b is a vernal pool located across from TS-W6a. The presence of adult salamanders, egg masses, and larvae confirms that this pool is a breeding site for tiger salamanders. However, the pond typically dries up before the larvae transform to sub-adults. This pool also contains contaminants and is scheduled for environmental cleanup in the near future, to improve water retention capabilities. The pool will continue to be surveyed annually for egg masses, larvae, and adults as appropriate.

STP-Holdup Ponds are lined basins designed to capture sewage waters suspected of containing radiological or chemical contaminants above BNL's SPDES Permit limits. These two ponds, located at the east end of the Sewage Treatment Plant, are lined with double plastic liners to prevent groundwater intrusion of potentially contaminated waters. Because the liners may tear or otherwise be damaged if not kept in place, several inches of water are maintained within the basins. This water is known to be a site of successful breeding by tiger salamanders, but the function of these ponds is protection of the Peconic River and groundwater from potentially harmful effluents. Therefore these ponds are not specifically managed for tiger salamanders, but every effort is made, in coordination with NYSDEC, to ensure the protection of larval tiger salamanders should transfer actions need to occur.

3.2 UNCONFIRMED BREEDING SITES

ts-3 and **ts-17** (renaming of ts-4 to eliminate confusion with TS-4) are vernal pools located near confirmed tiger salamander habitats. Although the ponds appear to be undisturbed and have suitable habitat and ample egg attachment sites, no evidence of salamander use has been found. Because these ponds tend to be shallow and dry down, they are not likely to be suitable habitat except during the wettest years. These ponds will be surveyed when water is present during the breeding season.

ts-16 (formerly ts-7, changed to avoid confusion with TS-7, and TS-A7) is composed of three recharge basins. Two smaller basins have been historically used for the discharge of cooling water associated

with operations at Building 490. Those operations no longer occur and it is likely that these two basins will never receive sufficient water in the future to benefit tiger salamander breeding. The larger basin is currently being used for the discharge of water generated by a groundwater treatment system. The volume of water generated is sufficient to support tiger salamander breeding. However, the flow rates generated result in sufficient current to limit tiger salamander breeding. This basin is also maintained specifically to enhance groundwater recharge, thus the basin has few, if any, suitable spots for egg mass attachment. This basin will continue to be surveyed for use by tiger salamanders, and maintenance of the basin will be coordinated to occur between August and December.

ts-11 was found to be suitable as a breeding site. However this pond is outside the jurisdiction of BNL and will not be managed under the NRMP, with the exception of complying with legal requirements should any actions be proposed in the area on BNL property.

ts-12 is composed of two ponds within a flooded forest depression resulting from the discharge of once-through, noncontact cooling water. The amount of discharge water has decreased over the years and typical water levels are only 1 – 2 inches in the cooler months. The majority of the ponds are dry during warmer months. It is not likely that this area is suitable for breeding, but it will continue to be surveyed for evidence of use by the salamanders.

ts-W2 is located within the fence of the Gamma Forest and is composed of several small ponds associated with the Peconic River. Persistent water and egg mass attachment sites make this site suitable for tiger salamanders. However, the persistent water and connection to the river also provides habitat suitable to support fish. This site will continue to be monitored to document the presence or absence of tiger salamanders.

ts-W5 is composed of two small ponds located north of Brookhaven Avenue near TS-W6b (a confirmed site). These pools hold water for extended periods only in wet years. The pool will be visited annually and surveyed only if it contains water during the breeding season.

ts-14: (Note: this pool was mistakenly included as a confirmed location under the Wildlife Management Plan. The designation has been changed from TS-14 to ts-14). This pool is located at the northeast corner of the sludge drying beds that were once part of the Sewage Treatment Plant. The pond was likely used as a final settling basin for the WW I facility. The Peconic River flows into the pond on the west and exits the pond on the east. The depth of the pond is unknown but exceeds 6 ft. The depth of the pond has prevented the accurate survey for egg masses, larvae, and adults. It is not likely that this is suitable breeding habitat due to the presence of fish (brown bullhead, chain pickerel, etc.).

APPENDIX B

PROTECTION OF THREATENED FISH

1.0 INTRODUCTION

As indicated earlier, the banded sunfish (*Enneacanthus obesus*) and swamp darter (*Etheostoma fusiforme*), Figures B-1 and B-2, are listed as threatened within New York State. They are not, however, in any protection category with the federal government. The reason for state threatened status is that the only remaining populations of the banded sunfish and swamp darter in New York are in eastern Long Island and these sites are considered vulnerable to adverse environmental impacts. The habitat of these fish is primarily in slow water areas within lakes, ponds, and backwaters of streams and rivers (Breder, 1936). Their preferred substrate is sand or mud, and other preferred areas are often shallow with vegetation over detritus-laden bottoms. Vegetation in these areas is dense enough to maintain a viable habitat for both fish.

2.0 PROTECTION OR ENHANCEMENT OF THREATENED FISH HABITAT

The current water- and vegetation-conditions in the Peconic River and large ponds associated with the river on site support the requirements for successful habitation by banded sunfish and swamp darters, as observed during the exploratory and routine sampling of fauna by BNL and NYSDEC. The primary impacts on such habitats have been predominantly natural. For example, lower than normal rainfall followed by extended drought conditions has contributed to lowering of the water table, leading to decreased water-flow in the river and drying of ponds. Given the above characteristics of the habitat of the banded sunfish, protection of threatened fish is based on the following actions:

- **Eliminating, reducing, or controlling pollutant discharges.** Discharges to the Peconic River are evaluated for pollution control at the *source*, as opposed to pollution control at the discharge point into the Sewage Treatment Plant (STP) or the recharge basins. BNL has a pollution prevention/process evaluation program that evaluates sources and develops and implements pollution prevention measures. Periodic reports are prepared on the pollution prevention program and progress.
- **Upgrading the Sewage Treatment Plant.** This \$8,000,000 project has improved the treatment process (primary to tertiary), reduced nitrogen loading in the Peconic River, and eliminated the use of chlorine as a disinfectant. Full implementation of this project was completed in 1998 and has resulted in tertiary treatment of BNL's sewage.
- **Maintaining an active environmental monitoring program for discharges to the river.** Monitoring for organic, inorganic, radiological and biological parameters is conducted, in accordance with the State Pollutant Discharge Elimination System (SPDES) Permit. Figure B-3 depicts the locations of the monitoring stations. Effluent limitations in the permit are based upon a Class C receiving water quality, which is based upon the protection of fish populations. The Whole Effluent Toxicity testing program has demonstrated that the discharges generally meet requirements for protecting fish populations.
- **Ensuring that adequate flow of the river is maintained** within areas currently identified as banded sunfish habitats (especially within the area from the STP outfall to about 500 ft from the old

site boundary, Station HM). This is achieved through routine observation of the river flow as part of the monitoring program. If discharges were to be eliminated or reduced in favor of groundwater discharge, a requirement to evaluate and address any major changes to the banded sunfish habitat will be imposed by NYSDEC during the permitting process. Creating deep pools at Station HM and HQ (Figure B-3), so that adequate volume of water is available to enable small fish, like the banded sunfish, to survive during droughts. Also, the addition of vegetation and other physical features that will promote the growth and sustenance of the Banded Sunfish population may be evaluated.

- **Ensuring that existing vegetation in the sunfish habitat area is not disturbed.** This is accomplished by reviewing all activities that are proposed in the Peconic River on site. If the selected environmental-restoration remedy for the contaminated sediment in the Peconic River is excavation and removal, the extent and duration of any disturbance will be minimized as much as possible and the habitat should be restored when the project is completed.
- **Continuing to monitor the banded sunfish population** by routine sampling of the river in cooperation with NYSDEC's Fisheries Branch and Cold Springs Harbor Fish Hatchery and Museum. Population counts and size measurements are made during the sampling surveys.
- **Reducing potential predator species.** For example, pickerel and largemouth bass are removed during the fish-sampling program. A record of the number of pickerel and largemouth bass taken is logged at each sampling event to determine the success of controlling predators.
- **Ensuring that on-going remediation efforts do not have an unacceptable impact on habitats.** It is anticipated that the Peconic River may undergo a significant cleanup. A remedial system design is in progress involving proposals to dredge the sediment on site to remove contaminants. The final decision has not been made. However, it is understood that any remedial action must consider the impact on the flora and fauna of the Peconic River, and that the habitat of the banded sunfish will be factored into the final assessment of the cleanup operation.
- **Restoration after natural disaster occurs.** The swamp darter is known to exist at only one BNL location, Zeke's Pond. The population and water levels of this site are periodically evaluated to determine continued suitability for this fish. Unfortunately, the drought of 2002 resulted in the complete drying of this pond, with the subsequent loss of the swamp darter population inhabiting the area. Consultation with NYSDEC Freshwater Fisheries should discuss the implementation of a restoration project.



Figure B-1. Banded Sunfish (NYS – Listed “Threatened” Species).



Figure B-2. Swamp Darter (NYS – Listed “Threatened” Species).

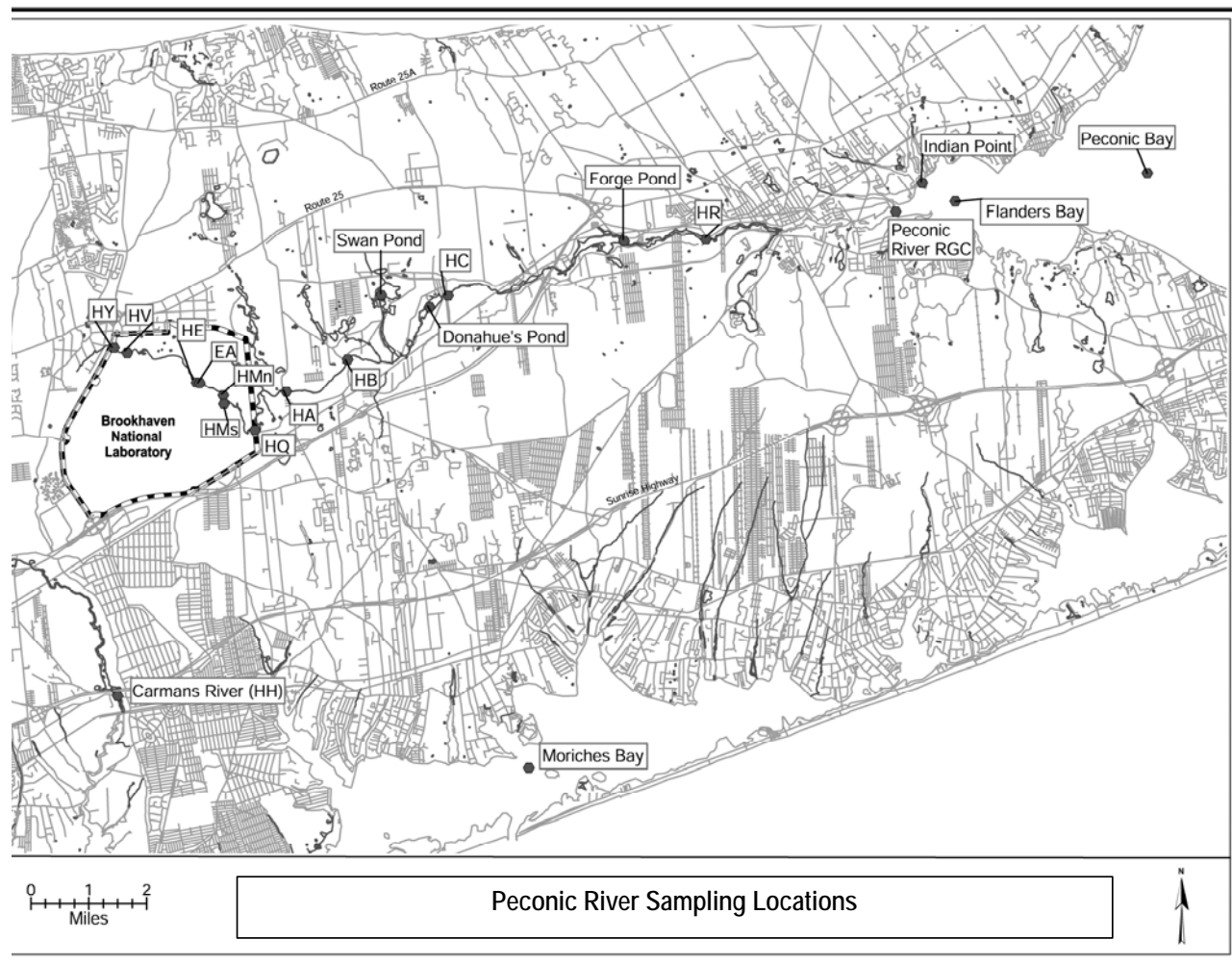


Figure B-3. Peconic River monitoring stations.

APPENDIX C

NATURAL RESOURCE MANAGEMENT PLAN – ACTION ITEMS

Priority	Site ID	Action Item	Planned Date	Action Taken
1	*Site-wide	Transition WMP Action into NRMP	December 2003	Complete
2	Site-wide	Annual Summary Report	Annual by March 31	Ongoing
3	Site-wide*	TAG Review of Annual Report	Annual by May	
4	Site-wide*	Adapt Management based on new information	As Required	
5	Site-wide*	Improve decision making through use of innovative tools	As Necessary	
6	Site-wide*	Maintain and Improve relationships with stakeholders	Continual	Ongoing
7	Site-wide	TS annual egg mass surveys at breeding ponds	Feb-April 2003	Ongoing
8	Site-wide	TS Larval Survey	Annual June-July	Ongoing
9	Peconic River Station HMn	Monitoring for flow: water quality	Monthly sampling SPDES Program	Ongoing
10	TS-7	Monitoring for water quality	Monthly sampling SPDES Program	Ongoing
11	Fish Sampling Peconic River	Fish sampling with NYSDEC/Cold Spring Harbor: population assessment of banded sunfish and swamp darter	Annual Spring/Summer	Ongoing
12	Education	Provide educational material or opportunities to BNL staff and public on environmental issues	Continual	Ongoing
13	*RHIC	New pond being added at RHIC	Summer 2004	
14	*Site-wide	Habitat assessment for lupine		
15	*Site-wide	Issue and Discussion Paper on deer management by Natural Resource Manager	Fall 2003	
16	*Site-wide	Environmental Assessment under NEPA for deer management		
17	*Site-wide	Implement Deer Management		
18	*Site-wide	Develop survey methodology to document all biota on BNL		
19	*Site-wide	Maintain Special-status species list	Annual Review	Ongoing
20	*Site-wide	Identify habitats of special-status species	Continual	Ongoing
21	*Habitat Specific	Confirm presence/absence of Frosted Elfin	May-June Annually	Ongoing
22	*Habitat Specific	Establish standard monitoring protocols for the Frosted Elfin		
23	*Species Specific	Maintain and Enhance habitat for the Frosted Elfin	Continual	Ongoing

APPENDIX C
NATURAL RESOURCE MANAGEMENT PLAN - ACTION ITEMS
(continued)

Priority	Site ID	Action Item	Planned Date	Action Taken
24	Site-wide	Bird nests/boxes	Ongoing	Routine monitoring and maintenance of bluebird and kestrel nest/boxes
25	Site-wide	Turkey sighting reports to NYSDEC	Ongoing	Reports sent annually in September
26	Site-wide	Deer population estimation	Nov-Jan May-June	Routine estimates made twice a year
27	Site-wide	NRMP Plan Update	Every 5 years	---
28	TS-A7	Lining of pool ER program	Aug 2003	In progress
29	TS-W6b	Pond Remediation ER program	To be determined	
30	OU V	Peconic River Remediation Program	Spring 2004	Planning in progress
31	Site-wide	Song bird surveys	April – Sept.	Continuing
32	Tiger salamander	Set up cover boards around one breeding site (as a test case)	Summer	Summer 2001 & 2002
33	RHIC Revegetation	Implement Revegetation	Ongoing	Grasses planted 2002 and 2003
34	Site-wide	Monitor Canada Goose and Wild Turkey populations	Ongoing	
35	*Site-wide	Manage Canada Goose population	As necessary	
36	*Site-wide	Manage Wild Turkey population	As necessary	
37	*Site-wide	Coordinate with Security to reduce illegal use of ATVs	Continual	Ongoing
38	*Site-wide	Identify and monitor distribution of invasive species.	Ongoing	Mapping started Summer 2003
39	*Site-wide	Identify funding for removal or control of invasive plants where possible.	As necessary	
40	*Site-wide	Establish volunteer "Weed Watchers" group	Ongoing	Group formed May 2003
41	*Site-wide	Establish SBMS subject area on pesticides and use for natural resource management.	As necessary	
42	*Site-wide	Establish protocol for use of native vegetation		
43	*Site-wide	Use native vegetation on restorations and new construction landscaping	As necessary and applicable	
44	*Site-wide	Establish policy and procedure for cutting trees		
45	*Site-wide	Establish BNL policy on feral animals and protocols for monitoring and managing them		
46	*Site-wide	Develop criteria to monitor wetland health		
47	*Site-wide	Determine functionality of BNL Central wetlands		

APPENDIX C

NATURAL RESOURCE MANAGEMENT PLAN - ACTION ITEMS

(continued)

Priority	Site ID	Action Item	Planned Date	Action Taken
48	*Site-wide	Maintain or improve wetland functions		
49	*Site-wide	Develop criteria to monitor forest health		
50	*Site-wide	Establish forest health monitoring locations		
51	*Site-wide	Implement Fire Management Plan	Sept. 2003	Plan Approved September 2003
52	*Site-wide	Implement use of prescribed fire and mechanical fuel reduction	March 2003	
53	*Site-wide	Identify cultural resources and develop into GIS layers	Ongoing	
54	*Site-wide	Develop natural resource data layers of GIS	Ongoing	
55	*Site-wide	Plan trails and paths that limit impact on the environment while introducing employees to forest diversity.		
56	*Site-wide	Fill data gaps concerning all flora and fauna, including the following: terrestrial and aquatic invertebrates, Lepidoptera, reptiles, amphibians, wild flowers, and grasses.		
57	*Site-wide	Identify, attract, and support ecological research at BNL		

Notes:

* New initiative

ER – Environmental Restoration

GIS – Geographical Information System

NEPA – National Environmental Policy Act

NYSDEC - New York State Department of Environmental Conservation

NRMP – Natural Resource Management Plan

OU V – Operable Unit V

RHIC - Relativistic Heavy Ion Collider

TS – Tiger Salamander

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APPENDIX D REGULATORY DRIVERS

Federal

Endangered Species Act
 Migratory Bird Treaty Act
 Clean Water Act
 Clean Air Act
 National Historic Preservation Act
 Comprehensive Environmental Response Compensation & Liability Act/ Superfund Amendment and Reauthorization Act
 10 CFR 1021 DOE's Rules Implementing the National Environmental Policy Act
 The Oil Pollution Act, Emergency Planning and Community Right to Know Act (EPCRA)
 Federal Insecticide, Fungicide, and Rodenticide Act
 10 CFR 1022 Compliance with Wetlands and Flood Plains Executive Orders
 10 CFR 1021 DOE's Rules Implementing NEPA
 Executive Order 13148 Greening the Government Through Leadership in Environmental Management
 Executive Order 13112 Invasive Species
 Executive Order 13186 Responsibilities of Federal Agencies To Protect Migratory Birds

Department of Energy (DOE Policy, Orders)

DOE P 141.1 Department of Energy Management of Cultural Resources
 DOE P 430.1 Land and Facility Use Policy
 DOE P 450.6 Secretarial Policy Statement; Environmental Safety and Health
 DOE O 450.1 Environmental Protection Program
 DOE O 451.1B National Environmental Policy Act Compliance Program
 DOE O 5400.5 Radiation Protection of the Public and Environment

State regulations applicable to natural resource management:

New York State Environmental Conservation Laws
 NYS Endangered Species Act
 Wild, Scenic, Recreational, Rivers Act
 NYS Wildlife Laws
 NYS Wetlands Protections Laws
 Pine Barrens Act